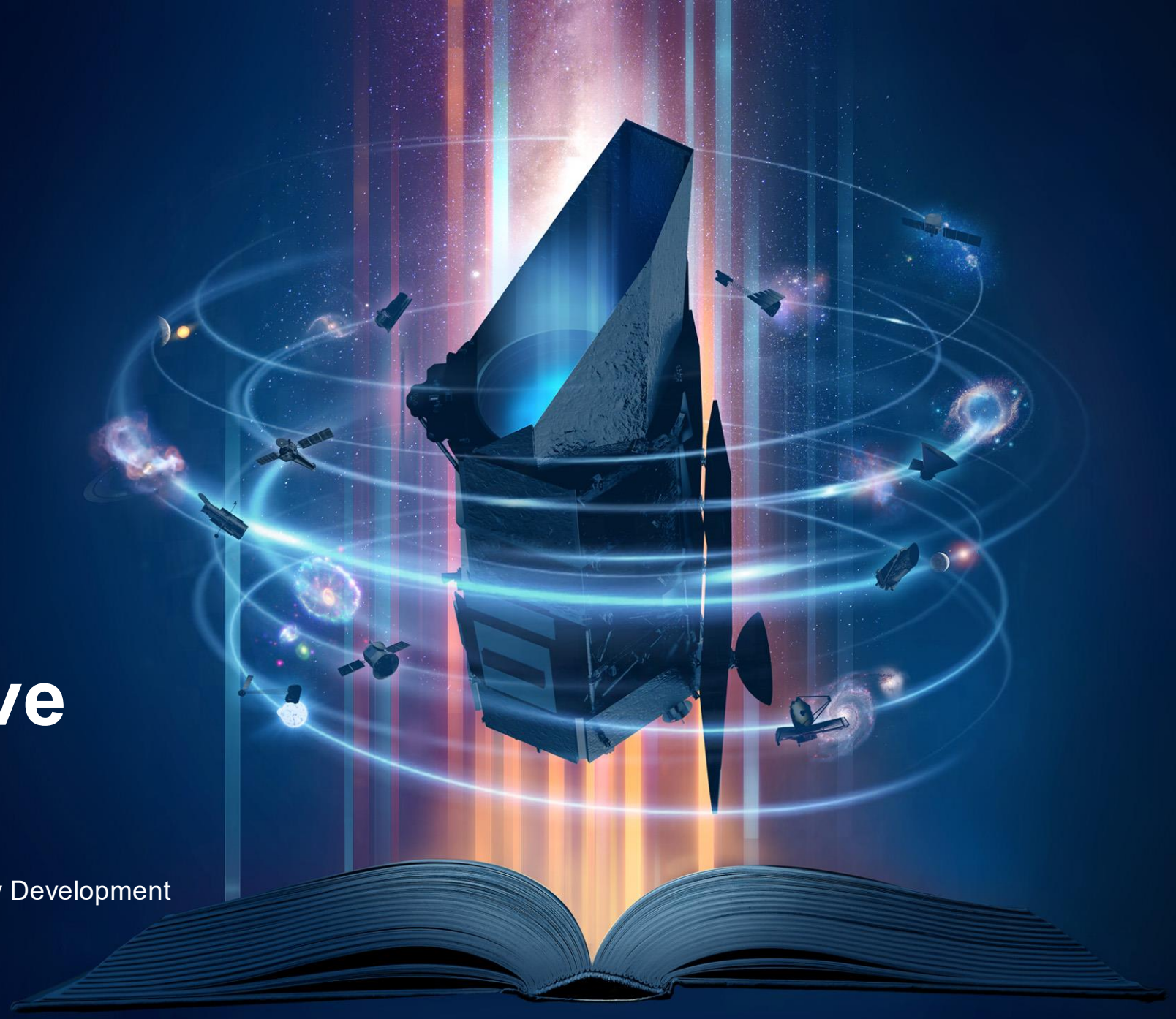
National Aeronautics and Space Administration

HWO and the ASTRA Initiative



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The Astrophysics Strategic Technology & Research Accelerator (ASTRA) Initiative

ASTRA is the superhighway to cosmic discovery. A multi-mission concept and technology incubator that accelerates the time from innovation to exploration (CML 3, MRL 4, TRL 5 (Goal)).

The ASTRA Initiative:

- Defines mission concepts and matures technologies for multiple strategic astrophysics missions.
- Embraces Astro2020 recommendations, emerging industry and other capabilities, and strategic NASA documents.
- Ensures continuous, programmatically responsible, groundbreaking astrophysics discovery.

Celeriter ad ASTRA!

Westerlund 2 is a multi-wavelength view of a cluster of young stars located~20,000 light years from Earth. Credit: X-ray: NASA/CXC/SAO/Sejong Univ./Hur et al; ; Optical: NASA/STScI

Preparing for the Future

THEN

HabEx, LUVOIR, Lynx, Origins
Flagship Mission Concept Studies

Input into Astro2020

NOW

X-Ray, Far-IR Flagship, and 4-6 (>$1B)
Mission Concepts Studies

Input into Next Decadal +

Preparing for the Future

THEN (2015-2019)

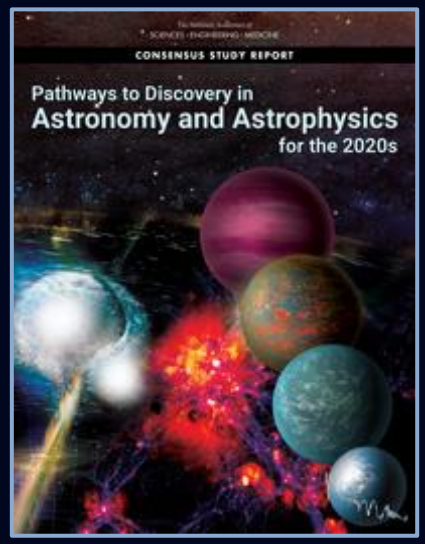
HabEx, LUVOIR, Lynx, Origins
Flagship Mission Concept Studies

Input into Astro2020

Great Observatories Mission and Technology Maturation Program

"…first mission to enter this program is a **large (~6 m aperture) infrared/optical/ultraviolet (IR/O/UV) space telescope**.... (aka HWO)

To prepare for future large, strategic missions, 5 years after beginning the maturation program for the IR/O/UV mission, the survey recommends commencing **mission and technology** maturation of both a **far-IR and an X-ray large strategic mission**..."



APD is asking the community to provide a *small* set (4 to 6) of candidate large strategic (>$1B) mission concepts to study as entrants into the ASTRA Initiative.

APD is encouraging traditional & non-traditional architectures, that may include:

- Single observatories that support generations (e.g., Hubble, Chandra, JWST, HWO)
- Constellations of suites of smaller missions, that span broad wavelength coverage, while collectively providing Flagship-scale science
- Space-based (and lunar) mission concepts (e.g. radio)

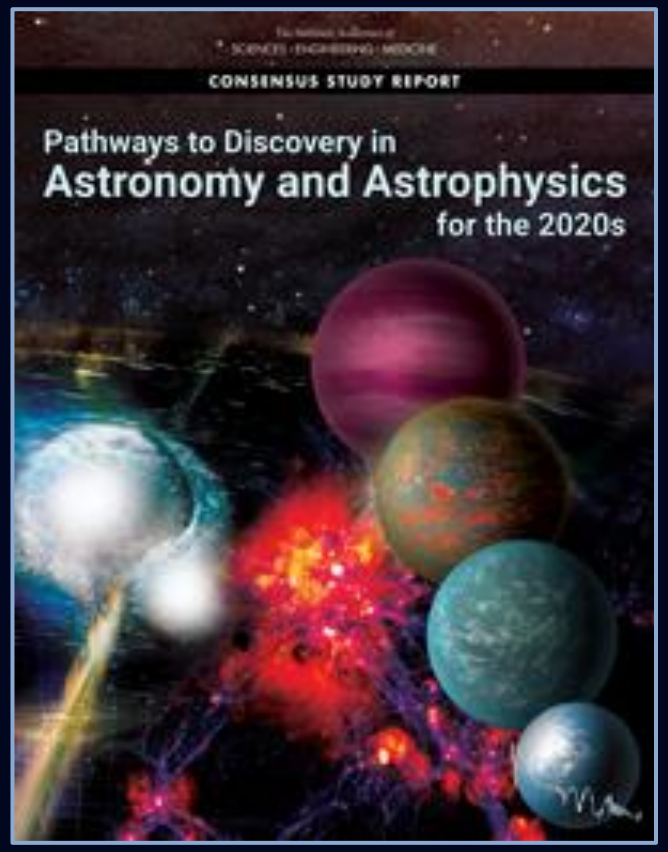
Selected mission concepts will be funded for study:

- To advance the concepts ahead of formal pre-Phase A activities
  - Concept Maturity Level 3 – defining science and mission architecture trade space, not a point design
  - Maturation Readiness Level 3 – defining early industry involvement and feasibility
- Identify tall-pole and long-lead time technology development needs – advancing technology to accelerate mission readiness

Astro2020 Recommendation

Selected mission concepts are in addition to:

- X-Ray flagship study (which is ramping up now)
- Far-IR flagship study



"…To prepare for future large, strategic missions, 5 years after beginning the maturation program for the IR/O/UV mission, the survey recommends commencing **mission and technology** maturation of both a **far-IR and an X-ray large strategic mission**..."

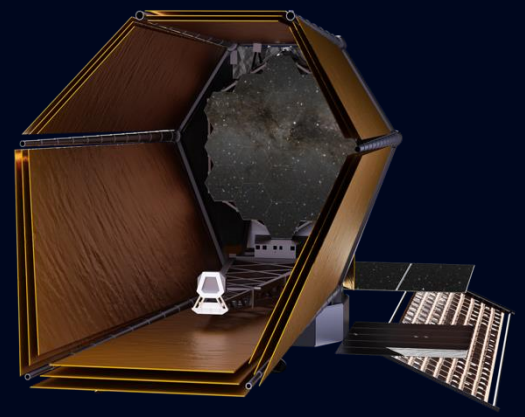
Is HWO included in the ASTRA Initiative?

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)
  - May inform ASTRA selected study implementation

Can UV/O/IR mission concepts be included in the ASTRA Initiative?

YES! The ASTRA Initiative study selection process will consider:

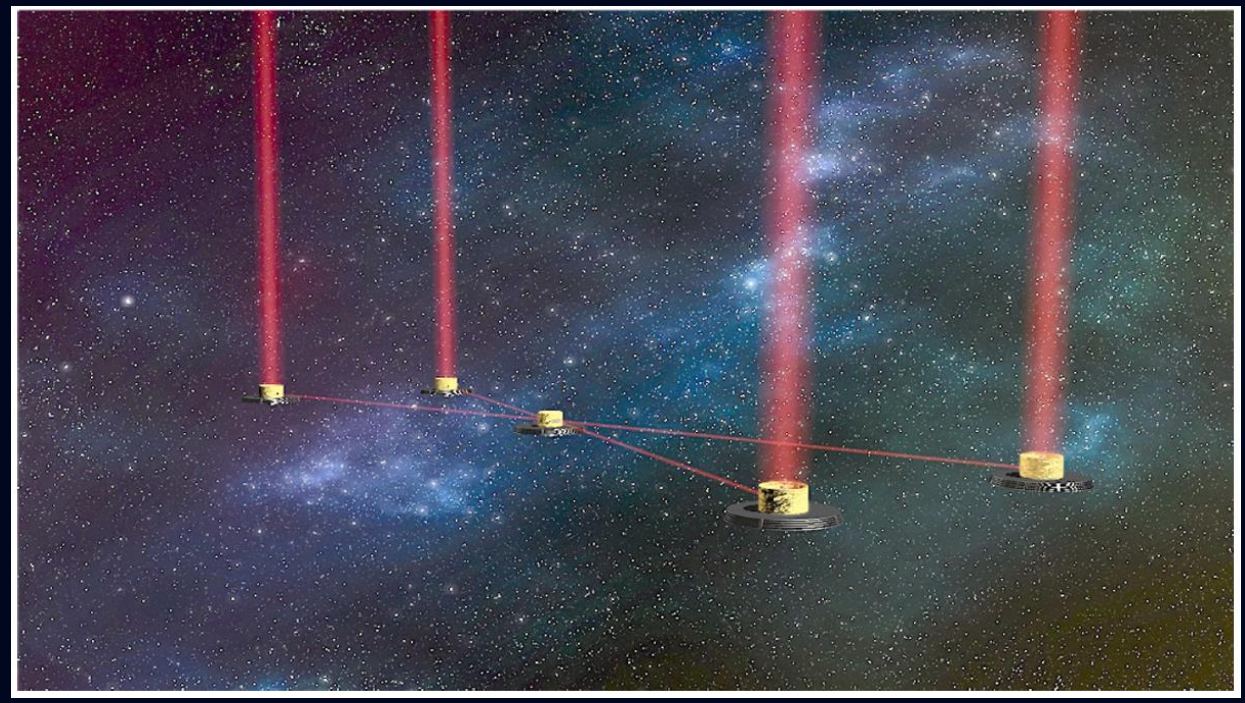
- *Complementary* (not identical or overlapping) concepts to HWO
- The identification of critical and/or long-lead development time technologies that will enable future strategic missions

Example:

Large Interferometer For Exoplanets (LIFE) – European-led mission concept

"Artist's impression of the LIFE nulling-interferometry mission, consisting of four collector spacecraft in a rectangular array configuration sending light to a beam combiner spacecraft in the center. The present analysis assumes an X-array configuration with a baseline ratio of 6:1."

Quanz, Sascha P., et al. "Large Interferometer For Exoplanets (LIFE)-I. Improved exoplanet detection yield estimates for a large mid-infrared space-interferometer mission." *Astronomy & Astrophysics* 664 (2022): A21.



ASTRA PROCESS

APD is encouraging the community to consider the following when prioritizing concepts for study:

- Industry and commercial capabilities, international partners, public/private partnerships, and the current and planned international fleet of missions.
- NASA's foundational strategic documents.
- Technology advancement needs over the next decade.

How to Participate:

- Through the PAGs!
  - Cosmic Origins (COPAG)
  - Exoplanet Exploration (ExoPAG)
  - Physics of the Cosmos (PhysPAG)

Each PAG may solicit the astronomy and astrophysics community for mission concept ideas. To accomplish this, each PAG is empowered to envision and use its own process.

Strategic Mission Study Selection Schedule

March 2026	**Community Announcement Release**. The Astrophysics Division released an announcement to the astronomy and astrophysics community trequesting feedback on large strategic (>$1B) mission concepts to study.
May 2026	**Workshop on Innovation for Astrophysics Missions**. A presentation will be provided to the community prior to the Community Science Ad ASTRA Workshop.
June 2026	**248th AAS Meeting**. An overview of the ASTRA Initiative will be presented in a Special Session, invited talks from the APD Division Director and others, followed by a panel Q&A session.
September 2026	**NASA Community Science Ad ASTRA Workshop**. A presentation will be provided to the community by the end of the year.
December 2026	**Joint PAG Virtual Presentation**. A public presentation will be given by PAG representatives to provide community input to the NASA Astrophysics Division Director regarding which mission concepts to study*.
January 2027	**249th AAS Meeting**. Mission concept study selections will be announced by the NASA Astrophysics Division Director during the Town Hall.

***Study process details will be provided at later date.**

ASTRA Initiative

National Aeronautics and Space Administration

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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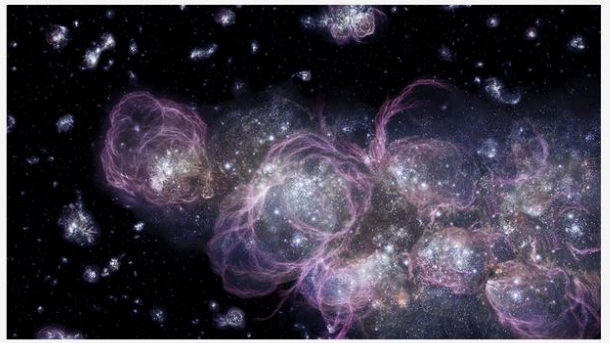
Technology

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.

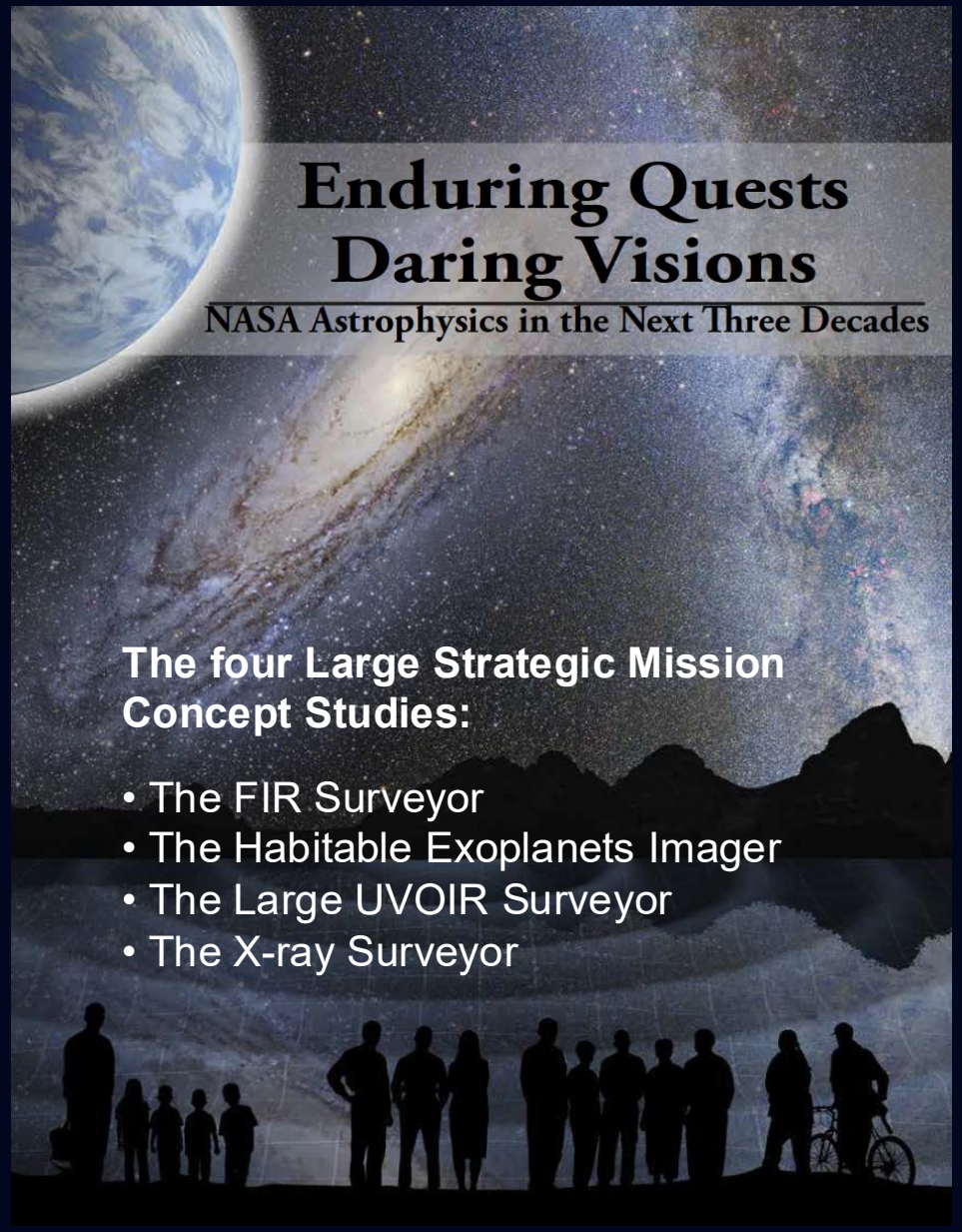
ASTRA aims to reduce the total cost, time-to-science, and schedule risk of future strategic missions, aligning with the guidance from Astro2020, LSSM, and AMP.



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

BACKUP

Preparing for the Future



The four Large Strategic Mission Concept Studies:

- The FIR Surveyor
- The Habitable Exoplanets Imager
- The Large UVOIR Surveyor
- The X-ray Surveyor

Science Summary

	Formative Era					Visionary Era			
	GW Surveyor	CMB-pol Surveyor	FIR Surveyor	LUVOIR Surveyor	X-ray Surveyor	GW Mapper	Cosmic Dawn Mapper	ExoEarth Mapper	Black Hole Mapper
Demographics of planetary systems			■	■				■	
Characterizing other worlds			■	■				■	
Our nearest neighbors and the search for life				■				■	
The origins of stars and planets			■	■				■	
The Milky Way and its neighbors	■	■	■	■	■	■		■	■
The history of galaxies	■		■	■	■	■	■	■	■
The origin and fate of the universe	■	■		■	■	■	■		
Extremes of matter and energy	■	■			■	■			■
Ripples of space-time	■	■				■			

■ Primary Goals ■ Secondary Goals

This chart shows the expected science return from a set of notional missions designed around the fundamental observational requirements for various parameters, such as wavelength, angular or spectral resolution, and sensitivity.

Technology Summary

	Formative Era					Visionary Era			
	GW Surveyor	CMB-pol Surveyor	FIR Surveyor	LUVOIR Surveyor	X-ray Surveyor	GW Mapper	Cosmic Dawn Mapper	ExoEarth Mapper	Black Hole Mapper
Formation flying				■		■		■	■
Interferometry: precision metrology	■		■			■	■	■	■
X-ray interferometry									■
High-contrast imaging techniques				■				■	
Optics deployment and assembly			■	■	■		■	■	
Broadband coatings		■		■					
X-ray optics					■				■
Large-format detector arrays		■	■	■	■				■
New detector capabilities			■	■	■				■
Cryogenics		■	■	■	■				

■ Essential Goals ■ Beneficial Goals

To achieve the goals of the notional mission technology advances are needed in many key areas. This chart provides an overview of these enabling technologies.