



National Aeronautics and
Space Administration

The ASTRA Initiative

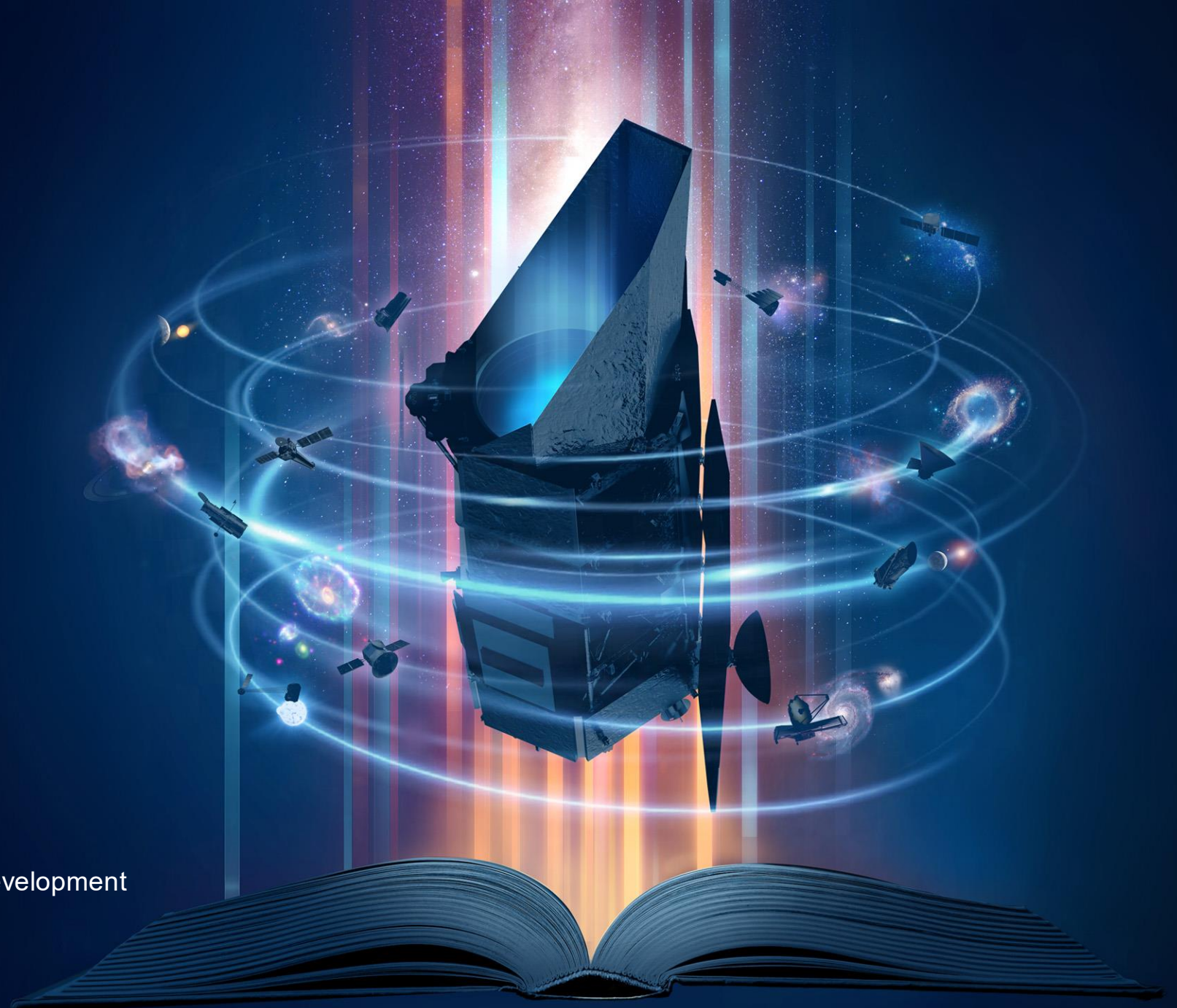
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Astrophysics Division

NASA Science Mission Directorate

Sept 1st, 2026



Ad ASTRA Workshop

Astrophysics Strategic Technology & Research Accelerator (ASTRA)

Celeriter ad
ASTRA!

- Identifies pre-Decadal mission concepts and technologies needing maturation for multiple strategic astrophysics missions
- Science First! Embrace Astro2020 recommendations and strategic NASA documents
- Considers emerging industry and other external-NASA capabilities
- Ensures continuous, programmatically responsible, groundbreaking astrophysics path to discovery

Have the right missions ready at the right time!

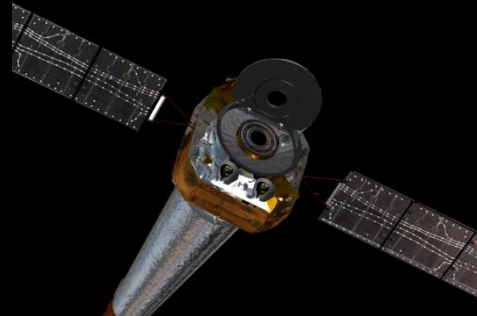
Portfolio mission readiness

- Must maintain a mission pipeline, which requires structured science community support, strategic technology investment, and parallel architecture studies.

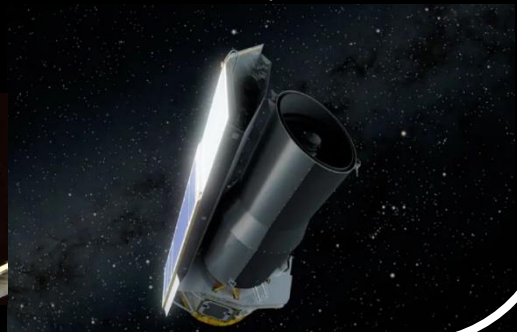
Hubble Space Telescope



Chandra X-Ray Observatory



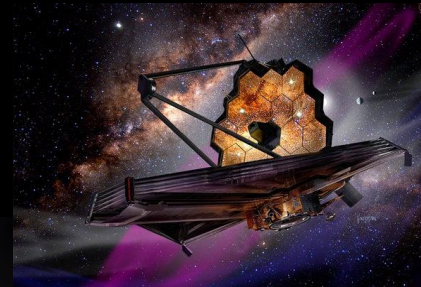
SIRTF/Spitzer



Compton Gamma Ray Observatory



James Webb Space Telescope



Nancy Grace Roman Space Telescope



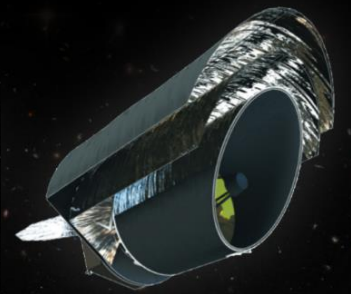
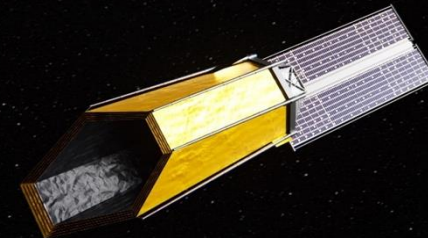
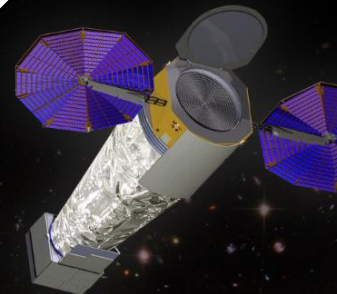
THE NEW GREAT OBSERVATORIES ?

Astro2020

X-RAY

Habitable Worlds Observatory

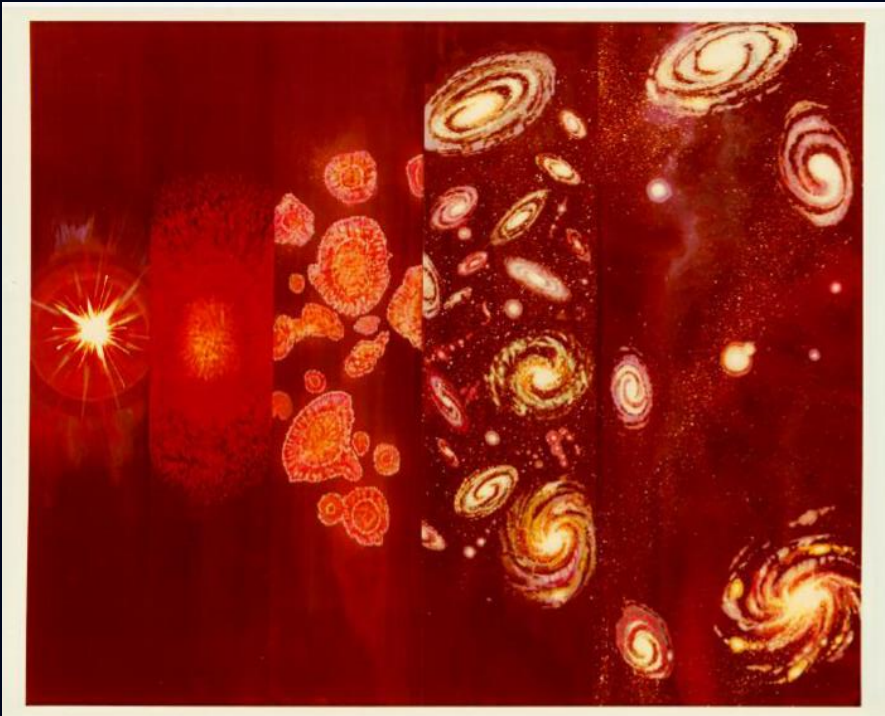
FAR-IR



Prioritizing Science

AXAF Scientific Objectives

- Determine the nature of celestial entities ranging from normal stars to quasars
- Understand the nature of the physics processes which take place in and between astronomical objects
- Add to our understanding of the history and evolution of the universe

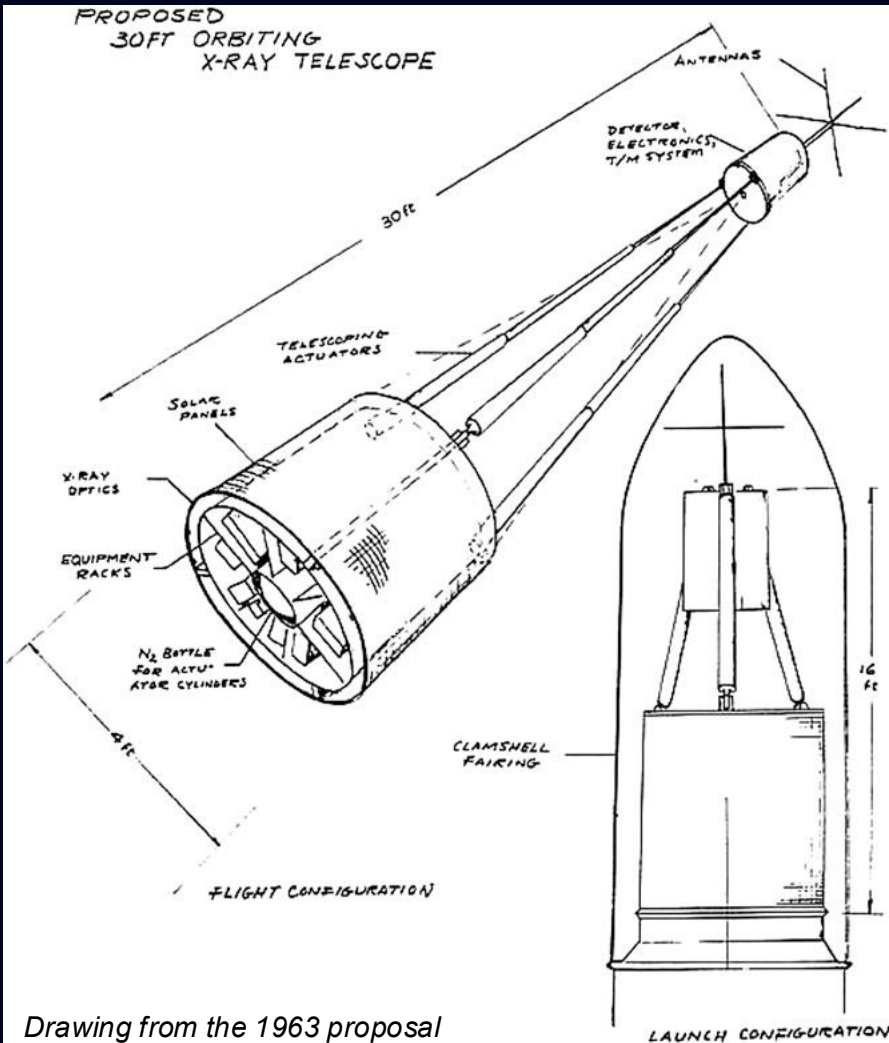


Groundbreaking Science Questions

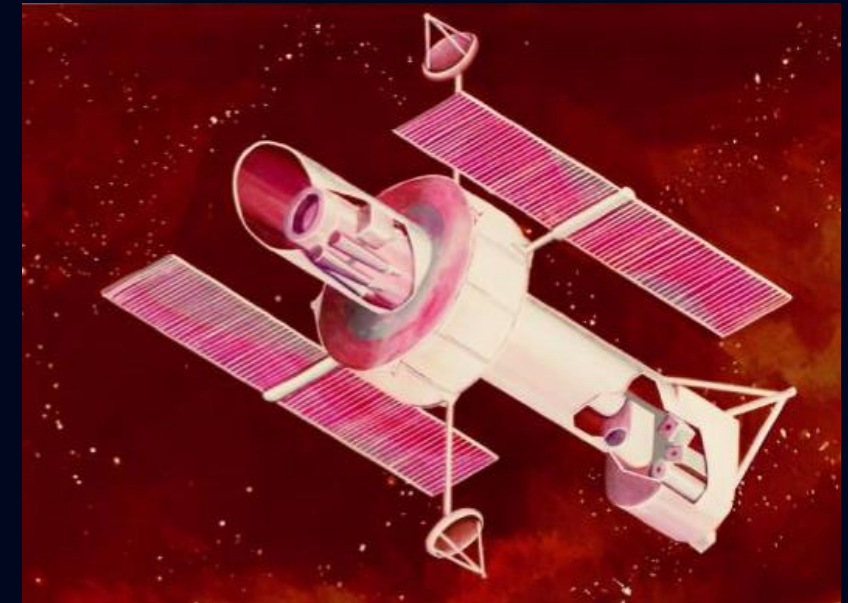
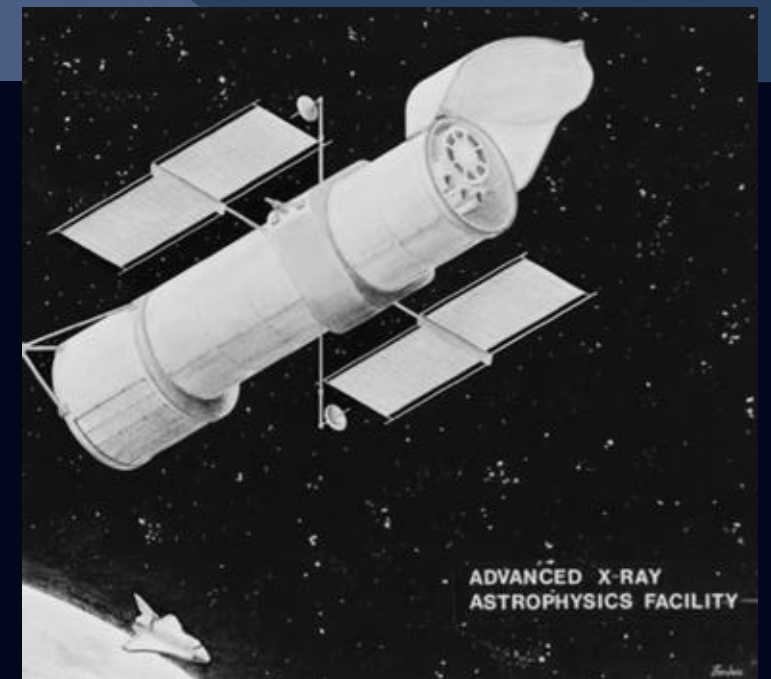
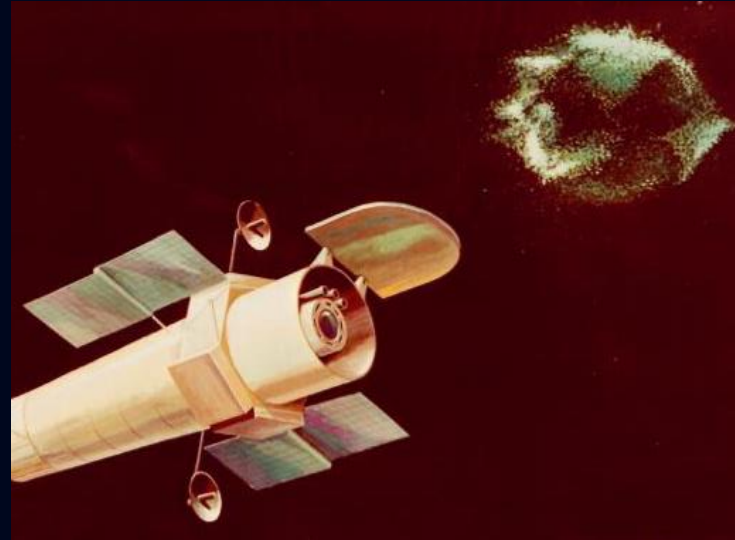
AXAF Big Questions Science (1990)

- How big and how old is the Universe?
- Where is Dark Matter?
- Why are quasars so powerful?
- Do Black Holes really exist?
- Why is the sky glowing in X-Rays?
- What remains when stars explode?
- How do other stars compare with the sun?
- Do exotic particles exist?

Designing for the Future – Starts with an idea!



Drawing from the 1963 proposal



Designing for the Future

AXAF High-Level measurements and capabilities & Early Solicitation of Science Instruments

Performance parameters will change over time.
Science is the most important!

MISSION LIFE:	15 YEARS
LAUNCH SYSTEM:	SPACE TRANSPORTATION SYSTEM SHUTTLE
ORBIT:	28.5 DEG, > 400 km
HIGH RESOLUTION MIRROR ASSEMBLY:	6 NESTED PAIRS OF WOLTER TYPE 1 GRAZING INCIDENCE MIRRORS
MIRROR ASSEMBLY APERTURE:	1.2 METER OUTER MIRROR DIAMETER
FOCAL LENGTH:	10 METER
ANGULAR RESOLUTION:	0.5 ARC SEC GOAL
SPECTRAL RANGE:	0.1 TO 10 keV (1.2 TO 120A)
ENCIRCLED ENERGY: (1 ARC SEC DIAMETER CIRCLE ON-AXIS)	90 PERCENT AT 1.0 keV 60 PERCENT AT 2.5 keV 35 PERCENT AT 5.0 keV 20 PERCENT AT 7.0 keV
EFFECTIVE COLLECTING AREA:	1,100 cm ² AT 2 keV, 200 cm ² AT 7 keV
FIELD OF VIEW:	1 DEG
SCIENCE INSTRUMENTS:	UP TO FOUR IN THE FOCAL PLANE AND GRATINGS
ASPECT DETERMINATION:	RECONSTRUCTED PSF OF 0.5 ARC SEC RMS DIAMETER WITH 1.0 ARC SEC ACCURACY ASSUMES PERFECT X-RAY DETECTOR
POINTING AND CONTROL:	30 ARC SEC POINTING; STABILITY OF 0.5 ARC SEC OVER 10 SEC
COMMUNICATIONS:	TDRSS
MAINTENANCE:	IN-ORBIT MAINTENANCE AND SERVICING

AXAF-85-34

CHRONOLOGY OF INSTRUMENT SELECTION

AUGUST 1983

ANNOUNCEMENT OF OPPORTUNITY RELEASED

FEBRUARY 1984

PROPOSALS RECEIVED:

24 INSTRUMENTS

14 INTERDISCIPLINARY SCIENTISTS (IDS's)

3 TELESCOPE SCIENTISTS (TS's)

SEPTEMBER 1984

INSTRUMENT PEER REVIEW

OCTOBER 1984

IDS/TS PEER REVIEW

MARCH 1985

SELECTIONS ANNOUNCED:

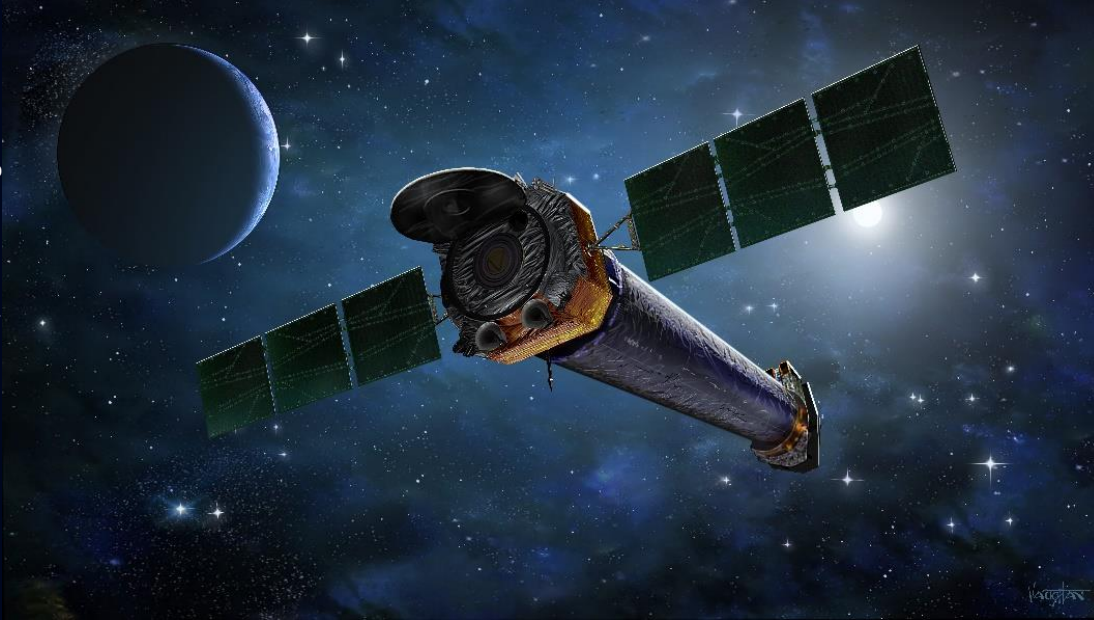
FIVE INSTRUMENT PRINCIPAL INVESTIGATORS (PI's)

FIVE IDS's

ONE TS

SELECTION BASIS:

THE INTENT WILL BE TO FLY FOUR OF THE FIVE INSTRUMENT INVESTIGATIONS. DECISIONS WILL BE BASED ON DEFINITION RESULTS.



Chandra Science Examples (1999 – M. Weisskopf)

- Establish and/or significantly extend the X-ray luminosity functions for all categories of astronomical objects such as stars, galaxies, cluster of galaxies and quasars
- Determine the evolution of supernova remnants through study of their density, chemical composition, and temperature
- Study the X-ray emission from planets
- Extend the study of active galaxies to large redshifts ($z = 4 - 10$)
- Study the formation and evolution of clusters of galaxies
- Study and map the matter content of galaxy clusters with emphasis on dark matter
- Exploit the Sunyaev-Zeldovich effect to measure the size and age of the Universe.
- Study the nature and cosmological implications of the diffuse X-ray Background

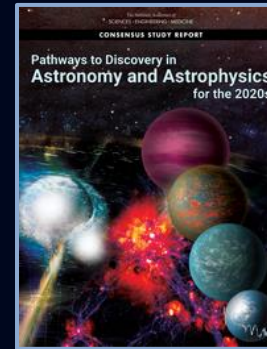


- The ASTRA Initiative

The NASA Astrophysics Division asks the community to provide a *small* set (4 to 6) of candidate large strategic (>\$1B) mission concepts to study in advance of Astro2030.

Selected mission concepts are in addition to:

- X-Ray flagship study
- Far-IR flagship study



Traditional & non-traditional architectures are encouraged, and may include:

- Single observatories that support generations
- Constellations or suites of smaller missions, that span broad wavelength coverage, while collectively providing Flagship-scale science
- Non-traditional space- and lunar-based mission concepts (e.g. radio)

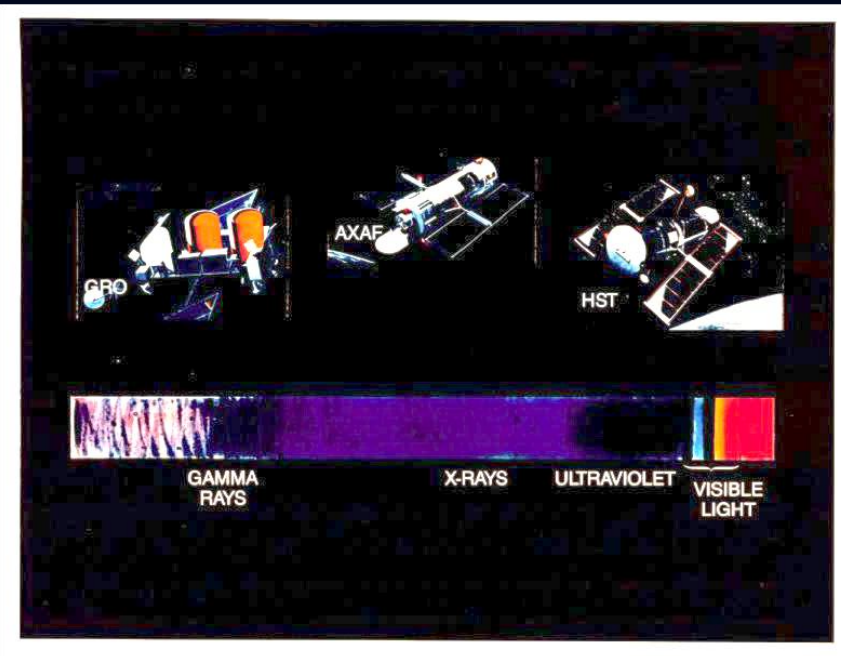
Additional Considerations:

- Industry and commercial capabilities, international partners, public/private partnerships, and the **current and planned international fleet**
- NASA's foundational strategic documents
- Technology readiness (existing, funded for development, new tech)

The Great Observatories

- Gamma Rays (GRO) – The Violent Universe
- X-Rays (AXAF) – The Hot Universe
- Visible Light (Hubble) – The Visible Universe
- Infrared Radiation (SIRTF) – The Cool Universe

Together ... The Total Universe



Preparing for the Future

THEN

Habitable-Exoplanet Imaging Mission,
UV/O/IR Surveyor, X-Ray Surveyor,
Far-Infrared Surveyor

Large Mission Concept Studies



NOW

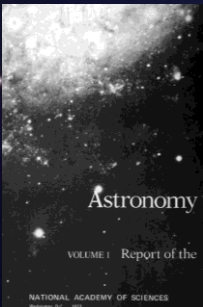
X-Ray, Far-IR Flagship, and 4-6 (>\$1B)
Strategic Missions

Concept Trade Studies

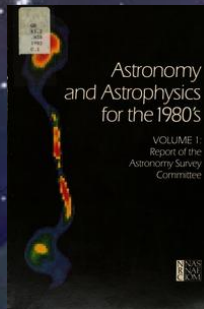


ASTROPHYSICS

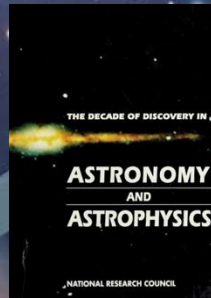
Decadal Priorities & Great Observatories



1972
Decadal Survey
Hubble



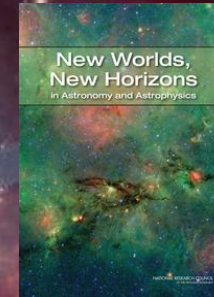
1982
Decadal Survey
CGRO, Chandra



1991
Decadal Survey
Spitzer, SOFIA

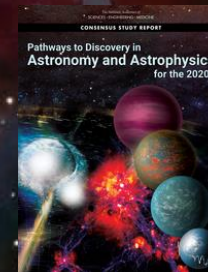


2001
Decadal Survey
Webb



2010
Decadal Survey
Roman

ASTRA Initiative

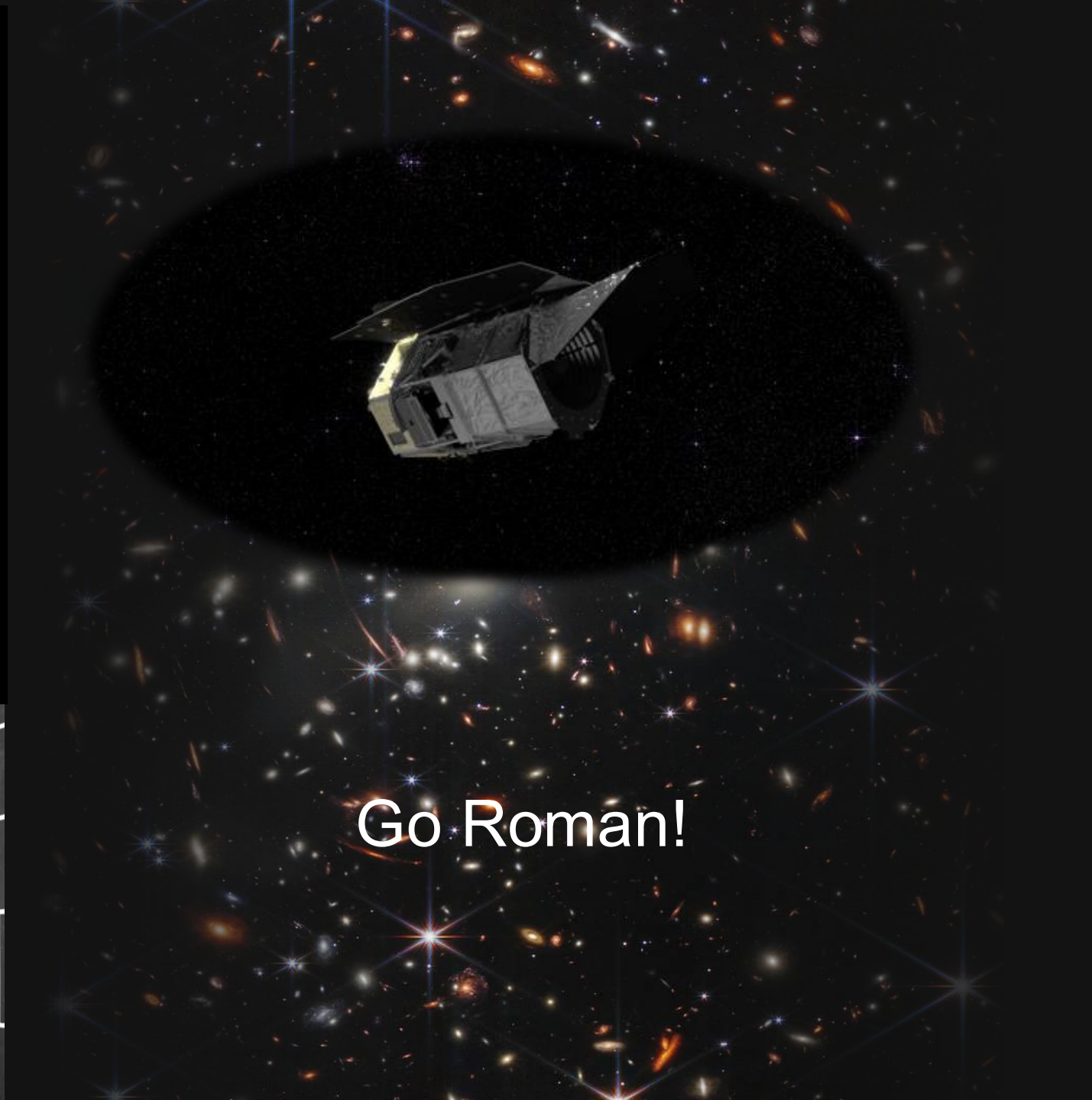


2023
Decadal Survey
GOMTMP (aka GOMAP)
1st **Habitable Worlds Observatory**
2nd *X-Ray & Far-IR*





Nancy Grace Roman



Go Roman!

BACKUP



Celeriter ad ASTRA!

ASTRA Initiative

The Future of NASA Astrophysics



Find out more about the
**Astrophysics Strategic
Technology & Research
Accelerator (ASTRA) Initiative.**

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Cosmic Origins Science

The Astrophysics Strategic
Technology & Research Accelerator
(ASTRA) Initiative

To maintain US leadership, NASA's Astrophysics Division (APD) is launching the Astrophysics Strategic Technology and Research Accelerator (ASTRA) Initiative.

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About the ASTRA Initiative

How does the universe
work? How did we get
here? Are we alone?

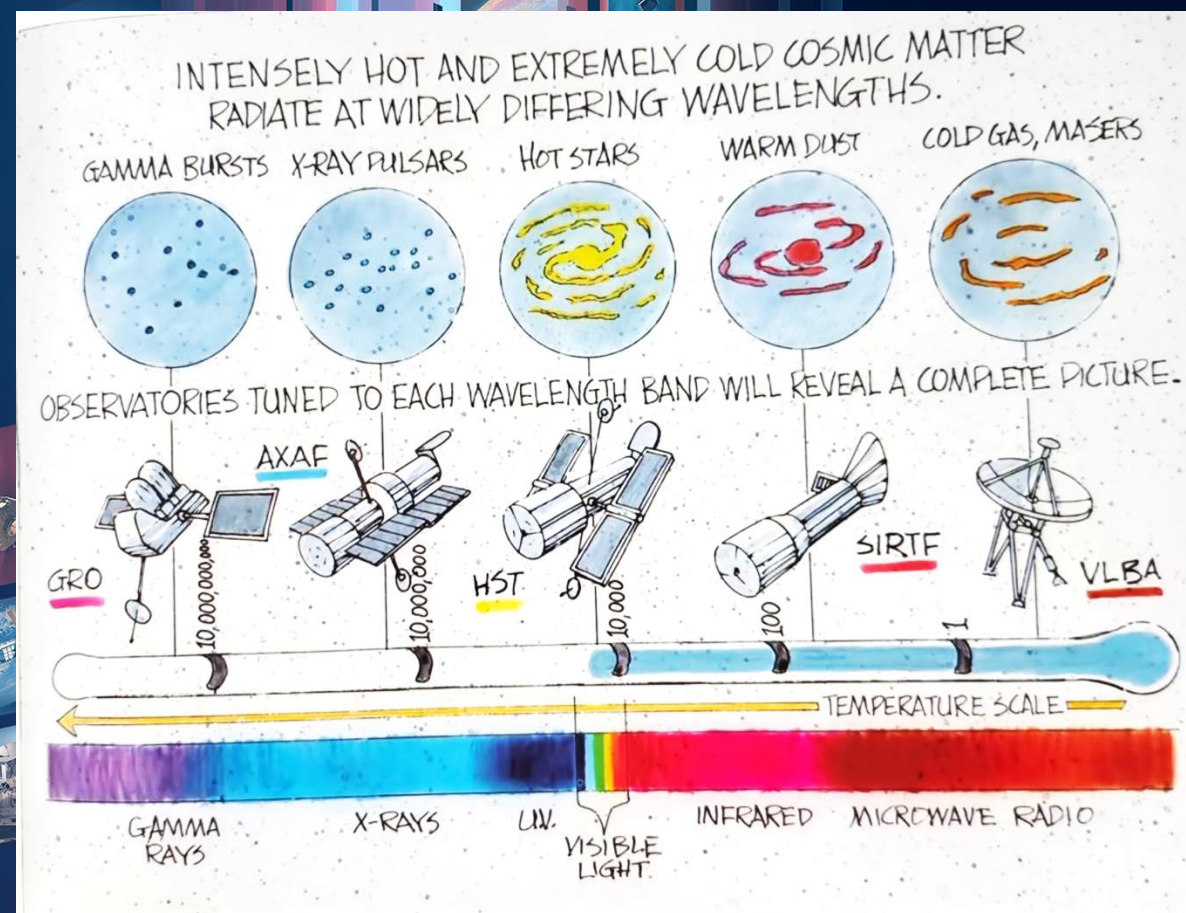
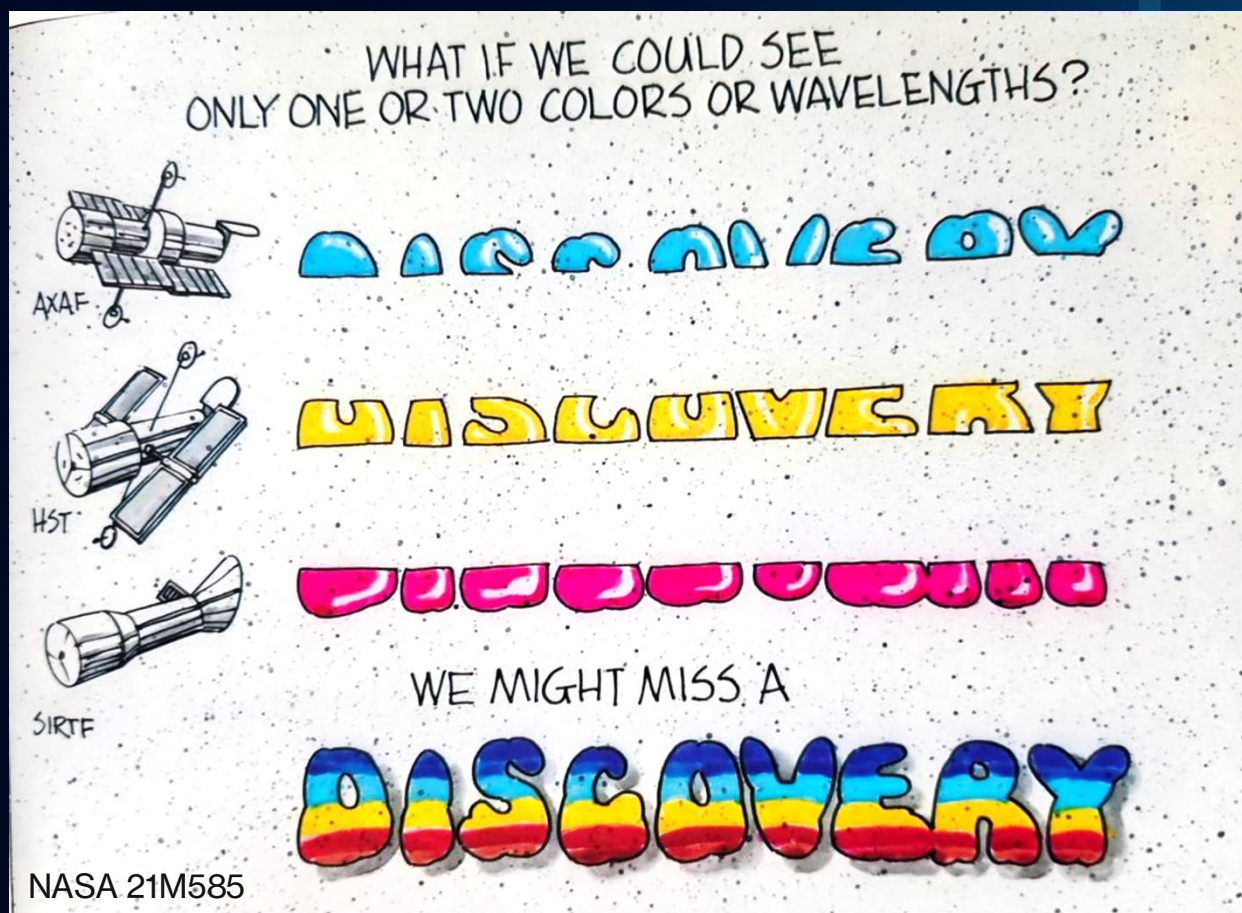
At every stage, NASA will collaborate with industry, academia, and international partners to advance necessary technologies, manufacturing capabilities, and reduce costs.

ASTRA aims to reduce the total cost, time-to-science, and schedule risk of future strategic missions, aligning with the guidance from Astro2020, LSSM, and AMP.



This is an artist's impression of how the very early universe (less than 1 billion years old) might have looked when it went through a voracious onset of star formation, converting primordial hydrogen into myriad stars at an unprecedented rate. Back then the sky would have looked markedly different from the sea of quiescent galaxies around us today. The sky is ablaze with primeval starburst galaxies; giant elliptical and spiral galaxies have yet to form. Unlike today there is very little dust in these galaxies, because the heavier elements have not yet been cooked up through nucleosynthesis in stars. Recent analysis of Hubble Space Telescope deep sky images supports the theory that the first stars in the universe appeared in an abrupt eruption of star formation, rather than at a gradual pace.
Credit: NASA, STScI A. Schaller

The Great Observatories for Space Astrophysics Booklet



- Pre- vs Post-Decadal

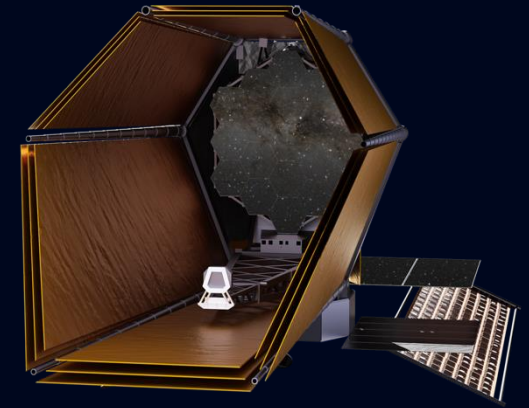
Pre-Decadal Studies

- The ASTRA Initiative is focused on pre-Decadal studies and identifying strategic technologies for maturation.

Post-Decadal Project

(High-priority in the APD portfolio)

- HWO is a NASA Project with a Project Office, and is NOT part of the ASTRA Initiative
 - HWO Technology Maturation Project Office (HTMPO)



How can HWO support ASTRA?

- Lessons Learned & Process
 - Science, Technology, Architecture Review Team (START) & Technical Assessment Group (TAG) to "establish goals and how best to pursue them"
 - Dynamic Integrated Science Return Analysis (DISRA)
 - Implementation of Concept Maturity Level (CML) and Science Traceability Matrices (STMs)
- HWO Science
 - Considered in the ASTRA study selection (future mission landscape)
 - Will inform ASTRA selected study implementation