

The background features a large, semi-transparent NASA logo watermark. The logo consists of a blue circular field containing the word "NASA" in white, bold, sans-serif capital letters. A red swoosh, representing a spacecraft's trajectory, curves across the logo from the bottom left to the top right. The entire scene is set against a light blue gradient background with soft, wavy patterns at the bottom.

Science Office For Mission Assessments Overview

**Dr. Chauncey Wu
Acquisition Manager**

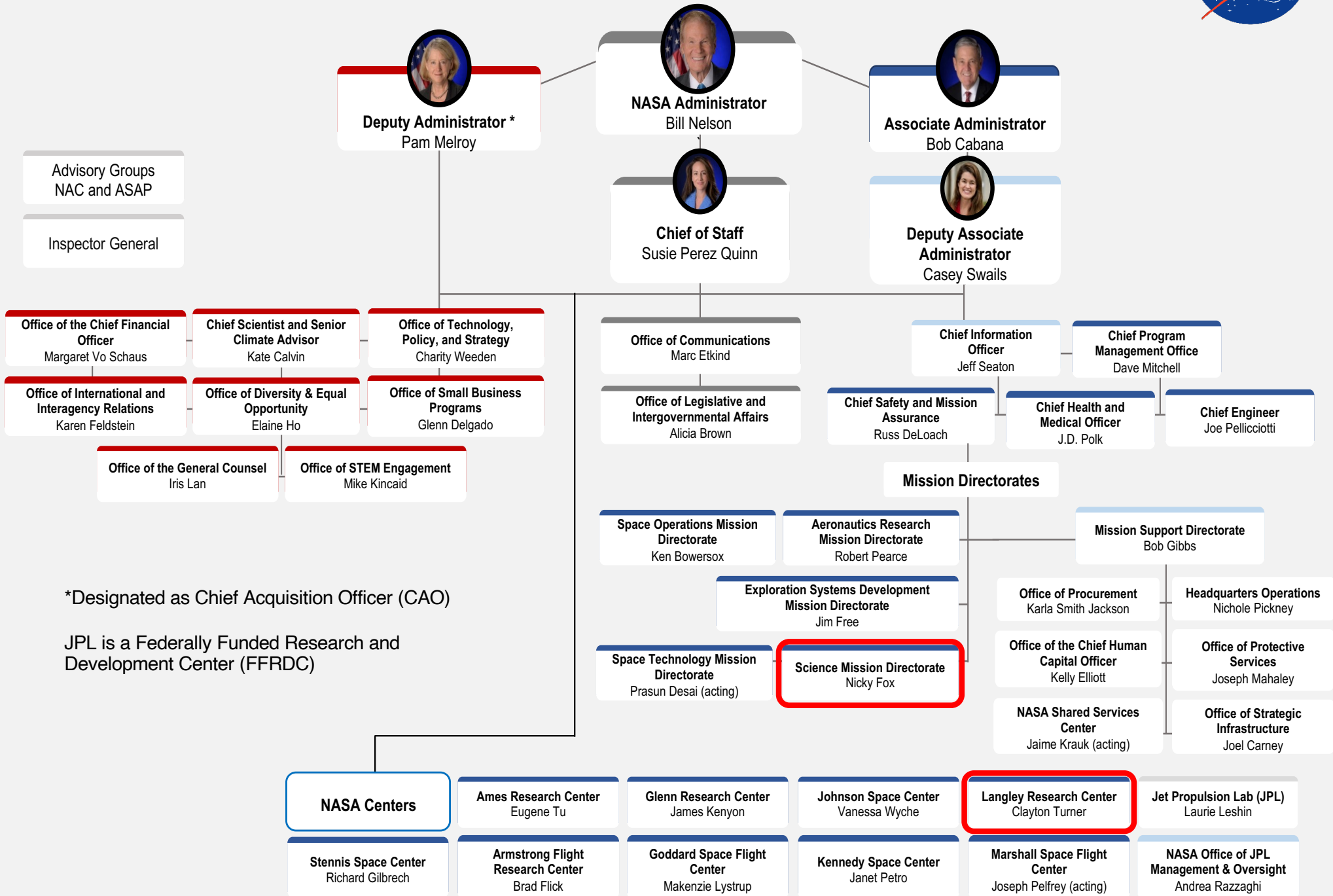
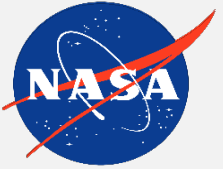
6 June 2024



Science Office For Mission Assessments

- SOMA supports NASA Science Mission Directorate (SMD) acquisition of future Earth- and space-science missions and instruments. SOMA is a Program Office of SMD, located at the NASA Langley Research Center.
- Announcements of Opportunity (AOs) are used to solicit proposals for Principal Investigator (PI)-led, competed Missions. The PI is responsible for their mission's scientific, technical, and programmatic success.
- SOMA works with SMD Program Scientists to develop AOs, and leads the Technical, Management, and Cost (TMC) evaluations of pre-Phase A proposals and Phase A Concept Studies received in response to the AOs.
- Mission budgets range from approximately \$30M (Missions of Opportunity) up to \$1B (2023 Astrophysics Probe).

NASA Organization Chart



*Designated as Chief Acquisition Officer (CAO)

JPL is a Federally Funded Research and Development Center (FFRDC)

NASA Langley Research Center Organization

Langley is a research, science, technology and development Center that provides game changing innovations to enable NASA to make significant contributions to the Nation.
We Deliver on Today's Commitments and Create Tomorrow's Opportunities



* Indicates Acting Leadership

Current as of 9/2/23

NASA Langley Research Center Organization

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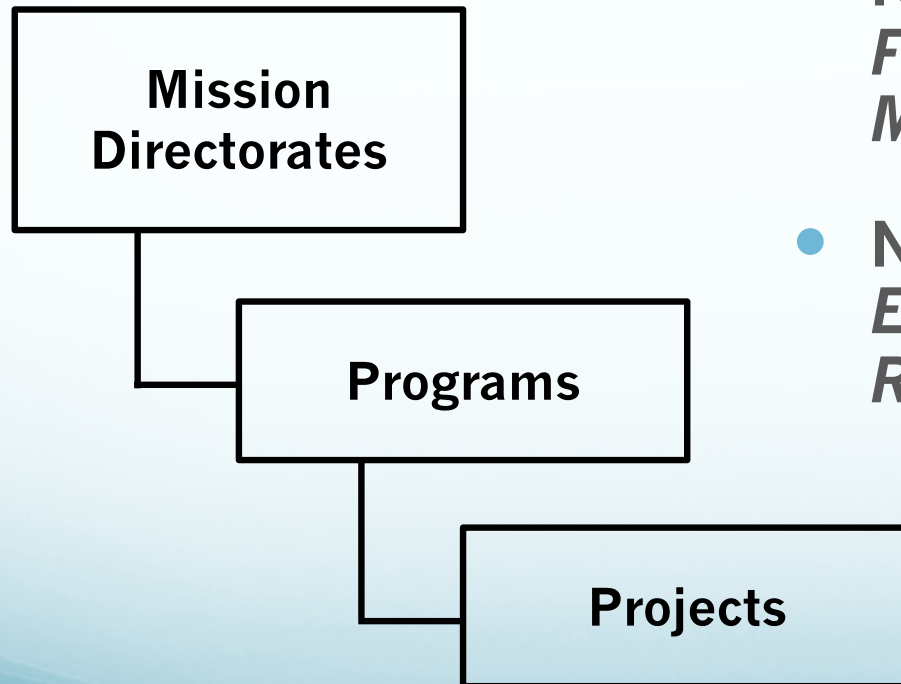


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Current as of 9/2/23

Space Flight Programs

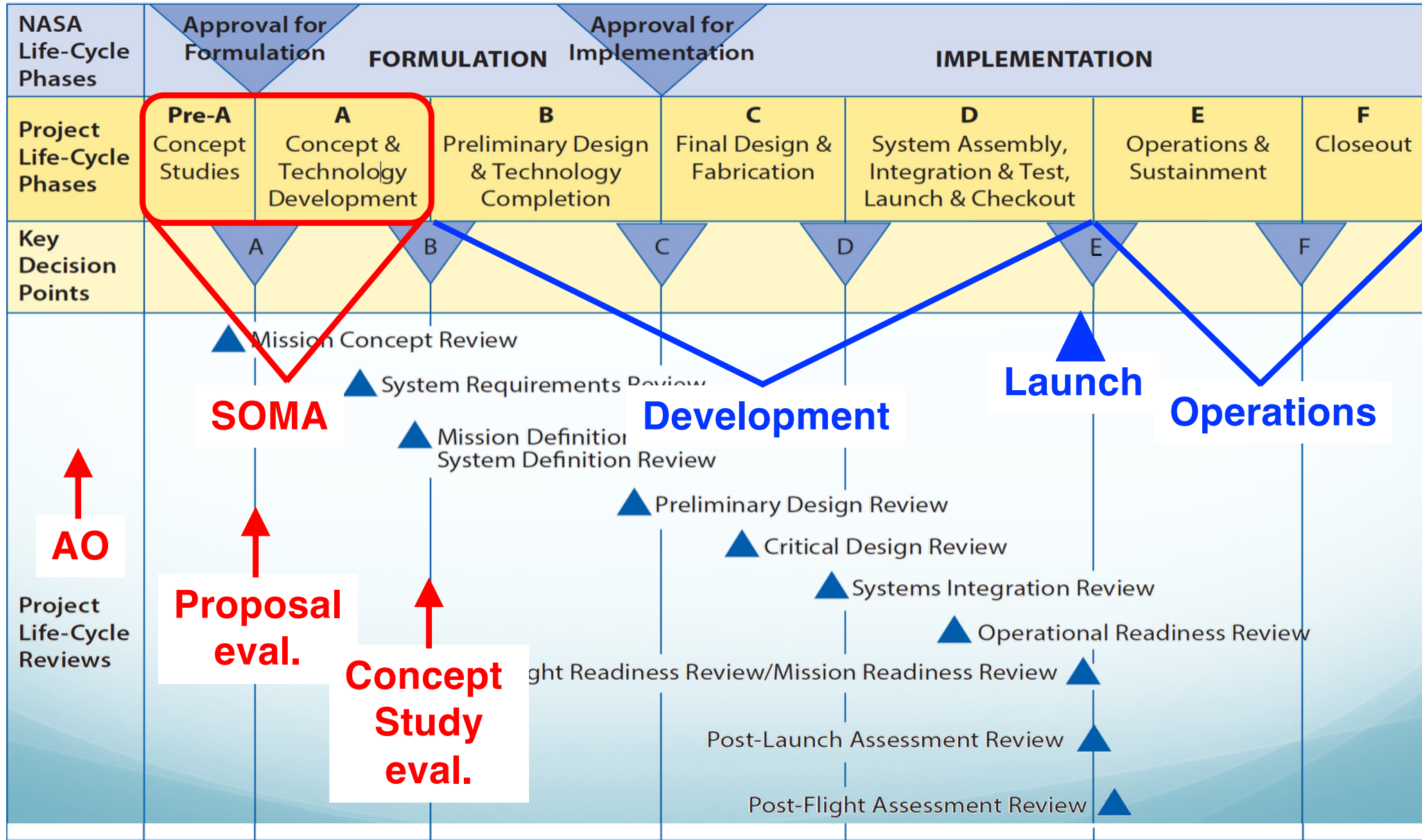
- Space flight programs and projects flow from the implementation of national priorities, defined in the Agency's Strategic Plan, through the Agency's Mission Directorates



- NPR 7120.5, *NASA Space Flight Program and Project Management Requirements*
- NPR 7123.1, *NASA Systems Engineering Processes and Requirements*



Simplified NASA Project Life Cycle



Competitive Peer Review

- NASA is committed to the principles of open competition and merit review as a key to excellence
- Mission proposals in response to the AO are chosen through an extensive competitive peer review process
- Proposals require careful trade-offs between science and cost to produce investigations with the highest possible science value for the cost
- NASA AOs can be found on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) website under “Solicitations.” NSPIRES also lists proposals selected to conduct NASA research
- <http://nspires.nasaprs.com/external/>

Proposal Evaluation

- SOMA conducts peer reviews of the Technical, Management, and Cost (TMC) aspects of proposals submitted to SMD's competed Space Flight Programs
- The SOMA Acquisition Manager leads a small, remote, multi-disciplinary engineering team to evaluate
 - pre-Phase A *proposals* (Step 1 of a 2-step process, or a 1-Step process)
 - Phase A *Concept Study Reports* (Step 2 of a 2-step process)
- SOMA hires non-conflicted contractor evaluators who are experts in the area of the proposal that they evaluate (Instruments, Mission Design and Operations, Flight Systems, Management and Schedule, or Cost)

2016 Heliophysics Small Explorer And Missions of Opportunity

- **Heliophysics Small Explorer (SMEX) AO**
 - Full Missions or ISS Payload
 - \$165M (FY2017) including launch
- **Heliophysics Mission of Opportunity (MO) AO**
 - Small Complete Missions (SCMs)
 - \$55M (FY2017) including launch
- **Step-1 Proposals (pre-Phase A)**
 - Final AO July 2016, proposals received October 2016
 - Proposals eval'd 2016-2017; selections made July 2017
- **Step-2 Concept Studies (Phase A)**
 - Concept Study Reports (CSRs) received August 2018
 - CSRs eval'd 2018-2019; down-selections made 2019-2020

Technical, Management, And Cost Feasibility Of The Proposed Mission Implementation

- The technical and management approaches of all submitted investigations will be evaluated to *assess the likelihood that they can be successfully implemented as proposed*, including an assessment of the likelihood of their completion within the proposed cost and schedule
- Factor C-1. Adequacy and robustness of the *science instrument* implementation plan
- Factor C-2. Adequacy and robustness of the *mission design* and plan for *operations*
- Factor C-3. Adequacy and robustness of the *flight systems*
- Factor C-4. Adequacy and robustness of the *management* approach and *schedule*, including the capability of the management team
- Factor C-5. Adequacy and robustness of the *cost* plan, including cost feasibility and cost risk

For Example...

Factor C-2. Adequacy and robustness of the mission design and plan for mission operations

- Assess overall mission design and mission architecture, spacecraft design and design margins (including *margins* for launch mass, delta-V, and propellant), concept for mission operations (incl. communications, navigation/tracking/trajectory analysis, and ground systems and facilities), and the plans for launch services
- Assess mission *resiliency* – the flexibility to recover from problems during both development and operations – including the *technical resource reserves and margins*, system and subsystem *redundancy*, and reductions and other changes that can be implemented *without impact to the Baseline Science Mission*




(*Italics mine*)

TMC Risk Rating Assigned To Each Proposal

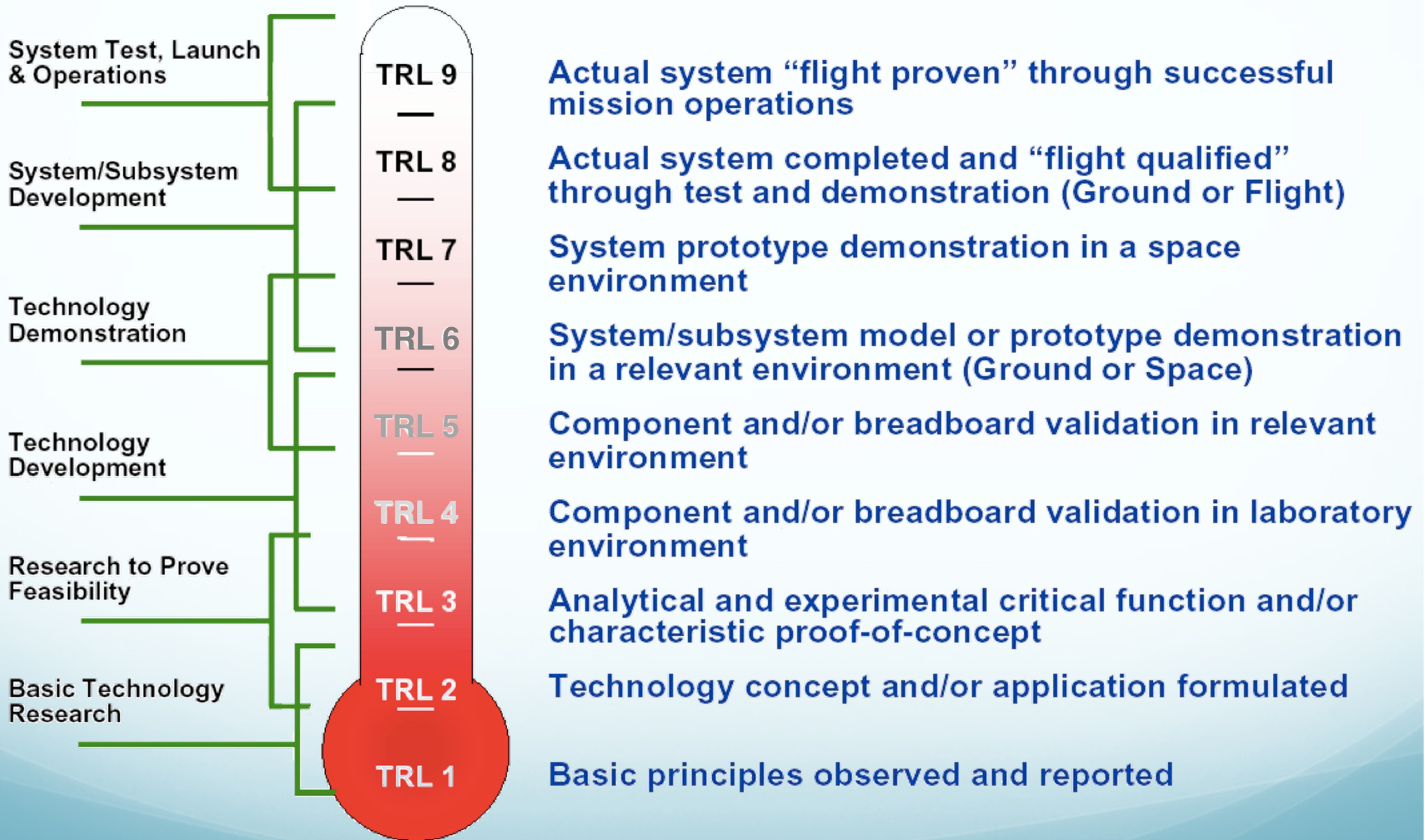
The third criterion, technical merit and feasibility, including cost risk, will be reported as Low Risk, Medium Risk, or High Risk, as defined in the table below.

Summary Evaluation	Basis for Summary Evaluation
<u>Low Risk</u>	There are no problems evident in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the Proposer's capability to accomplish the investigation well within the available resources.
<u>Medium Risk</u>	Problems have been identified, but are considered within the proposal team's capabilities to correct within available resources with good management and application of effective engineering resources. Mission design may be complex and resources tight.
<u>High Risk</u>	One or more problems are of sufficient magnitude and complexity as to be deemed unsolvable within the available resources.

TMC Risk Rating Developed For Each Proposal

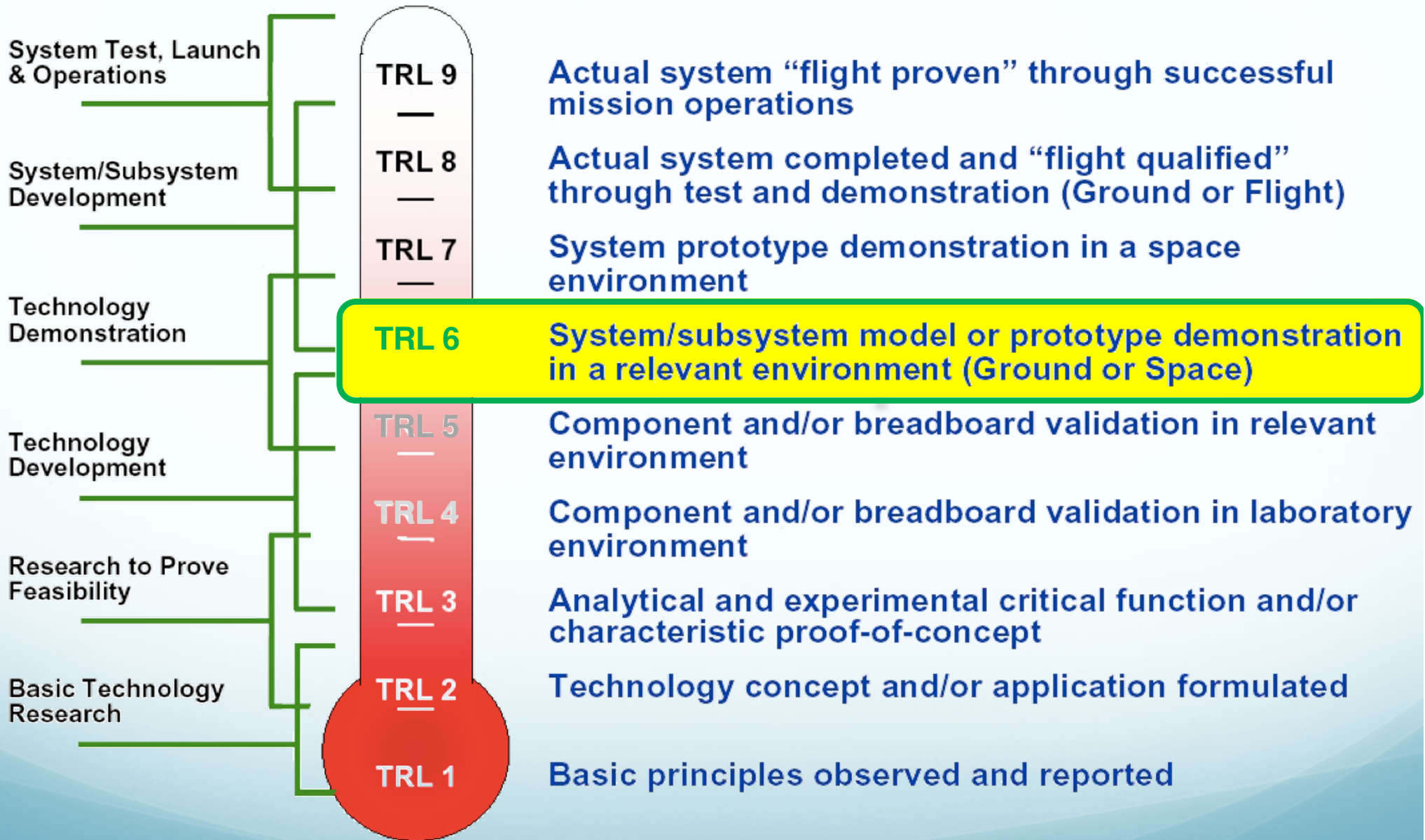
Summary Evaluation	Resources Required Versus Resources Available
<u>Low Risk</u>	 <p>Resources Required < Resources Available</p>
<u>Medium Risk</u>	 <p>Resources Required ~ Resources Available</p>
<u>High Risk</u>	 <p>Resources Required > Resources Available</p>

Technology Readiness Levels



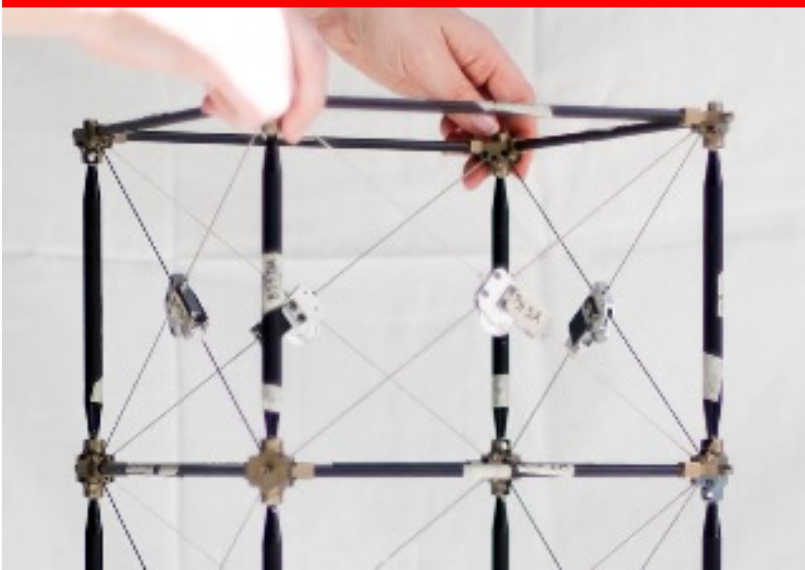
Use to assess technology maturity, and provide consistent basis for comparison

Technology Readiness Levels

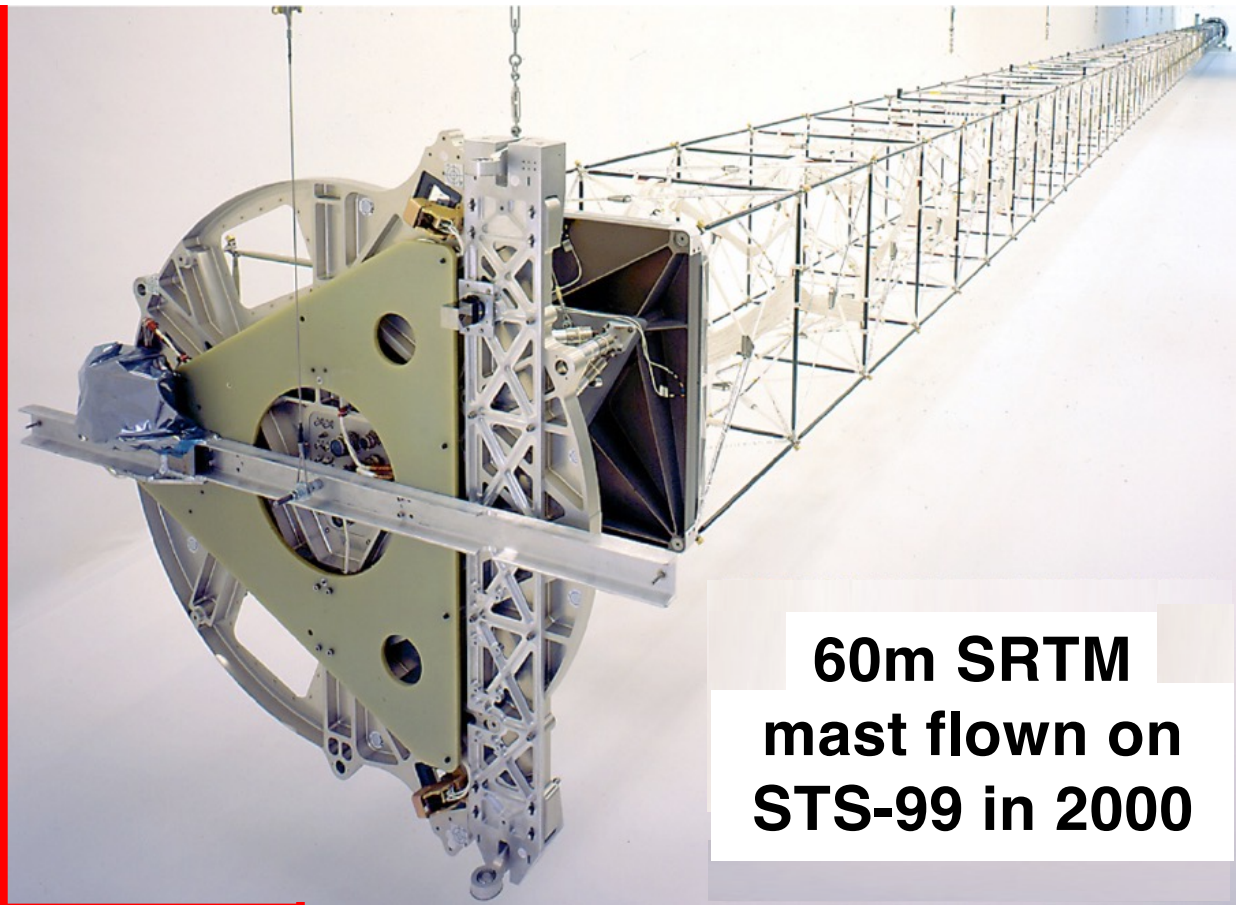


AO Requirement: All proposed technologies must be at TRL 6 by PDR/KDP-C

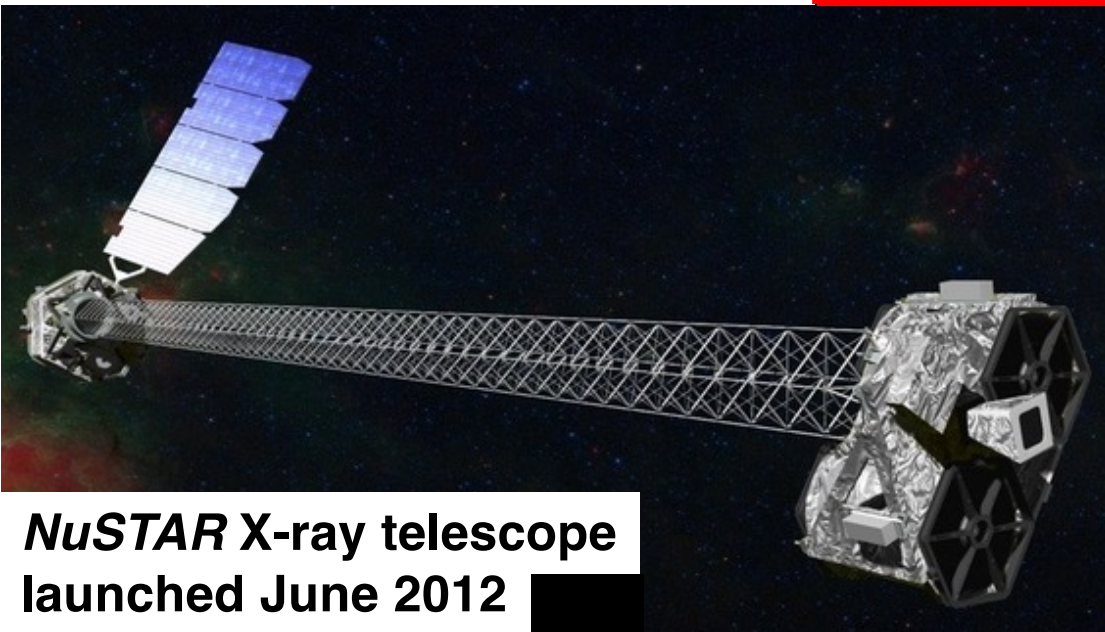
What Constitutes “Heritage”?



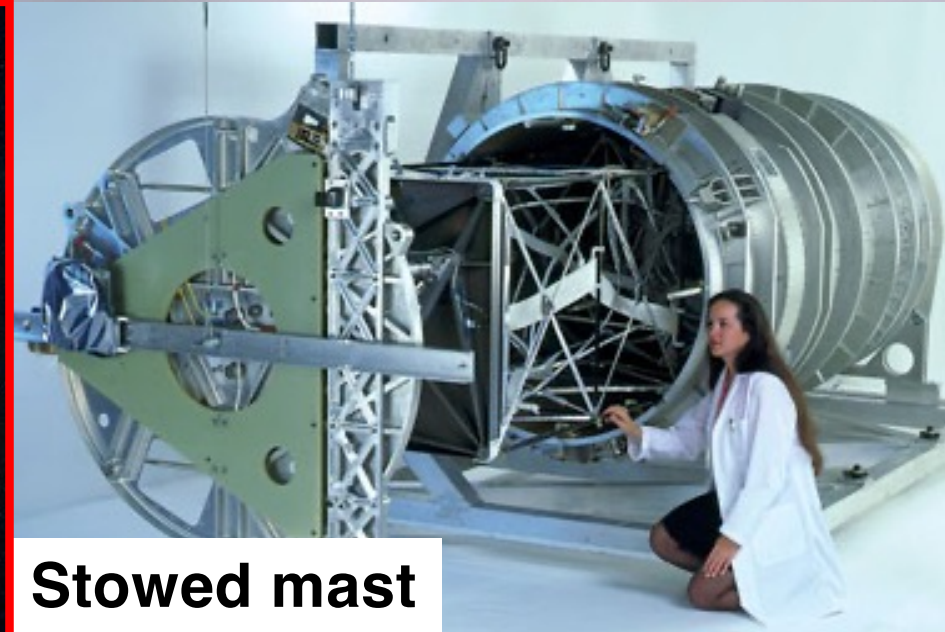
1 bay of 10m mast



**60m SRTM
mast flown on
STS-99 in 2000**

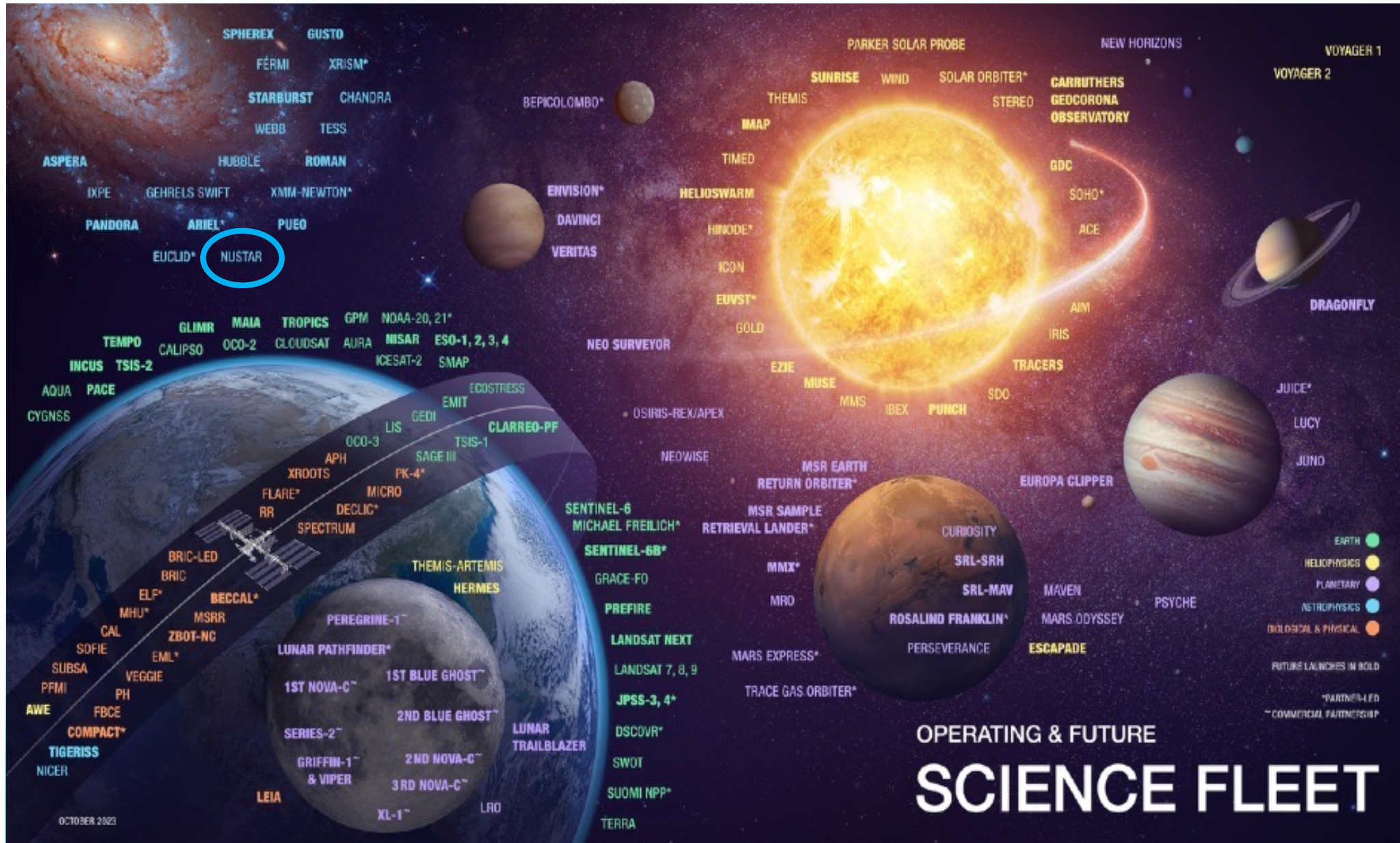


**NuSTAR X-ray telescope
launched June 2012**



Stowed mast

NASA Science Missions In Development And Operations



SMD Competed Space Flight Programs

Science Mission Directorate (SMD)		SMD Program Office responsible for Project Phase		
SMD Divisions	Competed Programs	Pre-Ph. A, KDP A	Phase A, KDP B	Phases B/C/D/E/F
Planetary Science Division	Discovery	SOMA	SOMA @ Langley	Discovery PO @ Marshall
	New Frontiers	SOMA	SOMA @ Langley	New Frontiers PO @ Marshall
	NASA instrument contributions to international missions	SOMA	Discovery & New Frontiers POs @ Marshall	Discovery & New Frontiers POs @ Marshall
	Mars Program Strategic Mission Instruments	SOMA	Mars PO @ JPL	Mars PO @ JPL
Heliophysics Division	Heliophysics Explorers	SOMA	SOMA @ Langley	Explorer PO @ Goddard
	Living With a Star (LWS)	SOMA	LWS PO @ Goddard	LWS PO @ Goddard
	Solar Terrestrial Probes (STP)	SOMA	STP PO @ Goddard	STP PO @ Goddard
	NASA instrument contributions to international missions	SOMA	Explorer, LWS, STP POs @ Goddard	Explorer, LWS, STP POs @ Goddard
Astrophysics Division	Astrophysics Explorers	SOMA	SOMA @ Langley	Explorer PO @ Goddard
	NASA instrument contributions to international missions	SOMA	Explorer PO @ Goddard	Explorer PO @ Goddard
Earth Science Division	Earth Venture Missions Earth Venture Instruments	SOMA	ESSP PO @ Langley	ESSP PO @ Langley
	Earth System Explorers	SOMA	SOMA @ Langley	Explorer PO @ Goddard

Explorers Program History

- The first U.S. spacecraft launched by the Army Ballistic Missile Agency in January 1958 was named “Explorer”. What discovery is Explorer 1 known for?
- To date, over 100 U.S. and cooperative international scientific space missions flown under the Explorers Program.
- 2002 Nobel Prize for Physics awarded to Dr. Riccardo Giacconi (AS&E) for pioneering contributions to astrophysics, including SAS-1/Uhuru (Explorer 42) discovery of cosmic X-ray sources
- 2006 Nobel Prize for Physics awarded to Dr. John Mather (NASA Goddard) for COBE (Explorer 66) discovery of cosmic microwave background radiation.
- Different funding levels for:
 - Full Missions: MIDEX ~ \$300M and SMEX ~ \$150M
 - Missions of Opportunity (MO) ~ \$75M

Explorer 1, 1958



- **W. Pickering, JPL (left)**
- **J. Van Allen, U.Iowa (ctr.)**
- **W. von Braun, ABMA (right)**
- **Discovered Earth's radiation belts**

Astrophysics & Heliophysics Explorers Missions

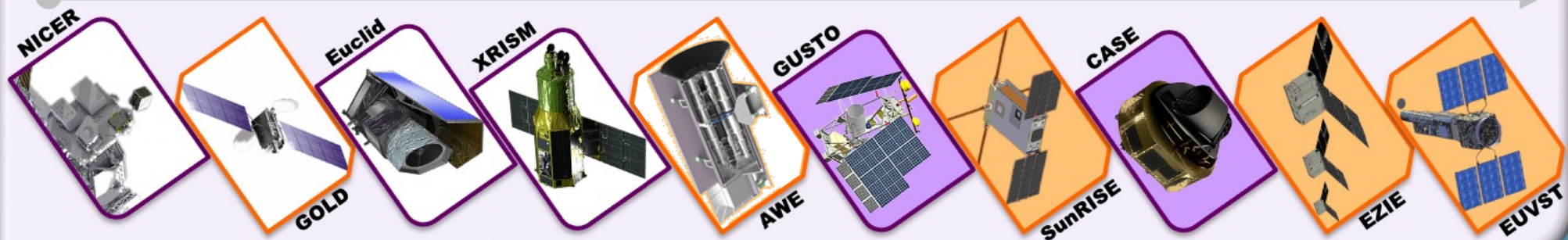
MIDEX



SMEX



UNEX • MO • INTERNATIONALS



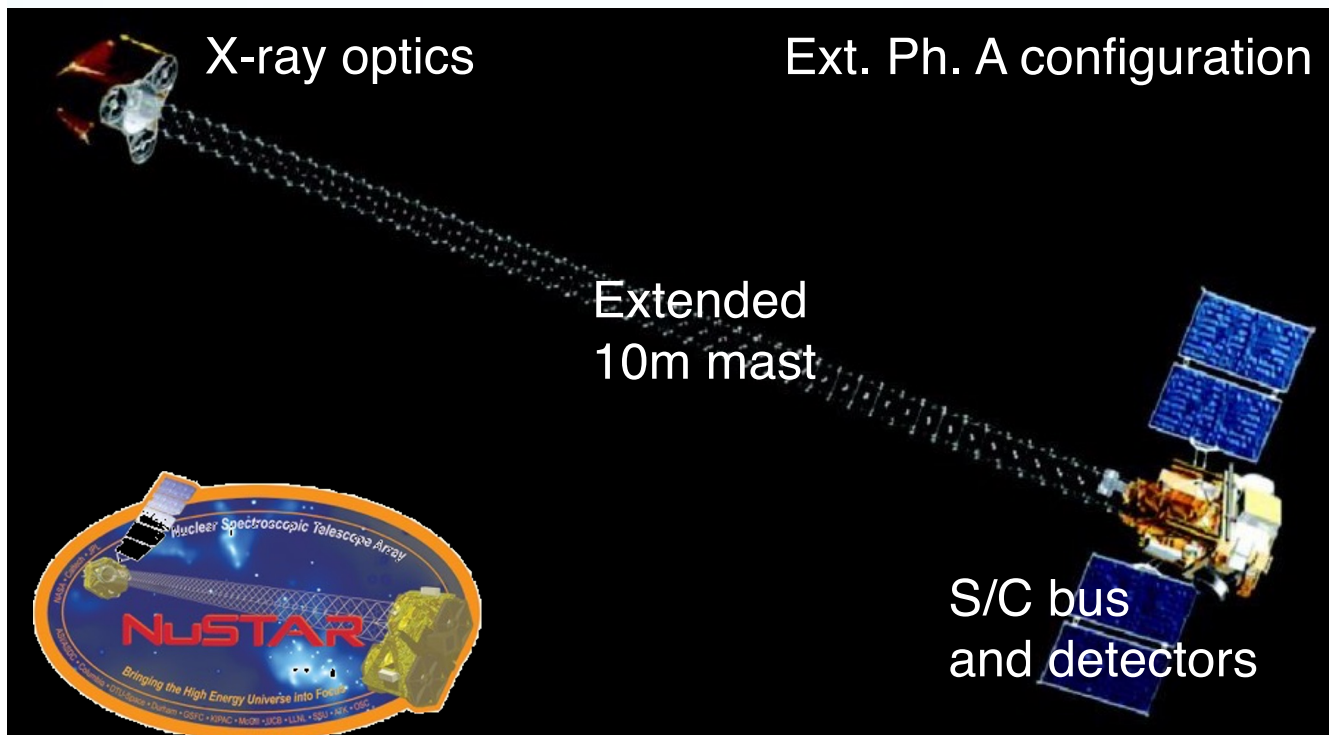
Astro./Oper.
 Astro./Dev.
 Helio./Oper.
 Helio./Dev.

NuSTAR Extended Phase A Study (2005-2007)

Nuclear Spectroscopic Telescope ARray (*Expl. 93*)

- Three focusing hard X-ray (6-80 keV) telescopes with a 10-meter deployable mast.
- Astrophysics Small Explorer (SMEX) mission cost-capped at \$120M (FY2003 AO).
- Caltech PI, with JPL project management and systems engineering.
- Launched on Pegasus XL in 2012 – and still operational in 2024!

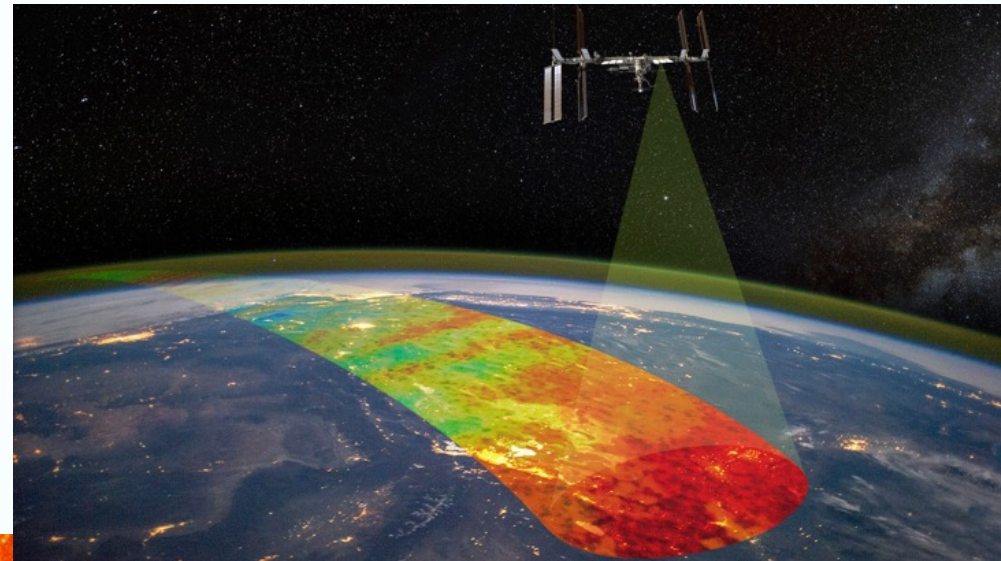
To reduce mast deployment failure risk, **additional strut** recommended for kinematic stability of mast interface to X-ray optics module.



Adjustment mechanism truss and mast bay model

2016 Heliophysics Mission of Opportunity (MO)

- AO development began in late 2015; (\$55M FY17 cost cap.
- 2 MOs down-selected by SMD in Feb. 2019 and March 2020 for development and flight.
- *AWE* (Utah State Univ.), ISS instrument to study atmospheric gravity waves, ***launched Nov. 2023!***
- *SunRISE* (U.Michigan), 6, 6U CubeSat radio interferometer to study solar particle storms, planned 2024 launch.



NASA/USU



NASA/JPL

2016 Heliophysics Small Explorer (SMEX)

- AO development began in late 2015; \$165M FY17 cost cap.
- 2 SMEXes down-selected by SMD in June 2019 at KDP B.
- Funded for development and flight.

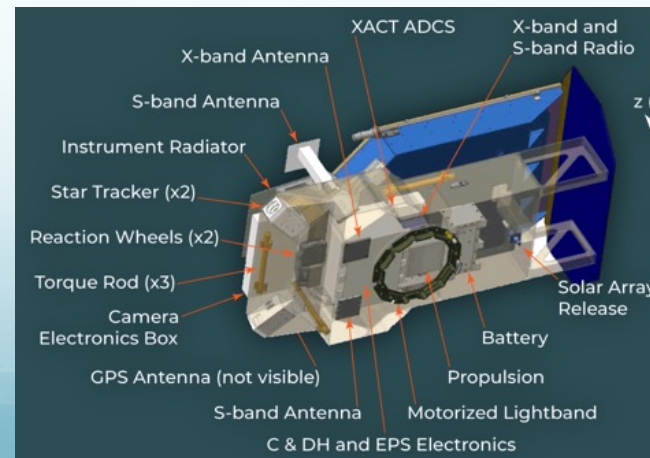
➤ *TRACERS* (U.Iowa),
2 s/c studying Sun-Earth magnetic field interactions.

➤ *PUNCH* (SwRI),
4 s/c imaging corona and solar wind.

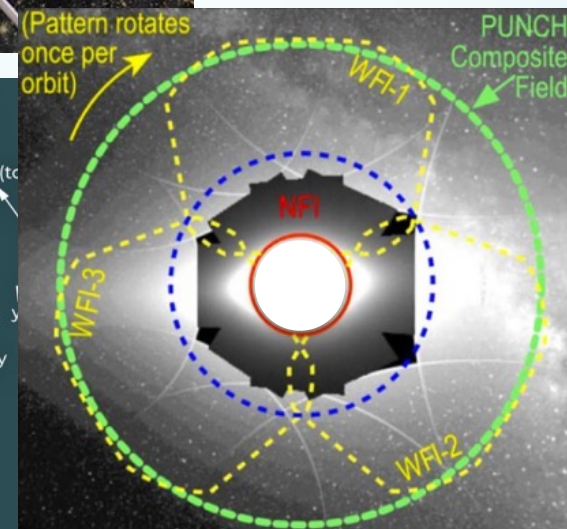
➤ Planned 2025 launches.



NASA/U.Iowa



NASA/SwRI





Heliophysics Missions In Development And Ops

Heliophysics Missions

Heliophysics Mission Fleet

Heliophysics missions are strategically placed throughout our solar system, working together to provide a holistic view of our Sun and space weather, along with their impacts on Earth, the other planets, and space in general. NASA's heliophysics mission fleet includes 19 operating missions using 26 spacecraft, 13 missions in development, 1 mission under study, a robust sounding rocket program and a variety of CubeSat missions.

- ESA = European Space Agency
- JAXA = Japan Aerospace Exploration Agency

*Numbers in parentheses indicate how many spacecraft each mission includes.

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UNDER DEVELOPMENT

- AME (ISS)
- Carruthers Geocorona Observatory
- ESCAPEDE (2)
- EUVST (JAXA)
- EZIE (3)
- GDC (6)
- HelioSwarm (9)
- HERMES (Gateway)
- IMAP
- MUSE
- PUNCH (4)
- SunRISE (6)
- TRACERS (2)

3

PRIMARY OPERATION

- Parker Solar Probe
- Solar Orbiter (ESA)
- AWE (ISS)

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EXTENDED OPERATION

- ACE
- AIM
- GOLD (SES-14)
- Hinode (JAXA)
- IBEX
- ICON
- IRIS
- MMS (4)
- RAD (Curiosity)
- SDO
- SOHO (ESA)
- STEREO
- THEMIS-ARTEMIS (2)
- THEMIS (3)
- TIMED
- Wind
- Voyager (2)

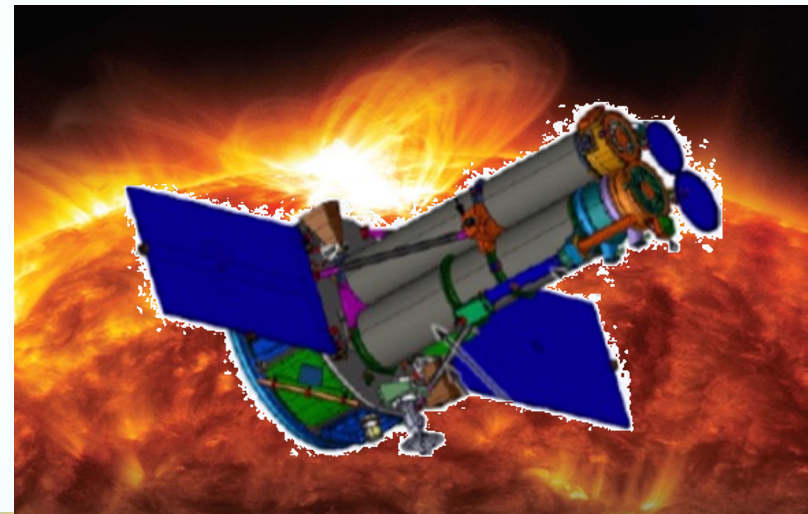
2016 AO



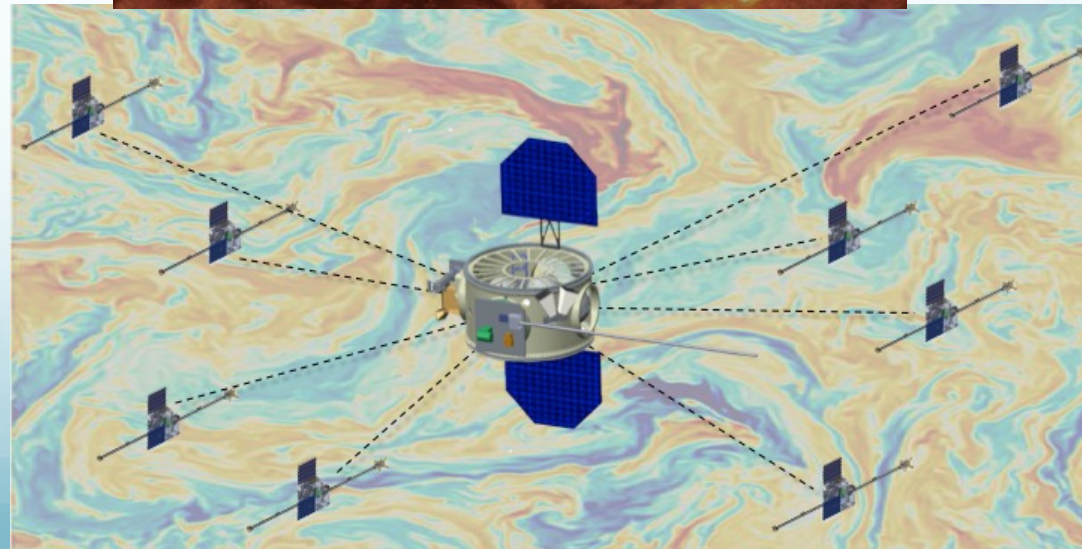
science.nasa.gov/heliophysics

2019 Helio Medium-Class Explorer (MIDEX)

- AO development began in early 2019; 250M FY19 cost cap.
- 2 MIDEXes down-selected by SMD in February 2022 at KDP B.
- Funded for development and flight.
- *MUSE* (Lockheed Martin), multi-slit spectrograph and EUV imager to study the Sun's corona.
- *HelioSwarm* (U.NH), 9 s/c to study multiscale turbulence in solar wind.
- Planned launches in 2027 and 2028.



NASA/
Lockheed
Martin



2022 Heliophysics Small Explorer (SMEX)

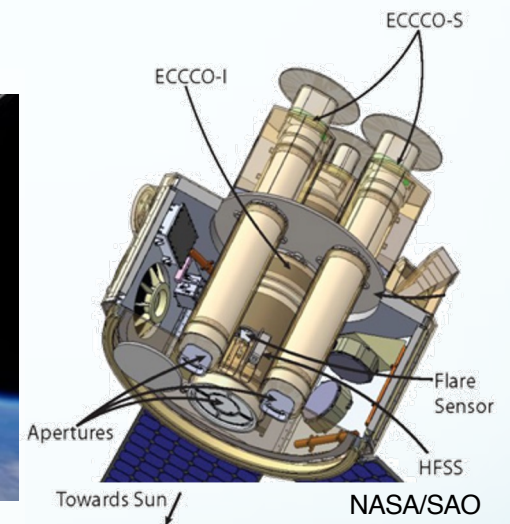
- AO development began in late 2021; \$150M FY22 cost cap.
- AO released in Sept. 2022; proposals recv'd Dec. 2022.
- 4 proposals selected by SMD in Sept. 2023 at KDP A for NASA-funded Concept Studies (\$2M each).

➤ *CINEMA* (Dartmouth);
9, 12U CubeSats to study
Earth's magnetotail.

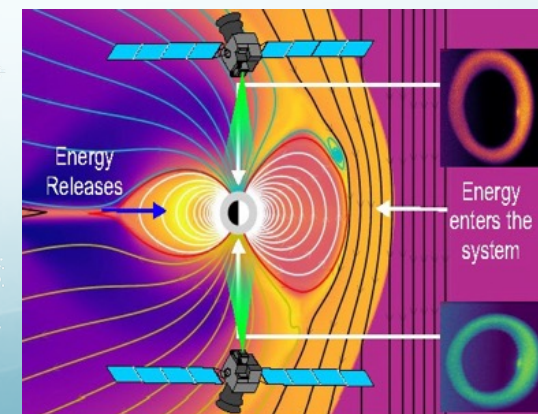
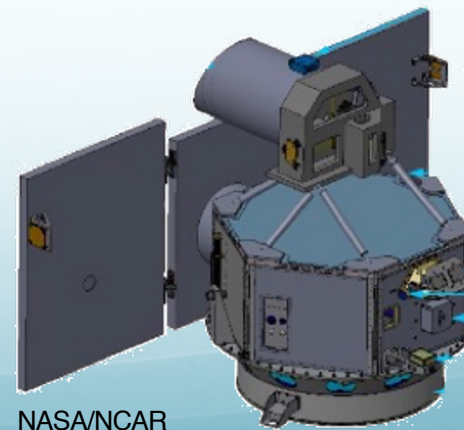


➤ *CME*x (NCAR) to study
the Sun's magnetic field.

➤ *ECCCO* (SAO) to study the
Sun's corona and CMEs.



➤ *MAAX* (U.Michigan) to study
Earth's M-I electrodynamic
coupling.



NASA Science Office for Mission Assessments (SOMA)

- SOMA website - <http://soma.larc.nasa.gov>
- Information on active AO proposal evaluations
- Information on upcoming AO releases
 - Planning List of SMD Solicitations
- General information for PIs
 - Lessons Learned
 - Common Causes of Major Weaknesses
 - Payload Risk Classification Study
 - PI Launchpad and Masters Forums

Questions?