

# GREAT OBSERVATORIES MATURATION PROGRAM (GOMAP)

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# HABITABLE WORLDS OBSERVATORY (HWO)

Infrared / Optical / UV space telescope with ~ 6-m inscribed diameter

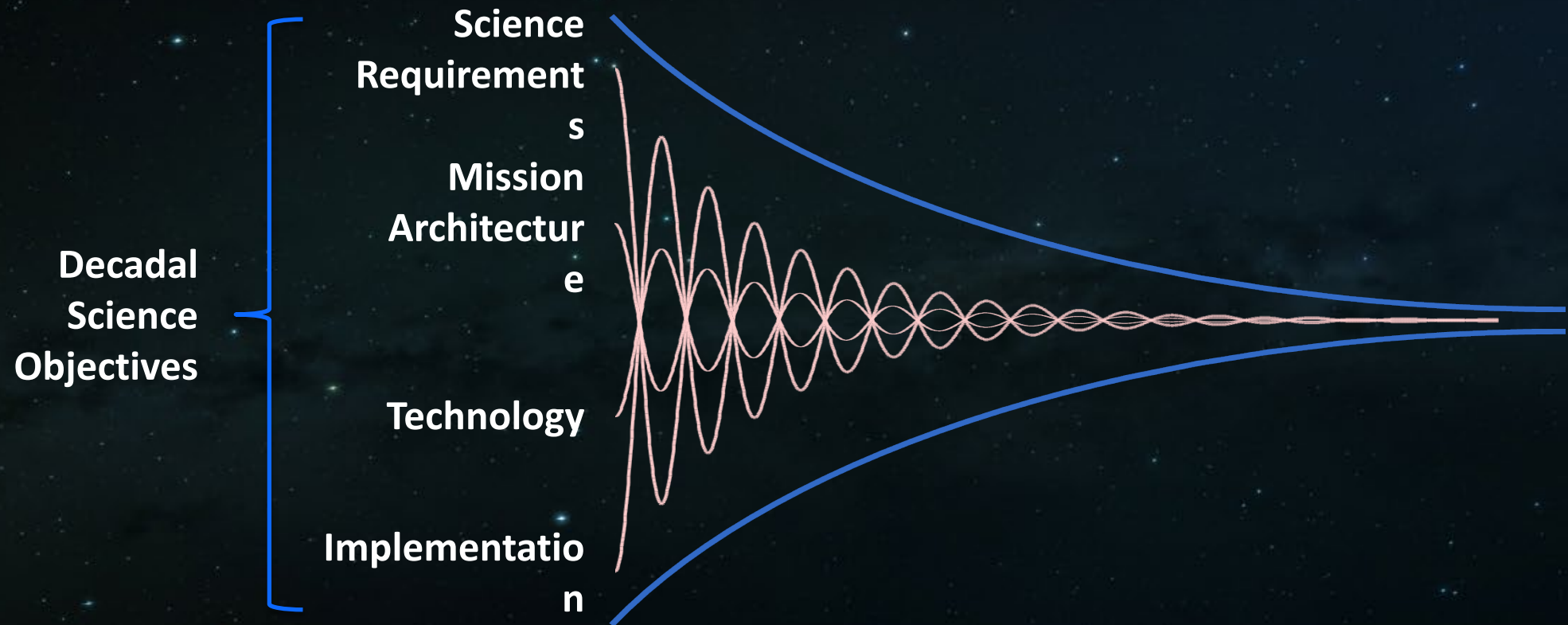
To **search for life on exoplanets** and **enable transformative astrophysics**

“If planets like Earth are rare, our own world becomes even more precious. If we do discover the signature of life in another planetary system, it will **change our place in the universe in a way not seen since the days of Copernicus** – placing Earth among a community and continuum of worlds. The coming decades will set humanity down a path to determine whether we are *alone*” – *Astro2020 Report page 1-5*

“The same large aperture telescope that can identify Earth analogs would be equally transformative for general astrophysics. ... This observatory will become one of the most scientifically versatile astronomical telescopes ever flown, and its observations will **directly address two-thirds of the 24 key science questions.**”

– *Astro2020 Report page 7-15*

# GOMAP IN A NUTSHELL



GOMAP will use lessons learned to formalize the habits of successful large missions

# STRATEGIES FOR THE PROGRAM

Build from the pre-Decadal studies and the Astro2020 Report

Mitigate future risks by implementing lessons learned from past NASA flagships

Move forward with Habitable Worlds Observatory as expeditiously as possible, while laying groundwork for other Future Great Observatories

- Guided by Astro2020 recommendations & expectations

Promote active engagement with an inclusive and transparent process

- Leverage broad & diverse participation (NASA, academia, industry)

80% of mission funding goes outside NASA over the lifecycle, starting with GOMAP

# LESSONS FROM PAST NASA FLAGSHIPS

1. Build to a schedule: Prioritize schedule reduction
2. Evolve technology from baseline JWST technical flight heritage
3. Employ new launch capabilities
4. Use planned servicing: A “mountaintop observatory” at L2
5. Start with robust science and technical margins
6. Reduce risk by maturing the whole mission concept & its technologies earlier

# HIGH-LEVEL SUMMARY OF GOMAP STAGES

## **Stage 1: HQ Preparation**

*Establish GOMAP plans and policies*

## **Stage 2: Habitable Worlds Observatory Concept Maturation Study**

*Analyze architecture options; Mature enabling technologies;  
Maintain technical capabilities for Future Great Observatories (FGOs)*

## **Stage 3: Evolved Pre-Phase A for Habitable Worlds Observatory**

*Establish mission architecture; Execute design trades; Mature technologies;  
Maintain technical capabilities for Future Great Observatories (FGOs)*

# GOMAP STAGES & KEY ACTIVITIES

## Stage 1

### *GOMAP Preparation – NASA HQ activities*

Establish GOMAP Leadership Team at NASA HQ.

Develop GOMAP governance documents, milestones, team structure, roles & responsibilities, and plans to proceed.

Review technology program to align with maturation of enabling technologies for HWO.

Prepare ROSES Precursor Science Proposal call.

**Exit criteria: Policies, procedures, and documents in place to conduct Stage 2 work**

Note: With the analyses done prior to and within Astro2020, HWO is currently at Concept Maturity Level 2 (CML 2).

## Stage 2

### *Habitable Worlds Observatory Concept Maturation Study*

Execute study with broad-based, integrated group.

Assemble HWO science objectives from Astro2020 Report.

Gather information on mission architecture options.

Assess each architecture option's ability to meet science objectives.

Analyze Technology Readiness Levels (TRLs) for each architecture option.

Identify & plan needed science, engineering, and programmatic tools.

Independent Consultants: Analyze mission funding profile and schedule options.

**Exit criteria: Deliver a public report exploring science objectives and architectural trades to understand the relationship between science return, cost, and risk**

# GOMAP STAGES & KEY ACTIVITIES

## Stage 3

### *Evolved Pre-Phase A for Habitable Worlds Observatory*

Develop prioritized science requirements & Science Traceability Matrix.

Converge on mission architecture and execute design trades.

Re-analyze mission funding profile and schedule options.

Plan, organize, and prioritize technology development.

Develop mission concept and all enabling technologies to recommended maturity levels before Phase A.

Identify and develop critical subsystem and/or subscale pathfinders.

Identify and develop plans for long-lead facilities, tools, etc.

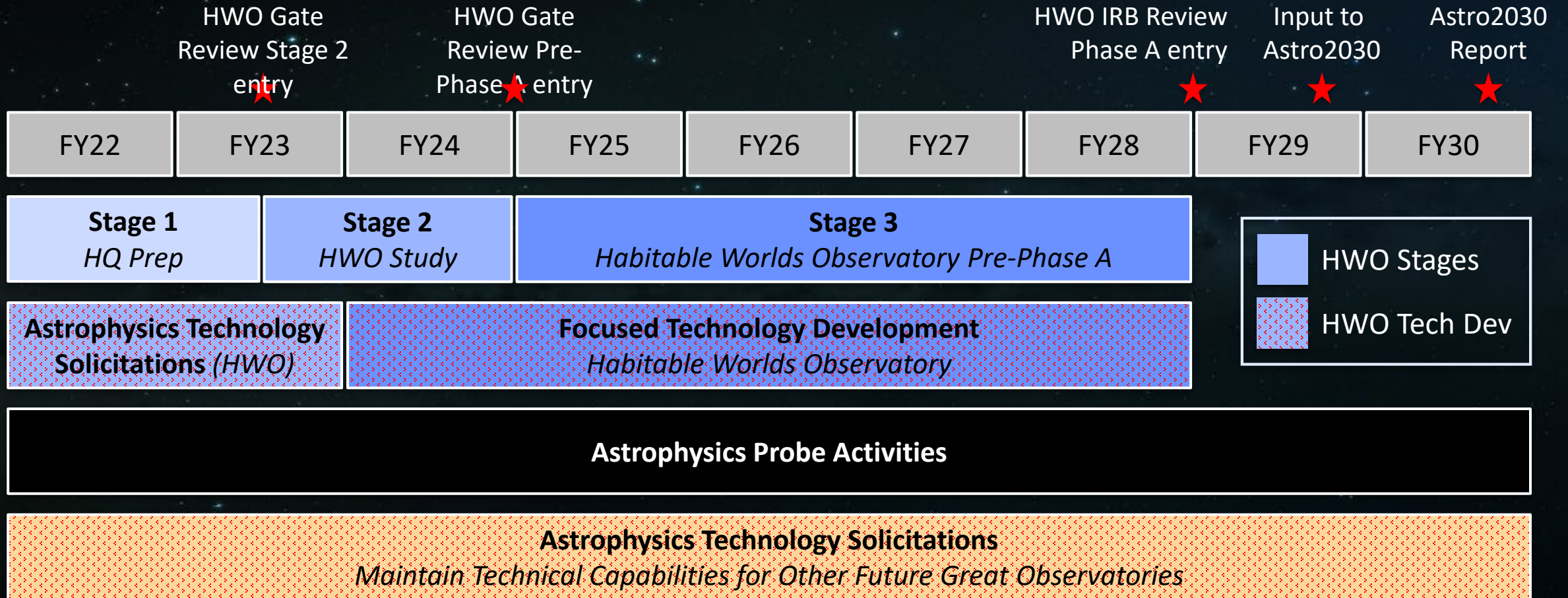
Define implementation approach and acquisition strategy.

Prepare deliverables for NASA Mission Concept Review (MCR) and independent Phase A entry gate review.

**Exit criteria: Successful NASA Mission Concept Review and Independent Review as recommended by Astro2020. Pass  
KDP-A**

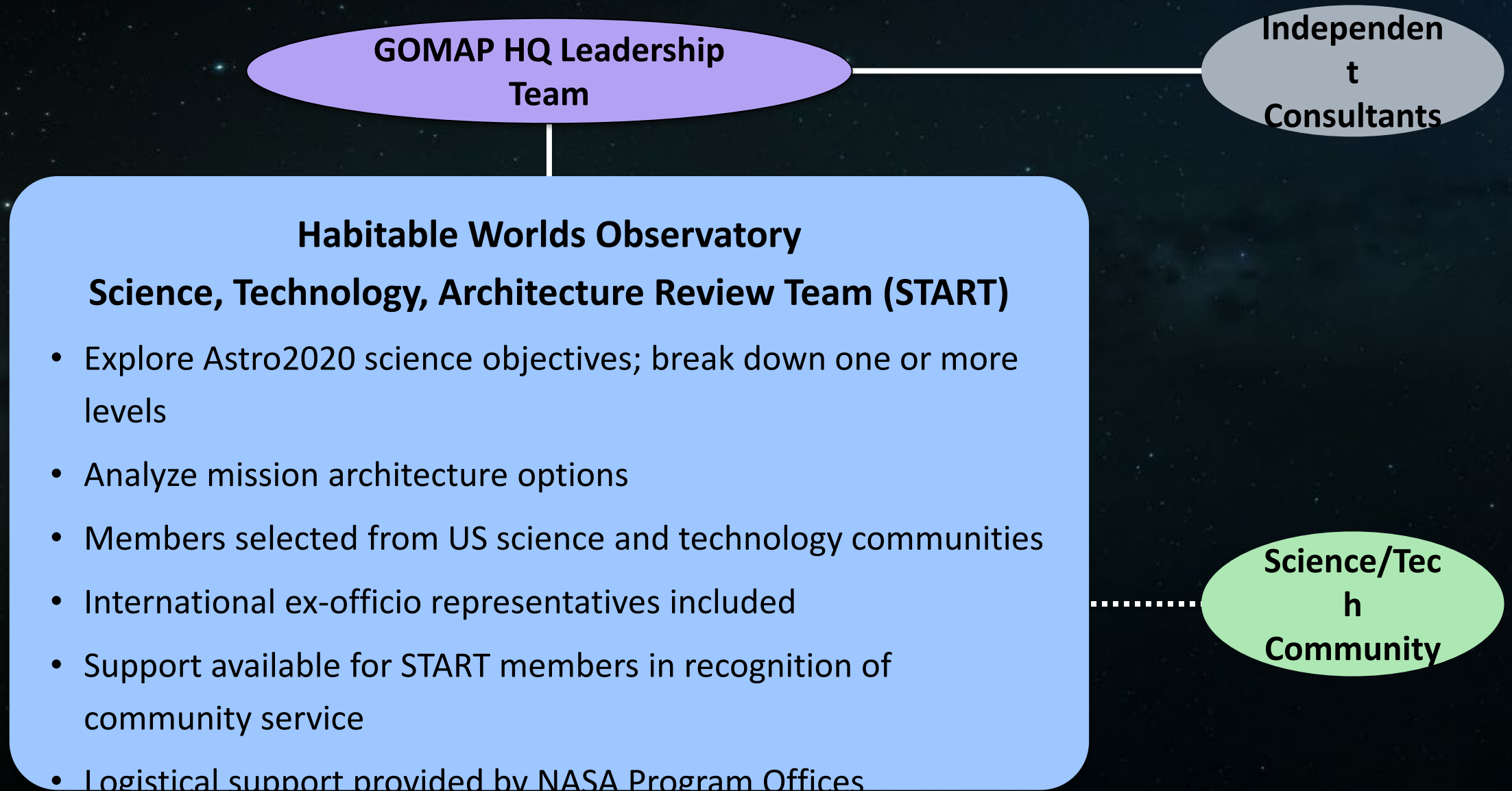


# NOTIONAL GOMAP TIMELINE



*Schedule dependent on appropriated funding levels*

# STAGE 2: HWO CONCEPT MATURATION STUDY



# CONSIDERATIONS FOR OTHER FUTURE GREAT OBSERVATORIES

Scientific value of a multi-wavelength fleet is enormous

We are following Decadal guidance on subsequent FGOs

Activities will support subsequent FGOs for the next Decadal Survey

Meanwhile, APD is aware that the other FGOs need to keep their communities active and technologies advancing

- Technology priorities have been revisited to ensure continuity

We hope the Far-IR and X-ray communities will actively engage in probe activities

# STRATEGIES FOR FUTURE IDEA PLAN

GOMAP will use APD Statement of Principles requiring inclusive practices by all partners to foster supportive work environments and diverse teams

Detailed IDEA plan(s) will be developed in consultation with professionals

Lower barriers to participation – such as access, resources, time – by members of under-represented groups and organizations such as Minority Serving Institutions (MSIs) and R2 universities

- Leverage established APD/SMD partnerships with minority-serving professional organizations
- Engage the MSI community at a workshop to gather feedback & develop strategies

Inclusively foster the next generation of subject matter experts in NASA missions

# NEXT STEPS

Finalize *GOMAP Implementation Strategy* document

Develop *Terms of Reference (TOR)* for Habitable Worlds Observatory Science, Technology, Architecture Review Team (START)

Form Habitable Worlds Observatory START

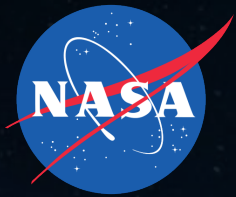
- Develop and release an invitation for self-nominations

Capture lessons learned from JWST while they are fresh (in progress)

Engage with Program Analysis Groups (PAGs)

Strategically focus solicitations

- Ensure that relevant future solicitations reflect GOMAP's strategies and priorities



# QUESTIONS

# A GOMAP HWO TECHNOLOGY SPLINTER SESSION

## Starlight Suppression Technologies for the Habitable Worlds Observatory Flagship

AAS241 splinter session  
Tuesday, Jan 10, 2023; 9am – 11am  
Room 4C-3 (this room)

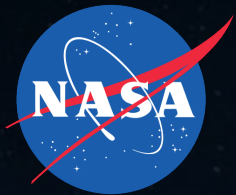
Chairs: Ruslan Belikov, Brendan Crill

Speaker	Topic
Bruce Macintosh	Decadal Survey science goals and the HWO Flagship.
Chris Stark	Interdependence between mission requirements and science requirements
Rhonda Morgan	Starlight suppression technologies from LUVOR and <u>HabEx</u> reports
Bertrand Mennesson	Advances of established starlight suppression technologies since LUVOR and <u>HabEx</u> .
Olivier Guyon	Emerging technologies and their potential.
Pin Chen	New initiatives: Coronagraph Survey, Coronagraph Roadmap, and DM Roadmap.
Everyone	Q & A / Discussion

Join webex <https://bit.ly/starlightsuppression> (direct link) or <https://jpl.webex.com>  
Meeting ID: 2762 178 2437  
Meeting PW: planets123  
Audio: 844-575-9329

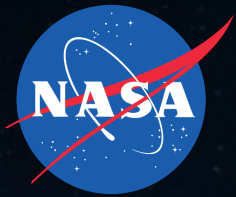
QR code to join webex





BACKUP





## Independent Consultants (IC)

SMEs from govt., industry, academia, science centers

### Responsibilities

- Enable a multi-sector, one-team environment for Stage 3 (Pre-Phase A)
- Research, plan, and develop a cross-discipline Interoperable Integrated Modeling framework coordinated with GOMAP Groups and Modeling SMEs
- Work with multi-sector contract specialists and lawyers to protect IP while enabling creative solutions across subsystem interfaces
- Investigate creative, incentivizing procurement strategy options for the HQ Leadership Team
- Develop Stage 3 governance options
- Investigate principles and processes for assembling Stage 3 teams (e.g., STDT, SRB, IRB)
- Create Pre-Phase A funding profile options and analyze impacts