Mission Concepts for the
Astrophysics Strategic Technology & Research Accelerator (ASTRA) Initiative

1. Summary and Background

NASA's greatest telescopes continue to expand our frontiers in both literal and metaphorical ways. They advance the limits of humanity's views of the cosmos while they address profound questions: How does the universe work? How did we get here? Are we alone? They also advance the frontiers of our technologies and capabilities by making the previously impossible routine, and in the process advancing US strategic interests consistent with the President's national space policy. NASA's Astrophysics Division (APD) pursues implementation plans for these frontier-expanding missions with guidance from: decadal surveys by the National Academy of Sciences, Engineering and Medicine including "Pathways to Discovery in Astronomy and Astrophysics for the 2020s" (Astro2020); internal NASA reports, including the Large Strategic Science Missions (LSSM) Report; and independent assessments including the Government Accountability Office's Assessment of Major Projects (AMP).

To ensure continued US leadership in expanding humanity's knowledge of the Universe, NASA Astrophysics Division is creating the Astrophysics Strategic Technology & Research Accelerator *(*ASTRA) Initiative, to: 1) identify strategic (flagship/probe) mission concepts that expand our frontier to dramatically advance astrophysics; 2) study those concepts at a low fidelity level to inform strategic decisions; and 3) advance the concepts ahead of formal pre-Phase A activities for potential projects. At each stage of this initiative, NASA will work with our industry, commercial, philanthropic, and academic partners to advance the technologies and manufacturing capabilities required to make these missions possible and will explore domestic and international partnerships that could reduce their costs to the agency. These preparatory activities are designed to follow the guidance from Astro2020, the LSSM, and AMP. This initiative is structured to reduce the total cost of future strategic missions, their time from conception-to-science, and their cost and schedule, in advance of formal project formulation.

A key recommendation from Astro2020 is for NASA to "prepare for future large, strategic missions" by studying three concepts and their technologies: an IR/O/UV mission, a Far-IR mission, and an X-ray mission. NASA is rapidly advancing the first of these through the Habitable Worlds Observatory Technology Maturation Project Office (HTMPO). APD will commence concept studies and technology maturation of both Far-IR and an X-ray large strategic missions as part of the ASTRA Initiative.

To ensure astrophysics technologies for future strategic missions beyond those presented in Astro2020 are identified and prioritized, APD is requesting that the astronomy and astrophysics community, with the support of the Program Analysis Groups (PAGs), identify candidate large mission concepts to follow the Far-IR and X-ray concepts in the ASTRA Initiative. These studies should be in pursuit of future portfolio balance, incorporate the latest advancements from the U.S. commercial sector, and pursue new partnership opportunities. The superset of these studies will provide NASA with an updated and broad set of large strategic-mission concepts. The number of mission concepts and their level of study is subject to APD fiscal and programmatic constraints.

2. Requested Response Topics

The Astrophysics Division is asking the community, with support from the PAGs, to provide feedback on a *small* set (4 to 6) of strategic mission concepts for study as entrants into this incubator program. This should be done in the context of actions APD is taking in response to Astro2020, the President's Budget Requests, and Congressional appropriations. Specifically, these actions include APD's continued support of HTMPO, on-going evaluation of competing probe concepts for the Far-IR and X-ray, and planned

initiation of Far-IR and X-ray flagship mission concept studies into the ASTRA frontier-expanding mission incubator program.

APD encourages non-traditional architectures, such as concepts of constellations of SmallSats or suites of smaller missions (that may span broad wavelength coverage), as well as space-based radio mission concepts. Concepts should prioritize discovery space and potential science return over specific wavelengths, particles, or gravitational waves (GWs).

Within the above context, the three Astrophysics Program Analysis Groups (PAGs) – the Cosmic Origins Program Analysis Group (COPAG), the Exoplanet Exploration Program Analysis Group (ExoPAG), and the Physics of the Cosmos Program Analysis Group (PhysPAG) are requested to jointly report up to six community prioritized mission concepts to the NASA Astrophysics Division Director, for consideration for entrance into the ASTRA Initiative. These six missions are in addition to the X-ray and Far-IR flagship mission concepts.

These studies will be conducted in a fiscally constrained environment. Therefore, there will be a trade-off between the number of studies and the fidelity of those studies, as well as other APD programmatic considerations. No study initiation or continuation is implied beyond available resources.

Additional Guidance

When suggesting mission concepts for study, APD asks that the community consider:

- **Industry and commercial capabilities, international partners, public/private partnerships, and the current and planned international fleet of missions.** To better inform the community and allow for open science discussion, APD is planning two workshops in 2026. The first is the Innovation Workshop (planned for May 27-28), and the second is the Community Science (Ad ASTRA) Workshop (planned for September 1st-3rd). It is expected that the PAGs will report community-selected mission studies after the second workshop. At these workshops, APD welcomes ideas to further accelerate and lower the costs of its missions, for example via adoption of commercial practices, leveraging of public/private and international partnerships, gradual deployment of suites of smaller missions, and serviceable missions. Concepts that leverage these new capabilities and opportunities will be prioritized for further study by APD.

- **NASA's foundational strategic documents.** Existing documents should be used as a starting point for discussion. However, ideas outside the scope of these documents are welcome, especially if they would address science questions that have arisen or leverage capabilities that have emerged since those documents were written. Key reference documents include the Astro2020 Decadal Survey (Pathways to Discovery in Astronomy and Astrophysics for the 2020s) and the long-term vision outlined in Enduring Quests, Daring Visions. Proposers are further expected to leverage the Astrophysics Technology Update 2025 to ensure concepts take into account the Astrophysics Division's technology portfolio.

- **Technology advancement needs over the next decade**. Mission Concept selections will trigger entrance into the Strategic Astrophysics Technology (SAT) opportunity. It is likely that there will be insufficient technology funding to advance all technologies, so prioritization will be made by the Astrophysics Division based on technical assessment, advisory input, and programmatic considerations. Programmatic considerations include advancing technologies for the non-HWO flagships recommended in Astro2020, with priority on the mission-concept(s) (X-ray and/or Far-IR) not being advanced as a probe.

3. Community Engagement and Anticipated Timeline

- 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.

- The community should consider which set of mission concepts should be studied to advance astrophysics as a whole; there is no desire for mission concepts to be identified as "belonging" to a specific Program or PAG. The number of large strategic mission concepts in the set should be kept as small as possible.

- Each PAG is requested to contribute to a joint presentation to follow the Ad ASTRA Workshop (see schedule below), where collectively they shall comment on all mission concepts to be considered for entrance into the ASTRA Program.

- The joint presentation is limited to 2 hours, the PAGs are asked to be succinct. Suggested content for the presentation is given below.

The Astrophysics Program Offices (Cosmic Origins Program Office, Physics of the Cosmos Program Office, and Exoplanet Exploration Program Office) will support the PAG activities in their program areas including support for workshops, communication, and reports, and technical analyses needed to inform deliberations.

Anticipated Timeline for the Identification of Mission Concept Studies

Community discussions led by the PAG Executive Committees will take place from March through September 2026, with selection of mission concepts for inclusion in the ASTRA Initiative to be announced at the Winter AAS meeting in 2027.

May 2026	**Workshop on Innovation for Astrophysics Missions**. The output of this will provide a summary of capabilities offered by commercial entities and Other Government Agencies; identify synergies and opportunities afforded by the Artemis and Moon-to-Mars infrastructure; and identify challenges and solutions to overcoming programmatic roadblocks. A presentation will be provided to the community no more than 60 days following the workshop.
June 2026	**248th AAS Meeting**. Presentation overviewing this initiative, including details of the study process, will be given in the joint PAG meeting or Special Session (TBC) (presentation and Q&A).
September 2026	**Community Science (Ad ASTRA) Workshop**. The output of this workshop will inform the NASA Astrophysics Division on which mission concepts warrant consideration for inclusion in the ASTRA Initiative. A presentation will be provided to the community, no more than 60 days following the workshop.
December 2026	**Joint PAG Virtual Presentation**. A 2-hour public presentation will be given by PAG representatives to provide community input to the NASA Astrophysics Division Director regarding which mission concepts are recommended for inclusion in the ASTRA Program.
January 2027	**249th AAS Meeting**. The ASTRA mission concept study selections, informed by community input, will be announced by the NASA Astrophysics Division Director during the Town Hall.

4. Suggested Presentation Content

While there is no prescription for the format of the joint-PAG talk (other than being succinct), some guidelines are provided.

It is suggested that the joint presentation include the following:

1. The process followed by each PAG to request input from community (meetings, white papers, emails, etc.);
2. A brief description of the community response;
3. The procedure and criteria used for determining community response. This response should factor in findings from the Workshop on Innovation for Astrophysics Missions and the Community Science (Ad ASTRA) Workshop;
4. An outcome of the analysis and final recommended set of mission concepts, each of which must be accompanied by a short rationale; and
5. Any additional considerations for NASA.

5. Points of Contact

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Questions regarding this initiative should be submitted to this link or using the QR code provided.

Questions and their responses will be posted on the NASA Astrophysics Programs public-facing website.

Acronym Glossary

AAS	American Astronomical Society
AMP	Accountability Office Assessment of Major Projects
APD	Astrophysics Division
ASTRA	Astrophysics Strategic Technology & Research Accelerator
CMB	Cosmic Microwave Background
COPAG	Cosmic Origins PAG
COR	Cosmic Origins Program (a NASA Astrophysics Program)
ExEP	Exoplanet Exploration Program (a NASA Astrophysics Program)
ExoPAG	Exoplanet Exploration PAG
GW	Gravitational Wave
HTMPO	Habitable Worlds Observatory Technology Maturation Project Office
HQ	NASA Headquarters
IR	Infrared
LSSM	Large Strategic Science Missions
NASA	National Aeronautics and Space Administration
O	Optical
PAG	Program Analysis Group
PhysCOS	Physics of the Cosmos Program (a NASA Astrophysics Program)
PhysPAG	Physics of the Cosmos PAG
SAT	Strategic Astrophysics Technology (a ROSES program element)
TBC	To Be Confirmed
UV	Ultraviolet