Astrophysics
Decadal Survey Missions

1972
Decadal Survey
Hubble

1982
Decadal Survey
Spitzer

1991
Decadal Survey
Webb

2001
Decadal Survey
Roman

2010
Decadal Survey

2021
Decadal Survey
Pathways to Habitable Worlds

- Decadal Survey (ASTRO2020) priority science area
  - Are there habitable planets harboring life elsewhere in the universe?
  - Survey sun-like, nearby stars for habitable planets and search for evidence of life

- Primary recommendation:
  - Space telescope similar in wavelength coverage to Hubble, with an aperture of ≥6 meter and coronagraphic imaging capability
  - Observe ~100 nearby stars, and successfully detect potentially habitable planets around at least a quarter of the systems.

- Primary Technical requirements
  - 6 meter Segmented mirror telescope with active control of optics to achieve ultrastability
  - Coronagraph achieving contrast levels of 10^{-10}

- Habitable Worlds Observatory
A Better Path to Habitable Worlds

A NEW APPROACH TO DEVELOP FLAGSHIPS

NASA Astrophysics Great Observatory Maturation Program (GOMAP)
Program Executive: Julie Crooke (julie.a.crooke@nasa.gov)
Program Scientist: Shawn Domagal-Goldman(shawn.goldman@nasa.gov)
May 5, 2023
Astro 2020: “Great Observatories Mission and Technology Maturation Program would provide significant early investments in the co-maturation of mission concepts and technologies.”

Astro 2020: First [GOMAP] entrant: Infrared / Optical / UV observatory
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NASA: Great Observatory Maturation Program (GOMAP)

Astro 2020: First [GOMAP] entrant: Infrared / Optical / UV observatory

NASA: Habitable Worlds Observatory (HWO)
JWST EXCEEDS COST CAP, LAUNCH DELAYED TO 2021
JUNE 28TH, 2018

For the second year in a row, NASA's budget request proposes to cancel the WFIRST astrophysics flagship mission. (credit: NASA)

Cost challenges continue for NASA science missions

by Jeff Foust
Monday, March 25, 2019
Megaprojects (projects with costs > $1bn) almost always come in over-budget, over-schedule, and/or do not meet originally promised goals. This is true across fields and national boundaries. - Flyvbjerg, 2021
A variety of documents from internal, external, and oversight groups all point to a consistent set of problems & solutions for large/flagship projects, across sectors.

Why GOMAP? Decades of research-based consensus on megaprojects

- Independent Research Papers
- Mission Concept Reports
- GAO Report on Major Projects
- SMD Internal Study on Flagship Projects
- National Academy Recommendations

Challenges and Potential Solutions to Develop and Fund NASA Flagship Missions

GAO Report on Assessments of Major Projects

Pathways to Discovery in Astronomy and Astrophysics for the 2020s
A successful flagship starts long-term work before staffing ramps up, and details get refined as the trade space continually gets more focused.

Decadal Science Objectives

- Science Requirements
- Mission Architecture
- Technology
- Mission Design

Timeline
How Do Complex Things Get Done On Time?

Define your scope earlier. Build in robust margins.

Consider previous investments and landscape opportunities.

Design as a system with long-term needs in mind.

Know that you can build it before you start.
HWO Technology Development and Concept Maturation Phase

GOMAP HWO PE and PS

GOMAP Support from Program Offices

HWO START Co-Chairs

Science, Technology, Architecture Review Team (START)

Color Key
HQ / PO only

NASA formed review groups Industry, Academia, NASA, Science Centers
This is a general structure that can be used for any FGO.
The START will be assembled first.
HWO Technology Development and Concept Maturation Phase

GOMAP HWO PE and PS

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HWO START Co-Chairs

International Partners
Ex Officio

Science, Technology, Architecture Review Team (START)

This is a general structure that can be used for any FGO.

The START will be assembled first.

We will onboard international space agency representatives as they become available.
HWO Technology Development and Concept Maturation Phase

This is a general structure that can be used for any FGO.

The START will be assembled first.

We will onboard international space agency representatives as they become available.

Soon after the START is assembled, we will onboard the Technical Assessment Group.
HWO Technology Development and Concept Maturation Phase

GOMAP HWO PE and PS

GOMAP Support from Program Offices

HWO START & TAG Co-Chairs

Science, Technology, Architecture Review Team (START)

Technical Assessment Group (TAG)

International Partners Ex Officio

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NASA review group (NASA)
HWO Technology Development and Concept Maturation Phase

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International Partners Ex Officio

Precursor Science Program

Roadmapping Groups

PAGs

Multi-discipline teams from industry, academia, govt., science centers compete for HWO technology development & trade studies (via ROSES, RFPs, etc.)

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NASA formed review groups
Industry, Academia, NASA, Science Centers

NASA review group (NASA)

Competed Work
Industry, Academia, NASA, Science Centers

No Exchange of Funds Activities
How Do Complex Things Get Done On Time?

Science, Technology, Architecture Review Team (START)

- Start with Decadal science
- Quantify all science objectives including their break points & slope of performance degradation
- Identify observatory/instrument capability needs

Define your scope earlier. Build in robust margins.
Which decadal science questions can HWO help address?

What observations do we need to answer those questions?

What capabilities will deliver those observations?

What performance can we expect?

Where do performance breakpoints exist?

What models do we need to predict performance?
Who is eligible?

- US-persons at US-based institutions with terminal degrees, including postdocs
- Scientists, engineers, and technologists

What about non-US persons or US-persons outside the US?

- Stay tuned - we are exploring future opportunities for these people
- Also see other community groups, including Science Analysis Groups (SAGs)

What about students and postbac scholars?

- Stay tuned - we will explore a separate opportunity for early career people including students, postbacs, and postdocs (possible postdocs may be eligible for both groups)
- We want the START to help determine this
Define your scope earlier.

Build in robust margins.

Mentoring Program

Mentoring Program Details

• START members will be allowed to mentor an early career team member

• We will provide travel support for both START members and mentors to attend meetings

• Any early career program will be designed to complement the mentorship program
START self-nomination process

• 1. Interest in being a member or co-chair (if applicable)
• 2. Expertise, capabilities, and experience that the submitter would bring to the START
• 3. Intended contributions and available level of effort to START activities (Quarterly hybrid meetings, more frequent remote meetings on a TBD cadence, and contribute to the final report. Additionally, START analyses and assessments may be performed by START members and/or their immediate colleagues/team members.
• 4. Commitment to incorporating NASA’s core values of IDEA as a member or co-Chair
• 5. Commitment to act in a manner consistent with the NASA Astrophysics Division’s Statement of Principles.
• 6. Interest, ability, availability, and experience to mentor an early career individual
The START is only the beginning…

Figure courtesy Roser Juanola and Jens Kammerer

Figure from HabEx Final Report
Questions and more information

**ASD Statement of Principles:**
go.nasa.gov/3Kwn07s

**Town Hall Q&A:**
https://nasa.cnf.io/sessions/rra9/#!/dashboard

**NASA GOMAP website:**
go.nasa.gov/4107ZzC

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Backup