



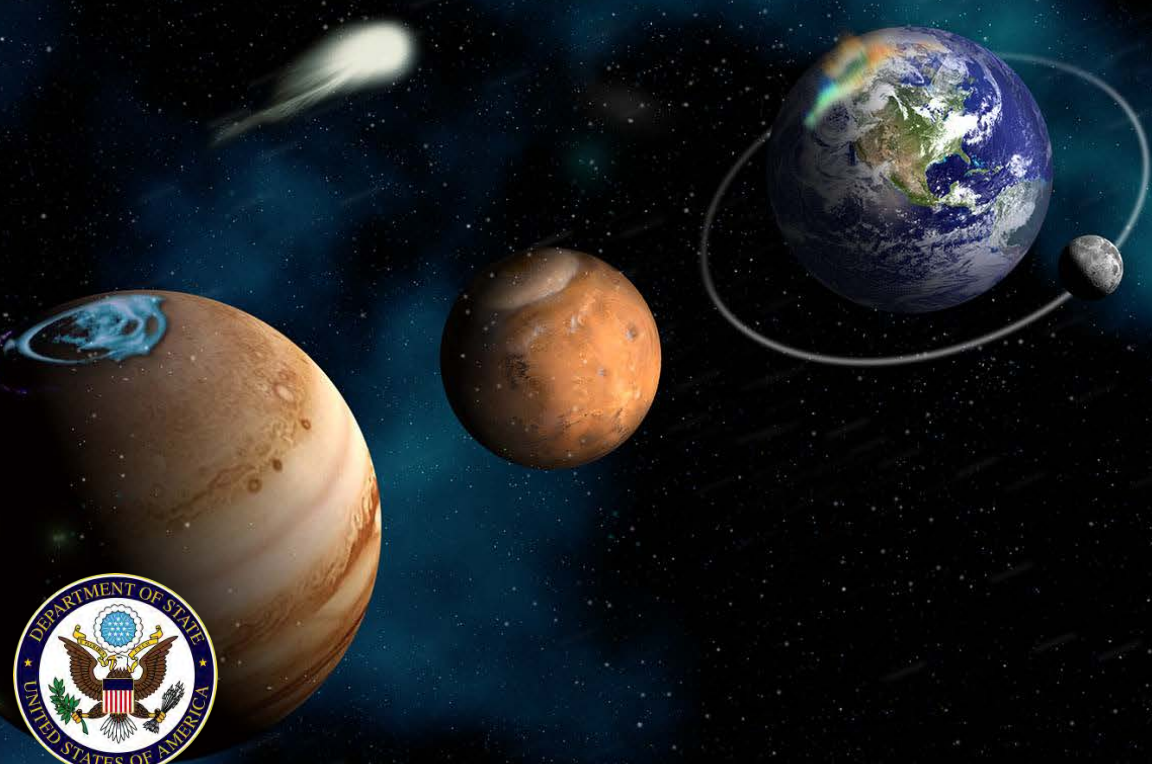
National Aeronautics and Space Administration



NASA Heliophysics Update

*Space Weather as a
Global Challenge Workshop*

Embassy of Italy



Steven W. Clarke
Director, Heliophysics Division
Science Mission Directorate

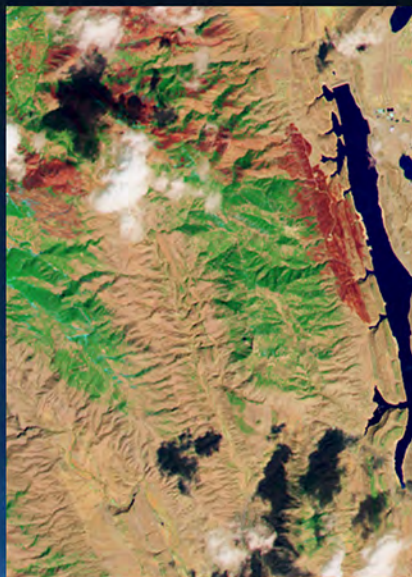


18 May 2017

NASA SCIENCE MISSION DIRECTORATE



HELIOPHYSICS



EARTH SCIENCE



PLANETARY SCIENCE



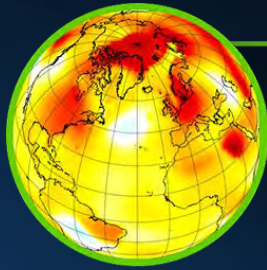
ASTROPHYSICS



Innovation & Discovery

An Integrated Program Enabling Great Science

KEY SCIENCE THEMES



Safeguarding and
Improving Life on Earth



Searching for
Life Elsewhere



Expanding our Knowledge



XMM-NEWTON KEPLER HUBBLE NEOWISE THEMIS WIND MMS VOYAGER 1

FERMI CHANDRA LISA PATHFINDER VAN ALLEN PROBES HINODE DAWN NEW HORIZONS VOYAGER 2

SWIFT NUSTAR TIMED ACE GEOTAIL

SPITZER SOHO RHESSI CASSINI

SOFIA SDO IRIS IBEX

SORCE (TCTE) CALIPSO OCO-2 CLOUDSAT OSIRIS-REX

DSCOVR ISS AQUA LANDSAT 7 LANDSAT 8 JUNO

CYGNSS GPM MARS ODYSSEY MARS EXPRESS

SMAP MARS CURIOUSITY EXOMARS 2016

GRACE MAVEN MRO

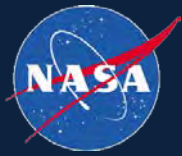
TERRA

QUIKSCAT

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- EARTH SCIENCE ●
- HELIOPHYSICS ●
- PLANETARY SCIENCE ●
- ASTROPHYSICS ●

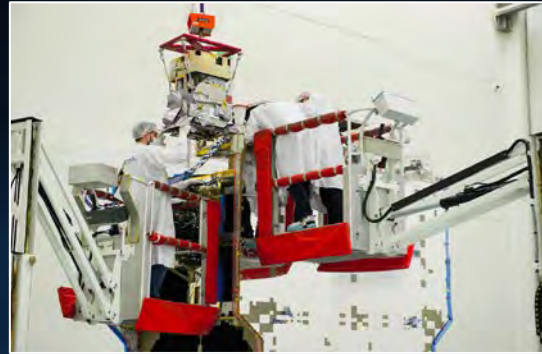
OPERATING SCIENCE FLEET



Mission Development Snapshots



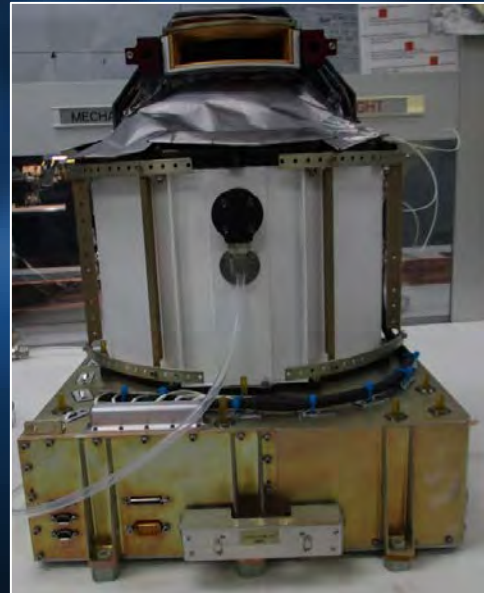
ICON
Aft deck removed, final closeout completed and reinstalled at OATK in Gilbert, AZ



GOLD
Integration to the SES-14 spacecraft in Toulouse, France



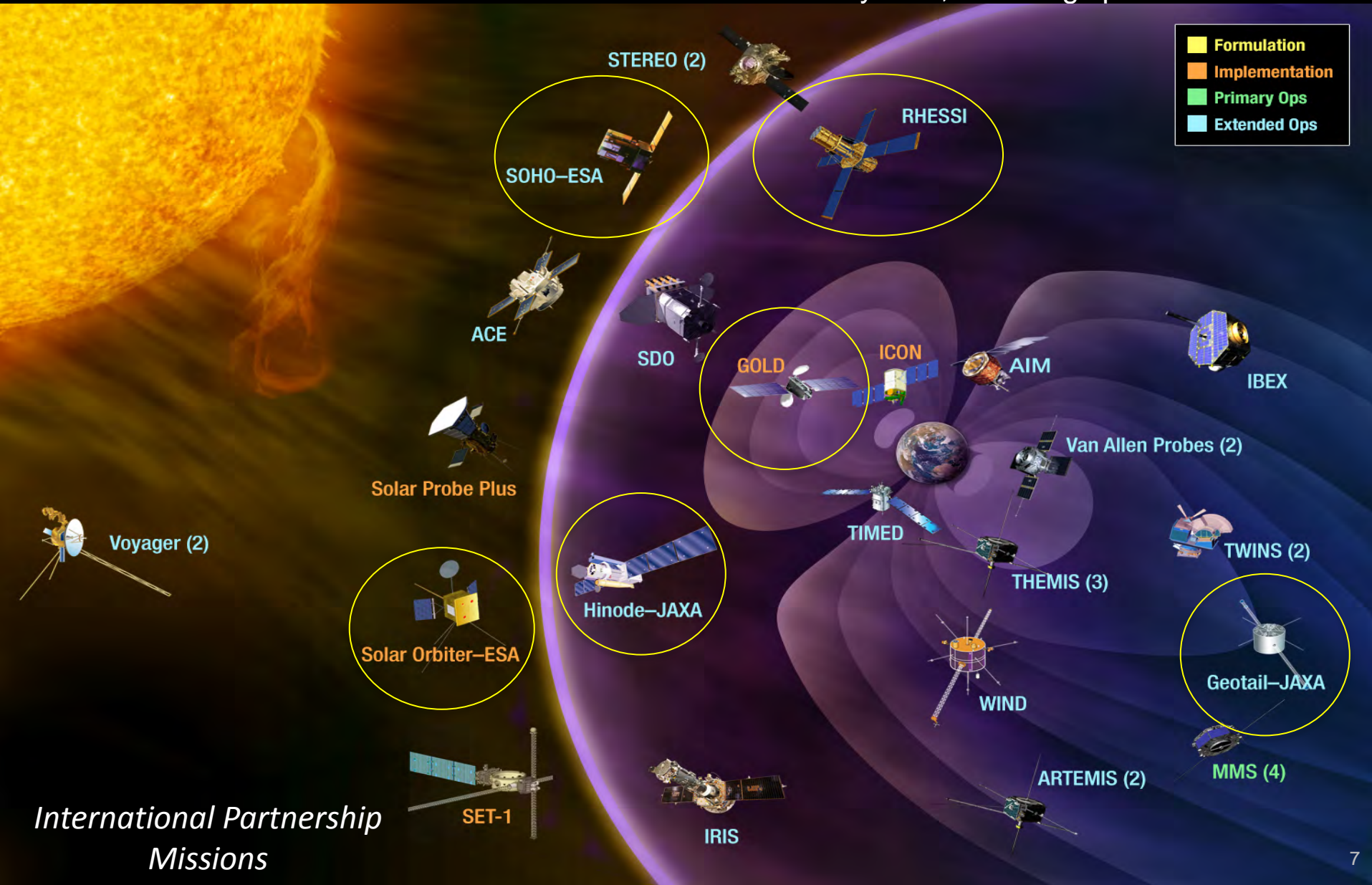
Solar Probe Plus
Spacecraft Integration at APL



Solar Orbiter
HIS Flight Instrument at SwRI

Heliophysics System Observatory

A coordinated and complementary fleet of spacecraft to understand the Sun and its interactions with Earth and the solar system, including space weather



Impacts occur even with relatively minor activity...

SECTIONS HOME SEARCH The New York Times Nov 2015

Solar Storm Knocks Out Flight Control Systems in Sweden

Oct 2014 THE WALL STREET JOURNAL

GENERAL NEWS

Solar Flares From Sunspot Hamper Pilots, Satellites

AR 12192 Has Launched Six Major Solar Flares Toward Earth, Disrupting Navigation Systems and Radio Communications



MENU TIME

SPACE

Solar Flare Delays Resupply Mission to International Space Station

It unleashed a level of radiation that could put a rocket at risk.

By Noali Rayman Jan. 08, 2014

Jan 2014

English.news.cn 新华网 NEWS

China

Solar flare affects shortwave radio communications in southern China

English.news.cn 2011-02-16 00:23:21

Feedback Print RSS

BEIJING, Feb. 15 (Xinhua) -- A large solar flare accompanied by electromagnetic storms affected shortwave radio communications in southern China on Tuesday, according to the China Meteorological Administration (CMA).

Feb 2011

USNews NEWS News, Opini

Solar Flares Likely Knocked Military Satellites Offline

Solar storms earlier this month may have caused military satellites to reboot.



Air Traffic Control


"Severe solar flare impact at 2249UTC, initially affecting *Central West Pacific* but by 2400UTC, impact peaked and was affecting all communications. 25 air traffic control messages were delayed."

REUTERS Edition: UK Jul 2012

Commodities | Mon Jul 16, 2012 10:37pm BST

UPDATE 2-NextEra cuts N.H. Seabrook output due to solar activity

Related: REGULATORY NEWS



TECHWATCH Apr 2010

Galaxy-15 satellite damaged by solar flare

could knock out power for some 40 million

Mar 2012

BROADBAND DSLReports.com login register

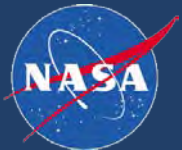
Solar Flares Knock Out LightSquared Satellite

Mar 2012

SPACE WEATHER

Quebec City
Power Outage 1989

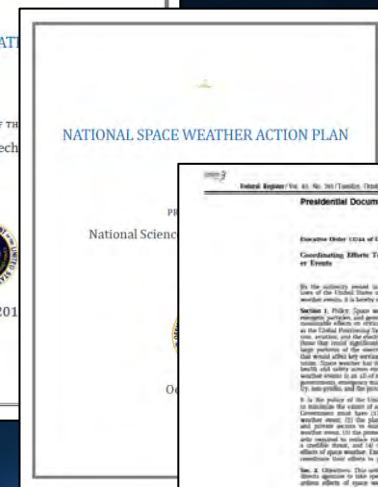
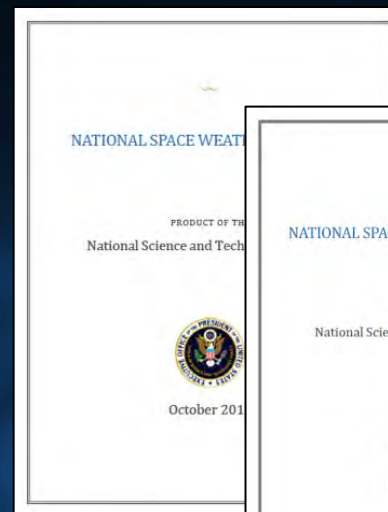




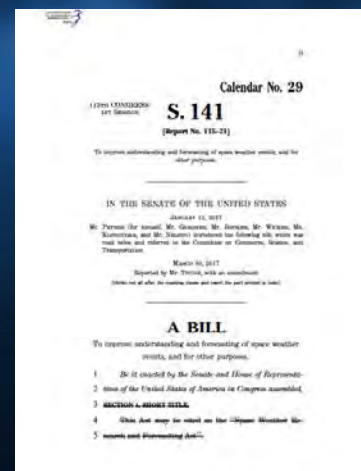
R20: National Effort

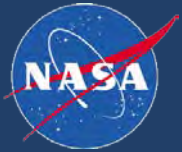


- White House
 - National Space Weather Strategy and Action Plan
 - Executive Order 13744



- Congress
 - Space Weather Research and Forecasting Act (S.141)



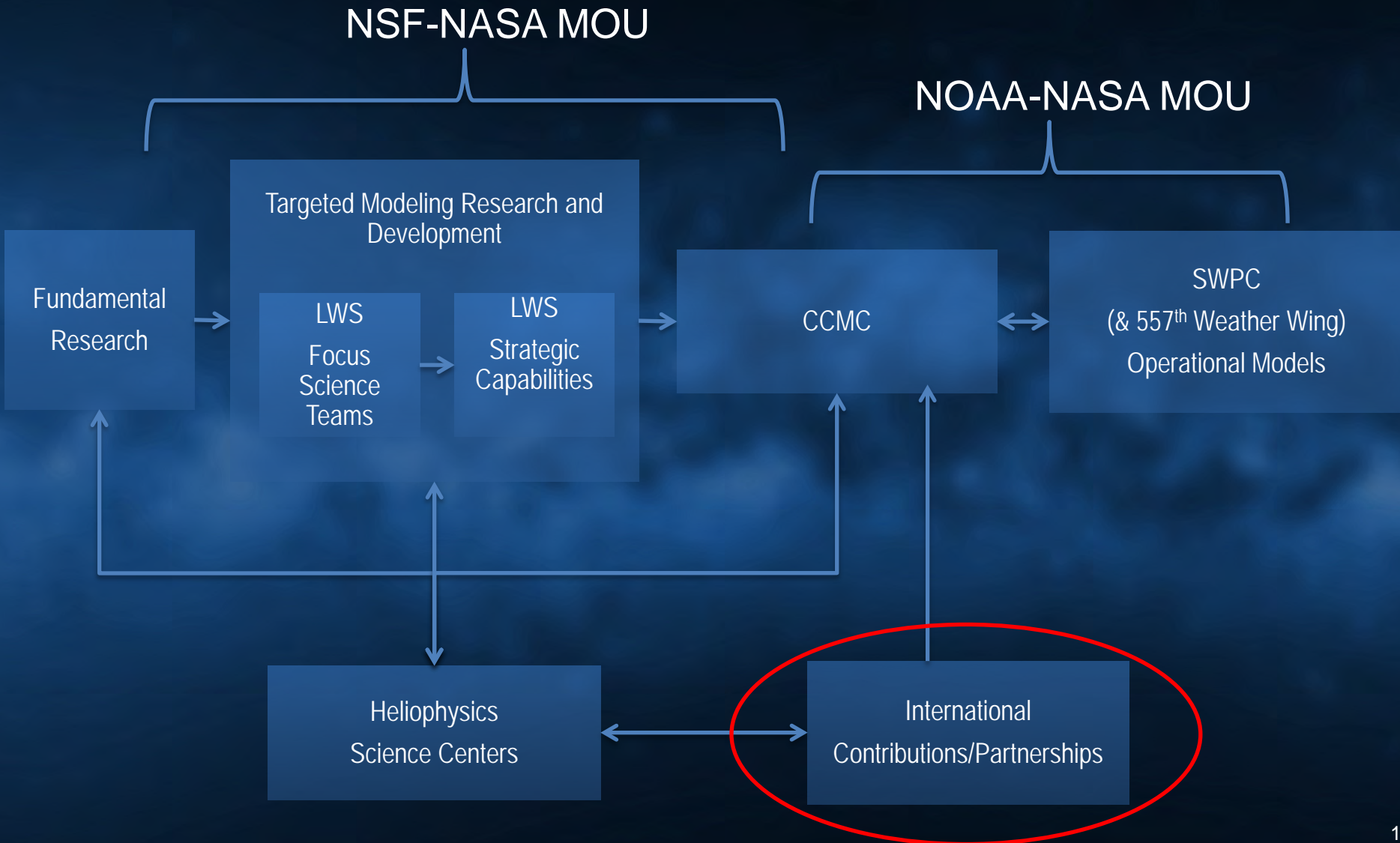


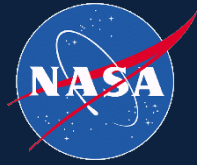
Partnerships



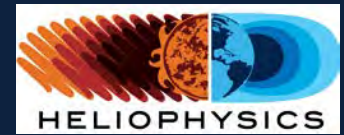
- NOAA-NASA MOU
 - Defines joint modeling activities to streamline the transfer of research models to operational use
 - Several reviews by the General Counsel offices of both agencies
 - Targeting mid-May for final approval
- NSF-NASA MOU
 - Final language under review
- NSF-NASA Grant Opportunity – “*Computational Aspects of Space Weather*” (*working title*)
 - 3 -Year Grant (FY18-20)
 - Includes NSF Directorates of Geosciences, Mathematical and Physical Sciences, and Computer and Information Science and Engineering
 - NASA anticipates contribution ~\$2M/YR from LWS Science funding
- Heliophysics Science Centers
 - RFI

R20 Concept of Operations





R20: International Effort



- NASA-Space Situational Awareness (SSA) discussions (re: L5 mission)



- Geospace Model @ CCMC
- Continued discussions concerning flying prototype coronagraph on a balloon flight in 2019



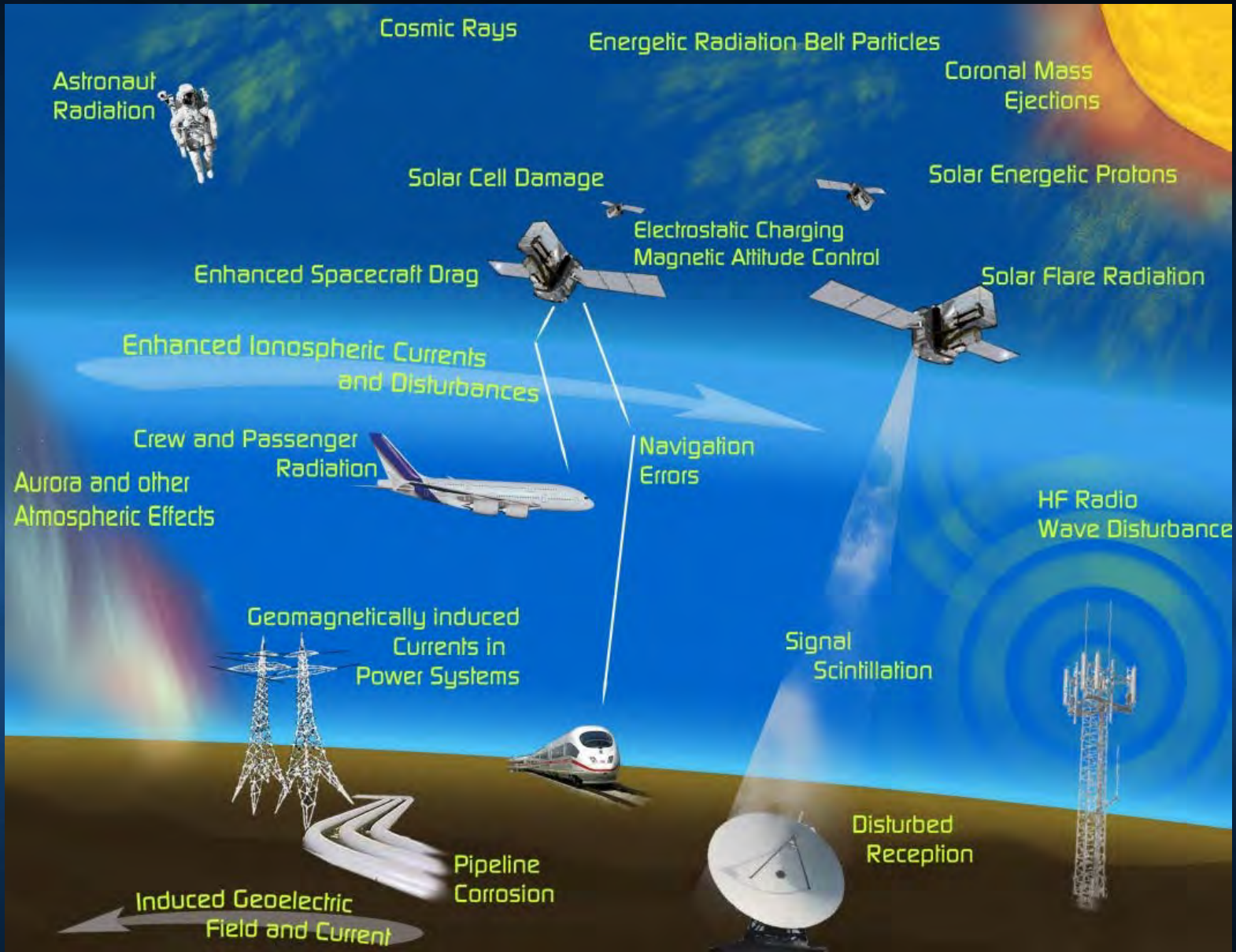
- Next Generation Solar Physics Mission (NGSPM) Science Objectives Team (SOT) draft report due in April; final in July

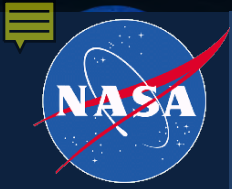


- 3 sub-working groups established - 1) Aditya-1 mission collaboration, **2) space weather modeling,** 3) long-term strategic collaboration focus areas



Goal: Minimize Impacts





Grazie!



Long-term interagency, international and public-private collaboration is critical to successful global space weather preparedness.



Questions? Comments? Email us at HQ-HelioConnects@mail.nasa.gov
Or contact me directly at steven.w.clarke@nasa.gov