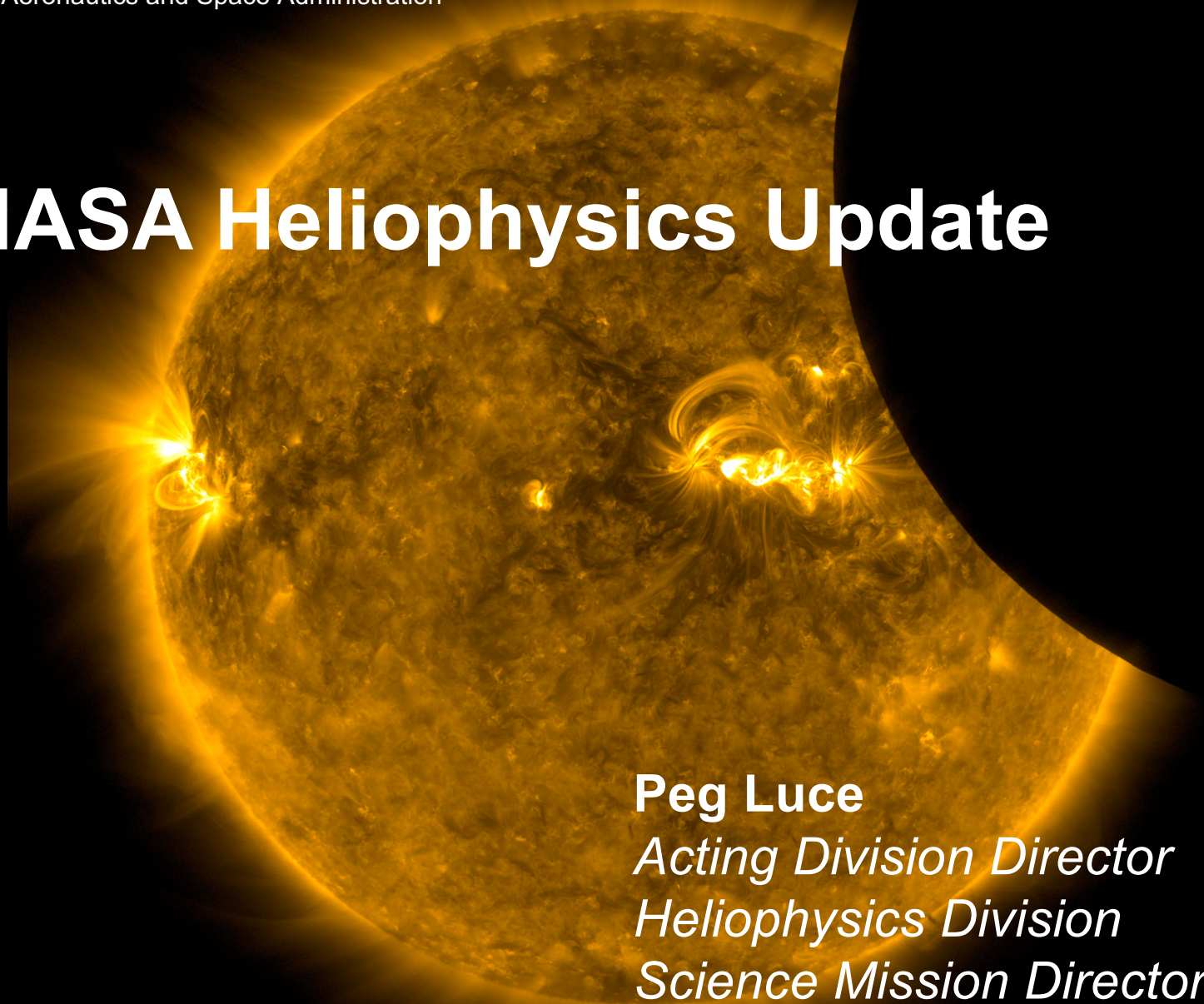
National Aeronautics and Space Administration

NASA Heliophysics Update



Peg Luce
Acting Division Director
Heliophysics Division
Science Mission Directorate

November 29, 2017

SDO/AIA 171 2017-08-21 19:41:46 UT

Some Heliophysics Division News

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

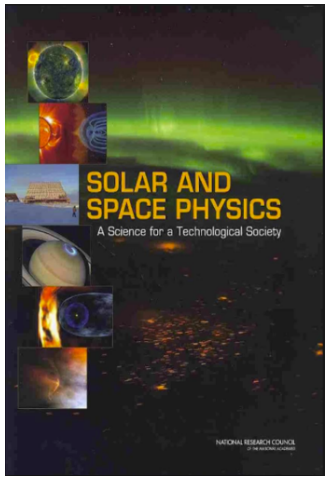
New faces: Janet Kozyra (recently joined NASA as IPA after NSF IPA assignment from U of Michigan)
Jared Leisner (joined from NASA Planetary Science Division)
Terry Onsager on detail from NOAA/SWPC started, November 2017
Roshanak Hakimzadeh on detail from GRC started, November 2017
Jim Spann on detail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

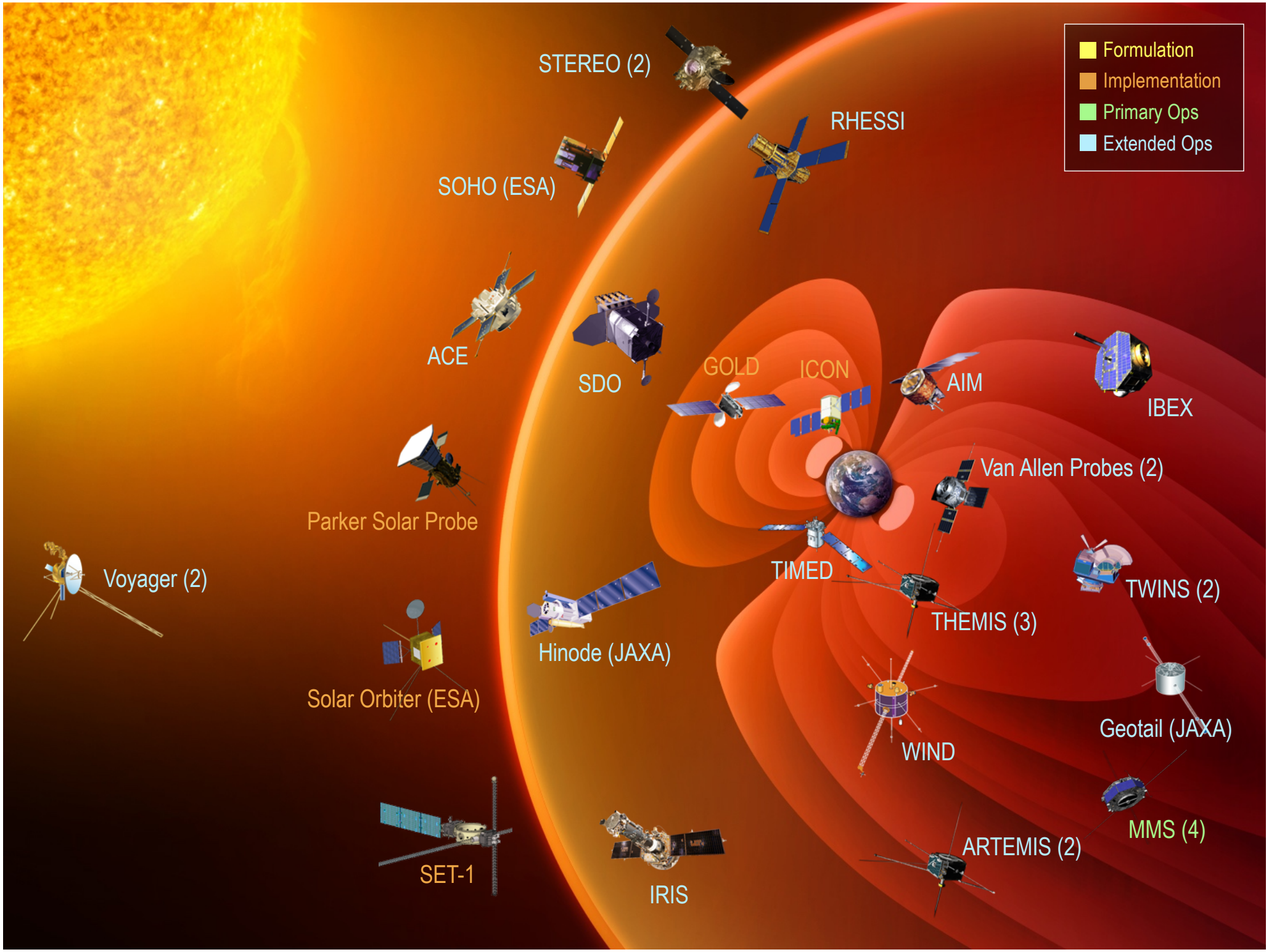
Coming soon on detail:
Bill Atkinson from KSC starting January 2018

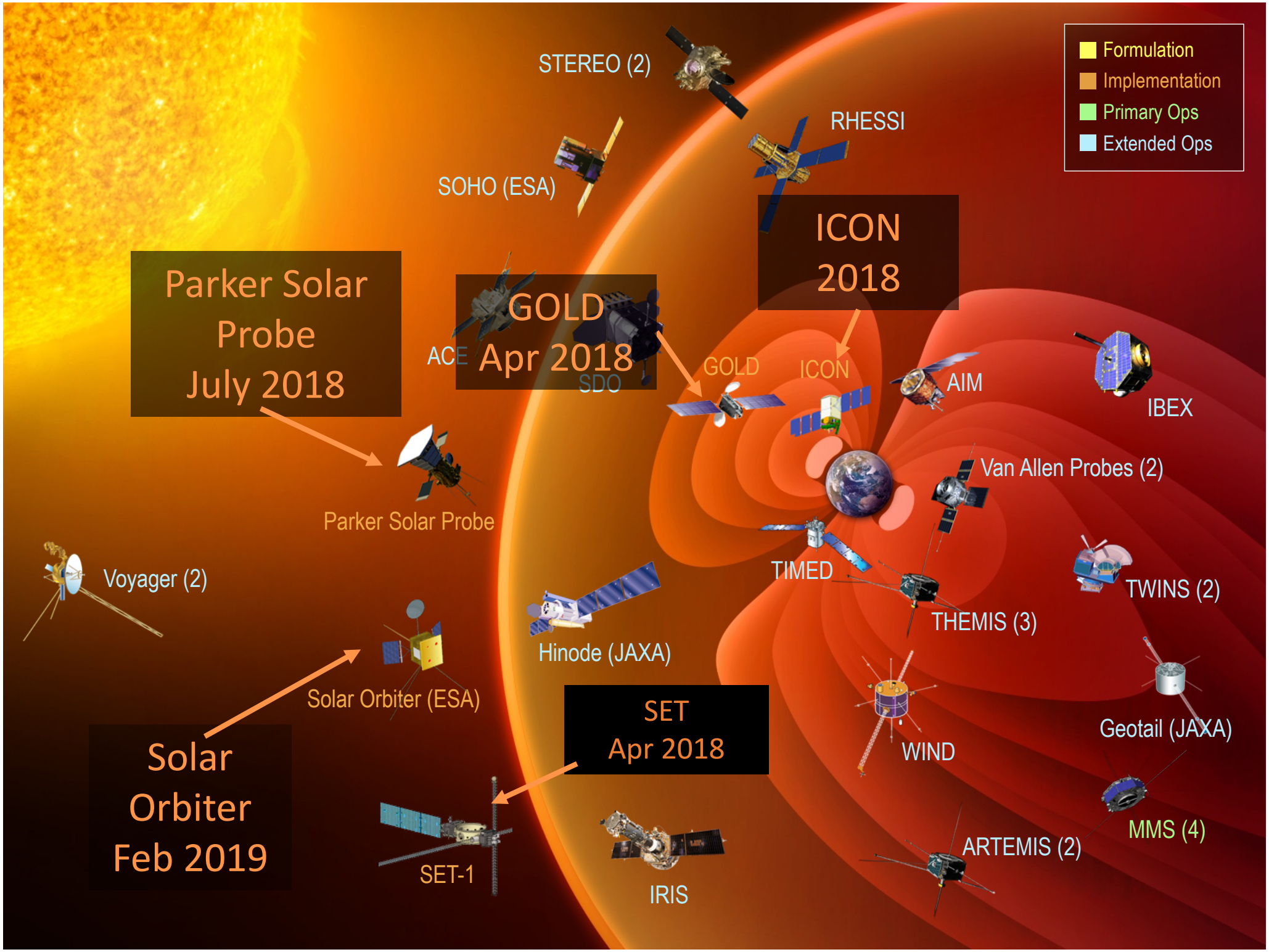
New Assignments:
Elsayed Talaat – Chief Scientist
Lika Guhathakurta on detail to Ames since May 2017
Jeff Morrill - LWS Program Scientist
Janet Kozyra - LWS Science Lead

Alignment with Decadal Survey

The NASA FY17 Appropriation and the FY18 President's Budget Request support the following:	
0.0 Complete the current program	Extended operations of current operating missions as recommended by the 2015 Senior Review; 5 missions currently in development (SET, ICON, GOLD, SOC and Parker)
1.0 Implement DRIVE (Diversify, Realize, Integrate, Venture, Educate)	Implemented DRIVE initiative wedge in FY15; fully funded in FY17 and onwards
2.0 Accelerate and expand Heliophysics Explorer program	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.
3.0 Restructure STP as a moderate scale, PI-led flight program	STP-5 (IMAP) mission AO released with IMAP as a PI-led mission with a LRD ~2024
4.0 Implement a large LWS GDC-like mission	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.




Formulation
Implementation
Primary Ops
Extended Ops
STEREO (2)
RHESSI
SOHO (ESA)
ACE
SDO
GOLD
ICON
AIM
IBEX
Van Allen Probes (2)
Parker Solar Probe
TIMED
TWINS (2)
Voyager (2)
THEMIS (3)
Hinode (JAXA)
Solar Orbiter (ESA)
Geotail (JAXA)
WIND
MMS (4)
ARTEMIS (2)
SET-1
IRIS


Formulation
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STEREO (2)
RHESSI
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2018
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Probe
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GOLD
Apr 2018
ACE
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ICON
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SET
Apr 2018
WIND
Geotail (JAXA)
Solar
Orbiter
Feb 2019
MMS (4)
ARTEMIS (2)
SET-1
IRIS

Heliophysics Program Highlights

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 FACA-chartered Committee) met in October and will report to the Heliophysics Advisory Committee this week.

Mission Highlights

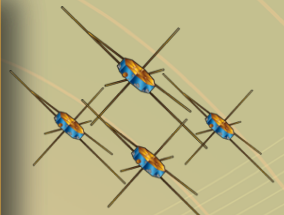
ICON Observatory Prior to Close-Out for Shipment to VAFB

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

Heliophysics Program

HELIOPHYSICS

Solar Terrestrial Probes



Magnetospheric Multiscale (MMS) March 2015

Heliophysics MO 2023*

Heliophysics Tech MO 2024*

Interstellar Mapping and Acceleration Probe (IMAP) 2024*

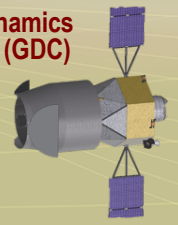
Living With a Star

Space Environment Testbeds (SET) NET April 2018

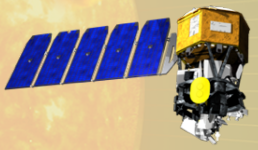
Parker Solar Probe July 2018

Solar Orbiter Collaboration (with ESA) February 2019

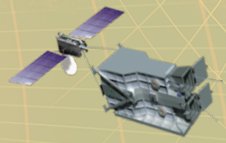
Geospace Dynamics Constellation (GDC) 2025*



Explorers

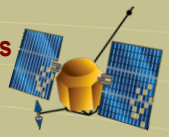


Ionospheric Connection Explorer (ICON) December 2017

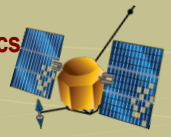


Global-scale Observations of the Limb and Disk (GOLD) April 2018

Heliophysics SMEX 2022*



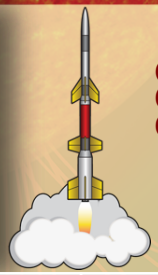
Heliophysics MIDEX 2024*



Heliophysics MO 2022*

Heliophysics MO 2024*

Research Program



Green – Oct 2017
Chrisley – Nov 2017
Clark – Dec 2017

Ongoing

Heliophysics Missions
Astrophysics Missions
Planetary Missions
External to SMD

2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

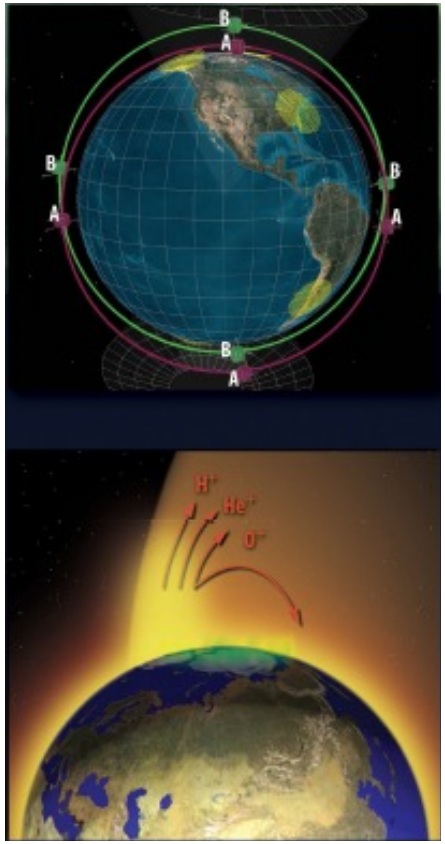
*Notional

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

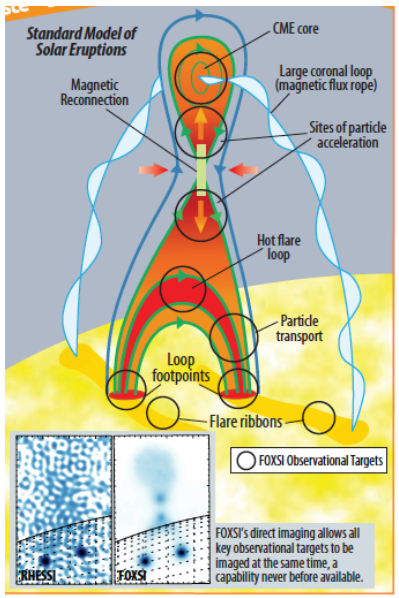
AO 2016 SMEX Selections [1/2]

- Five SMEX missions in Phase A competition, LRD ~2022
  - MEME-X, FOXSI, MUSE, TRACERS, PUNCH



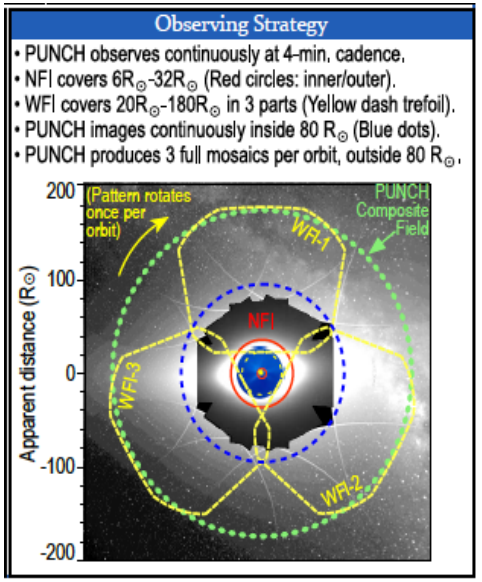
MEME-X

Mechanisms of Energetic Mass Ejection eXplorer



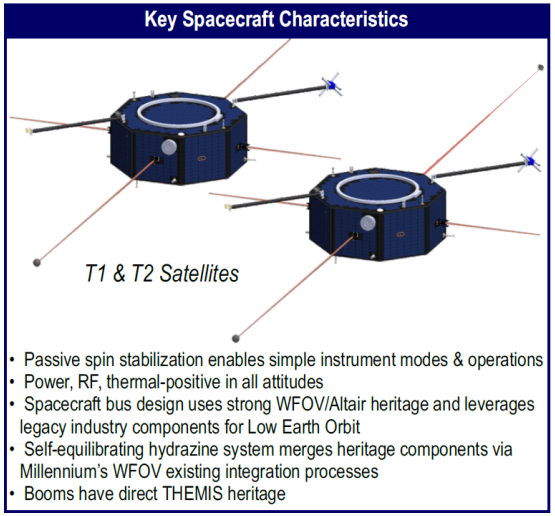
FOXSI

Focusing Optics X-ray Solar Imager



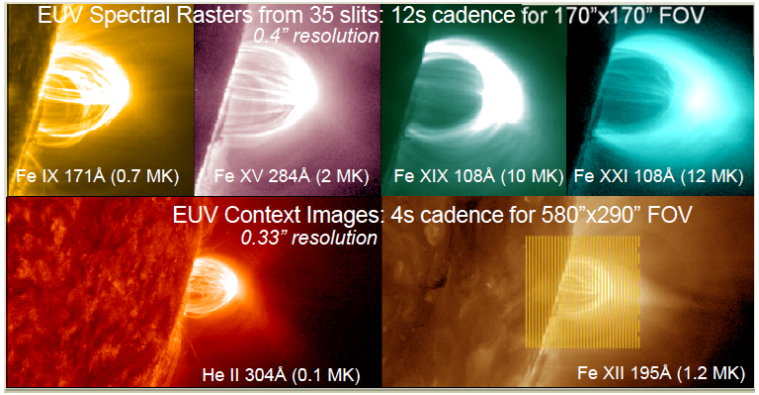
PUNCH

Polarimeter to Unify the Corona and Heliosphere



TRACERS

Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites

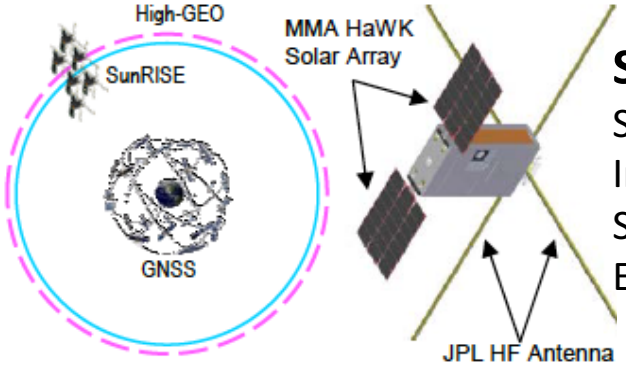


MUSE

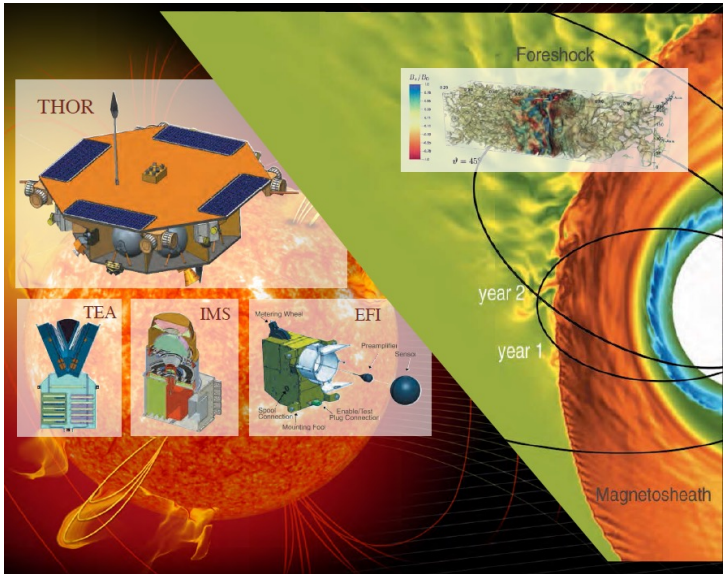
Multi-slit Solar Explorer

AO 2016 SMEX Selections [2/2]

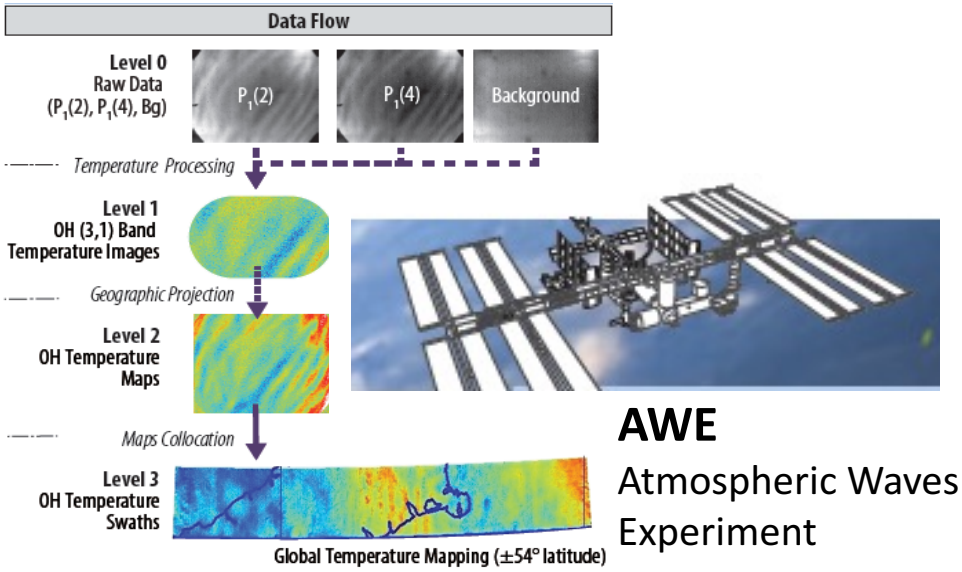
- Three MOs selected to proceed:
  - Two MOs (SunRISE, AWE) in Phase A competition, LRD varies
  - One partner MoO: THOR-US, contingent on selection of ESA M5 mission
- Tech development funding for Cat-3 MO: COSIE
- Several selections use multiple CubeSats/SmallSats
  - Technology development that can be leveraged for future Decadal Survey missions



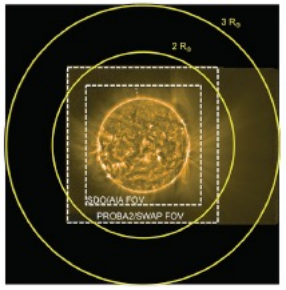
SunRise
Sun Radio Interferometer Space Experiment



THOR-US
Turbulence Heating ObserveR



AWE
Atmospheric Waves Experiment



COSIE
Coronal Spectrographic Imager in the EUV

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

HPD ROSES17 Status

ELEMENT	STEP 1 PROPOSALS (Due Date)	STEP 2 PROPOSALS (Due Date)	AWARDS (Expected)	YEAR 1 ($M)
B.2 H-SR	194	177	(25-30)	($6.0M)
B.3 H-TIDeS	101	88	(12)	($4.0M-$6.0M)
B.4 H-GI Open	193	175	(25-30)	($4.7M)
B.5 H-GCR TMS	N/A	N/A	N/A	N/A
B.6 H-LWS	(12/5)	(2/6/2018)	(15-20)	($3.75M)
B.7 H-DEE	15	9	(<=9)	($0.5M)
B.8 H-GI MMS	54	(1/11/18)	(8-10)	($1.3M)
B.9 H-GCR SC	TBD	TBD	TBD	TBD

DRIVE implemented in FY18 President's Budget

HELIOPHYSICS

$M		FY16	FY17	FY18	FY19	FY20	FY21	FY22	Delta FY18	FY20-FY18
Sounding Rocket Program Office	FY15 PBR	**48.3**	53.0	53.0	53.0				10.7	4.1
	FY18 PBR	49.8	53.3	59.0	61.1	63.1	63.1	63.1		
Guest Investigator	FY15 PBR	**8.0**	8.0	8.0	8.0				7.2	4.8
	FY18 PBR	10.5	11.6	15.2	20.0	20.0	20.0	20.0		
Research & Analysis (HSR, H-TIDeS, H-GCR)	FY15 PBR	34.0	**33.9**	33.9	33.9				16.0	8.7
	FY18 PBR	36.3	39.4	49.9	58.2	58.6	58.6	58.6		
LWS Science	FY15 PBR	17.5	17.5	17.5	17.5				7.1	6.3
	FY18 PBR	18.4	**21.9**	29.0	35.5	35.3	35.3	35.3		
									+$41M	+$24M

Eugene Parker Honored

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.

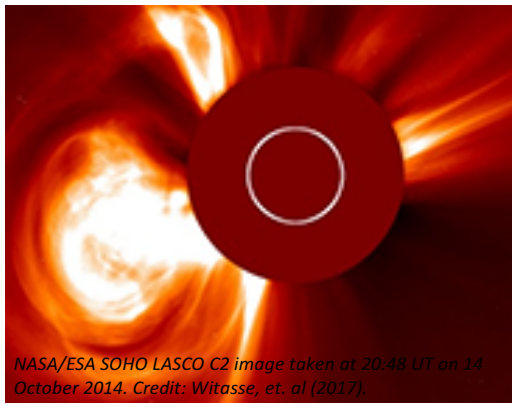
40th Anniversary of Voyager

Smithsonian Air & Space Museum, Sept 5

William Shatner sent message to Voyager

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.

NASA, ESA Spacecraft Track Solar Storm Through Space

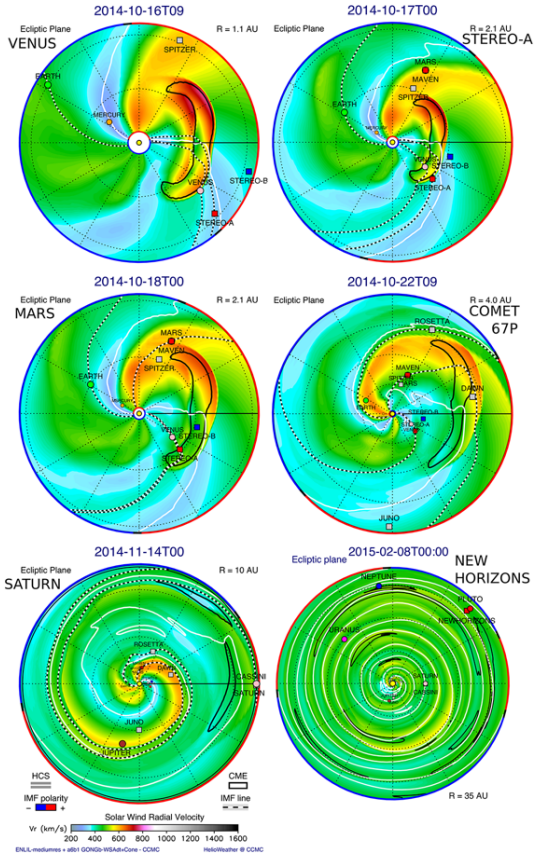


NASA/ESA SOHO LASCO C2 image taken at 20:48 UT on 14 October 2014. Credit: Witasse, et. al (2017).

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.

Date	Detected By	Location in Space	Distance from the Sun
Oct. 14, 2014	--	Sun – CME Launches	--
Oct. 16, 2014	Venus Express *(indirect data)*	Venus	0.72 AU
Oct. 16, 2014	STEREO-A	The Far Side of the Sun	0.96 AU
Oct. 17, 2014	Curiosity	Mars	1.41 AU
	MAVEN		
	Mars Express		
	Mars Odyssey		
Oct. 22, 2014	Rosetta	Comet 67P	3.13 AU
Nov. 12, 2014	Cassini	Saturn	9.94 AU
Jan. 18 – Feb. 14, 2015	New Horizons *(possible detection)*	En Route to Pluto	31.49 AU
Late March 2016	Voyager 2 *(possible detection)*	The Heliosheath	111.06 AU



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.

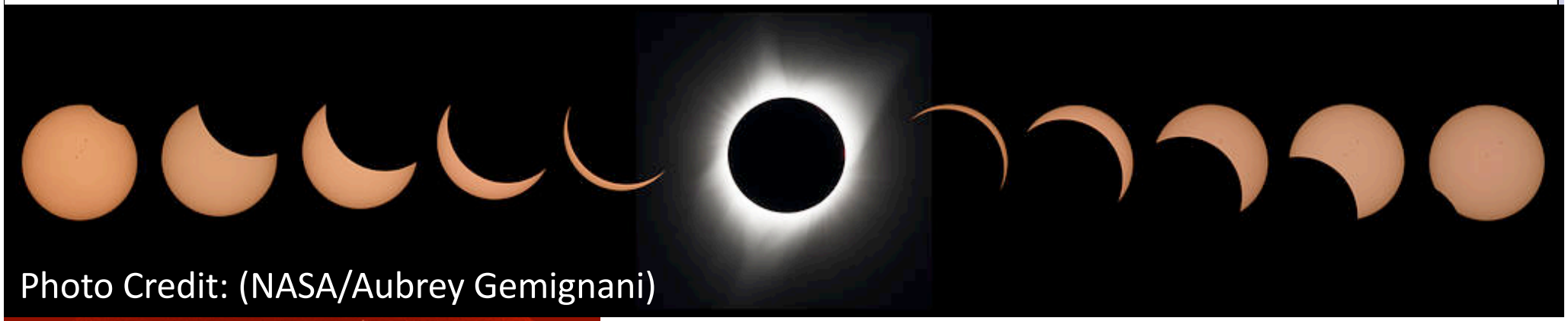
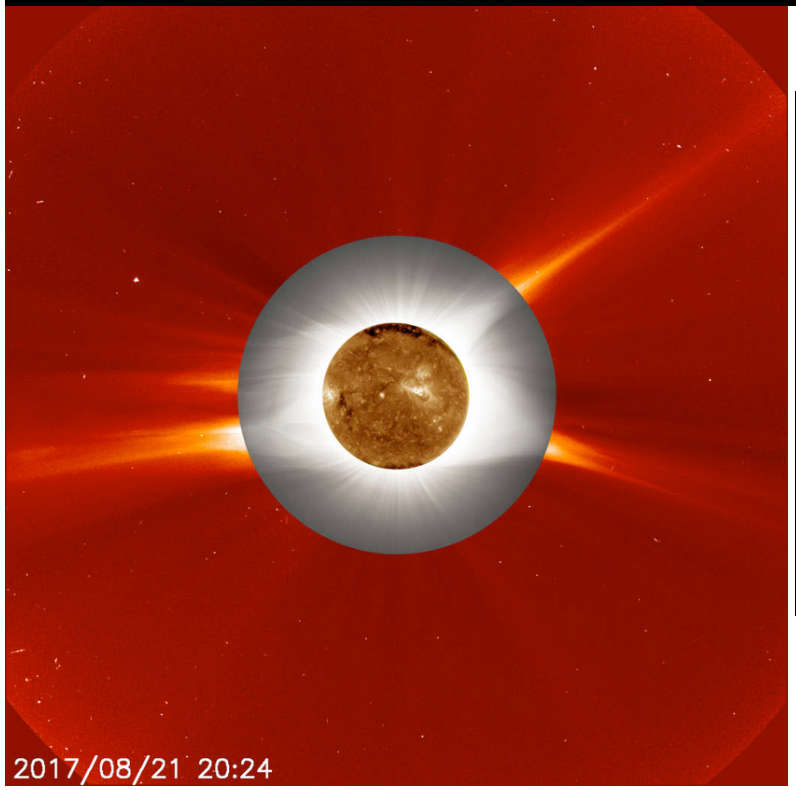
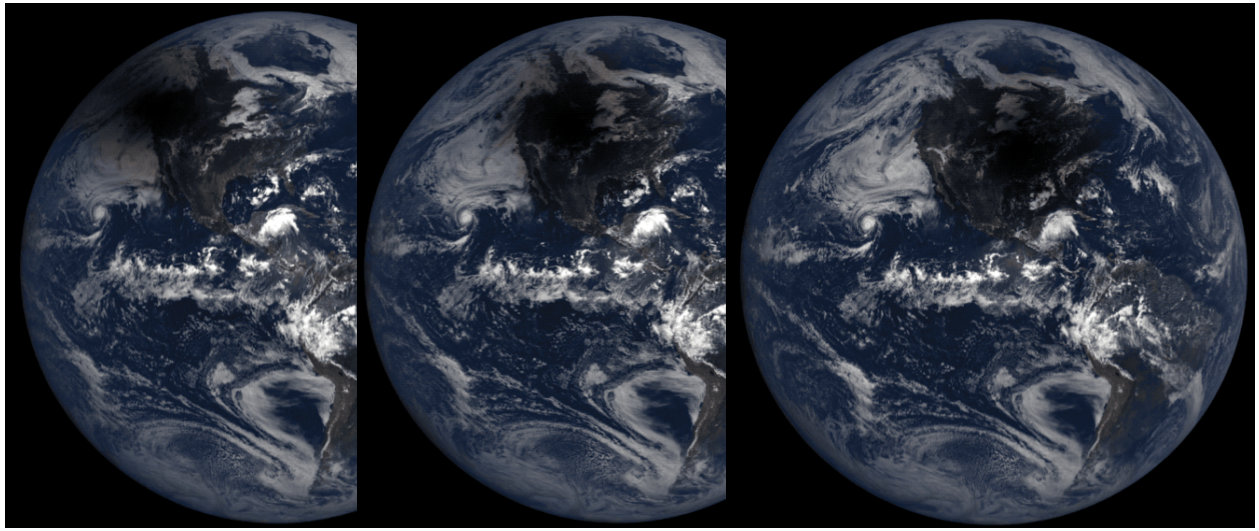


Photo Credit: (NASA/Aubrey Gemignani)



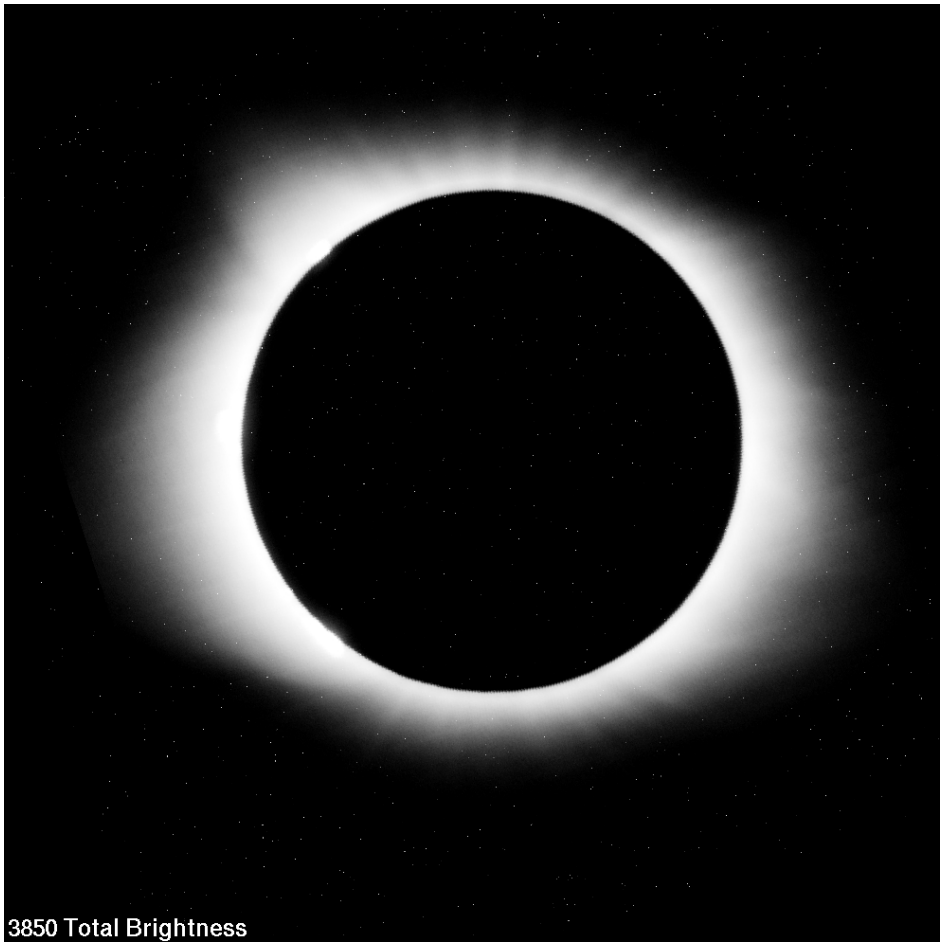


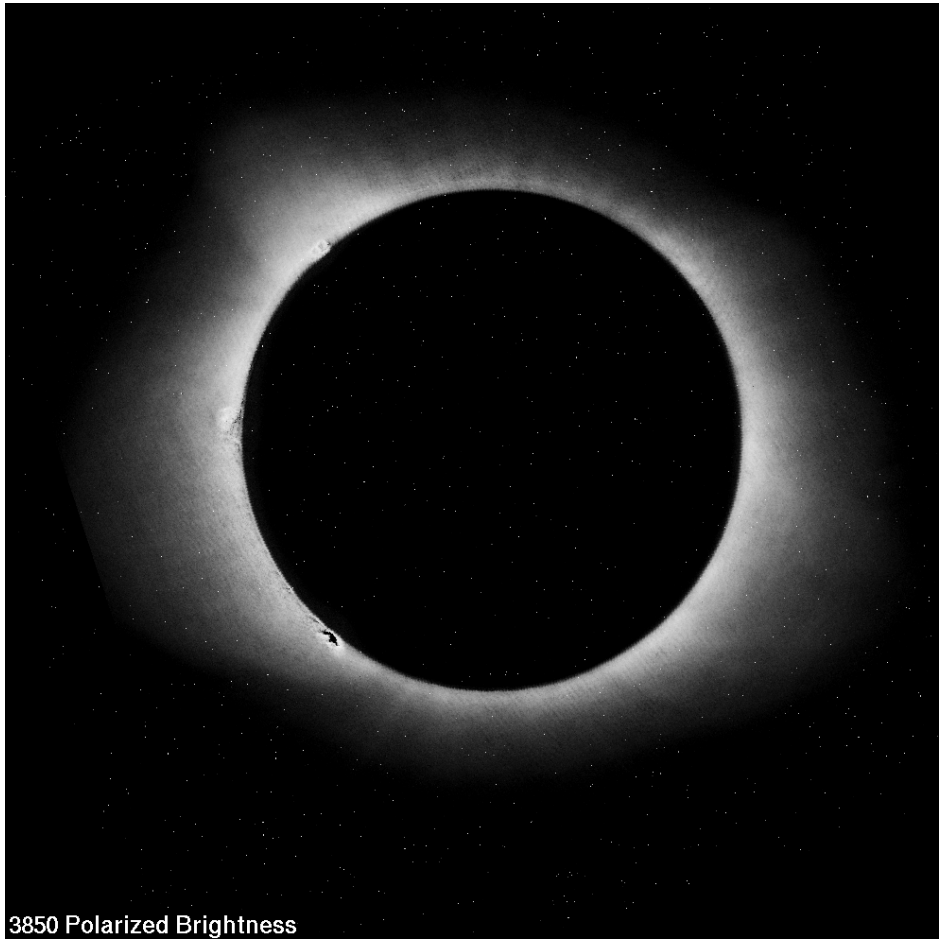
Moon's shadow moving across North America as seen by EPIC on DISCOVR. **Credit:** NASA EPIC Team

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