

NASA'S HABITABLE WORLDS OBSERVATORY

FROM SCIENCE TO ENGINEERING

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H A B I T A B L E
W  R L D S
O B S E R V A T O R Y

HIGH-LEVEL SUMMARY OF CURRENT ACTIVITIES

Explore the science, engineering, & technology trade space

Develop Technology Maturation Plan

Get everything ready to make good decisions rapidly in Phase A

GREAT PROGRESS IN THE LAST YEAR

Credit: M. Ansdell / J. Ziemer

MILESTONES

**GOMAP
Established
(June 2023)**

**START & TAG
Formed
(Oct 2023)**

**Initial Working
Groups Formed
(Jan 2024)**

**Technology
Maturation Project
Office Formed
(Aug 2024)**

**Science Cases and
Sensitivity Studies
(July 2025)**

**Concept
Maturity
Level 3**

**WE ARE
HERE**

**Goal:
August 2025**

ACTIVITIES

Begin Decadal Survey implementation

Investigate potential science cases & identify mission drivers

Solicit & select initial START & TAG members

Develop analytic science & engineering codes & models

Develop precursor science & technology calls

Assess technology gaps & aerospace landscape

Communicate GOMAP approach with HWO

Develop technology maturation roadmaps

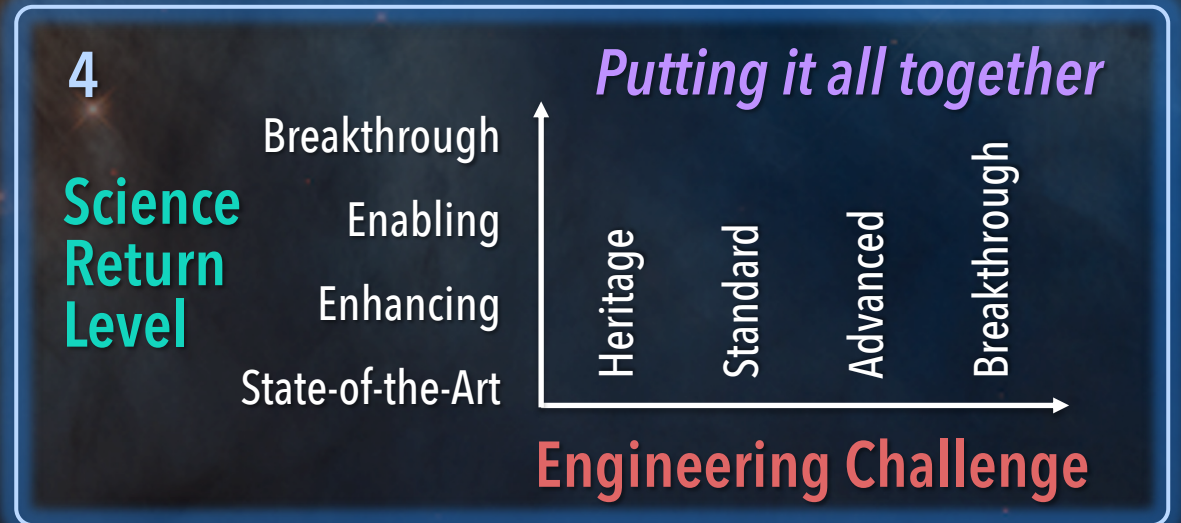
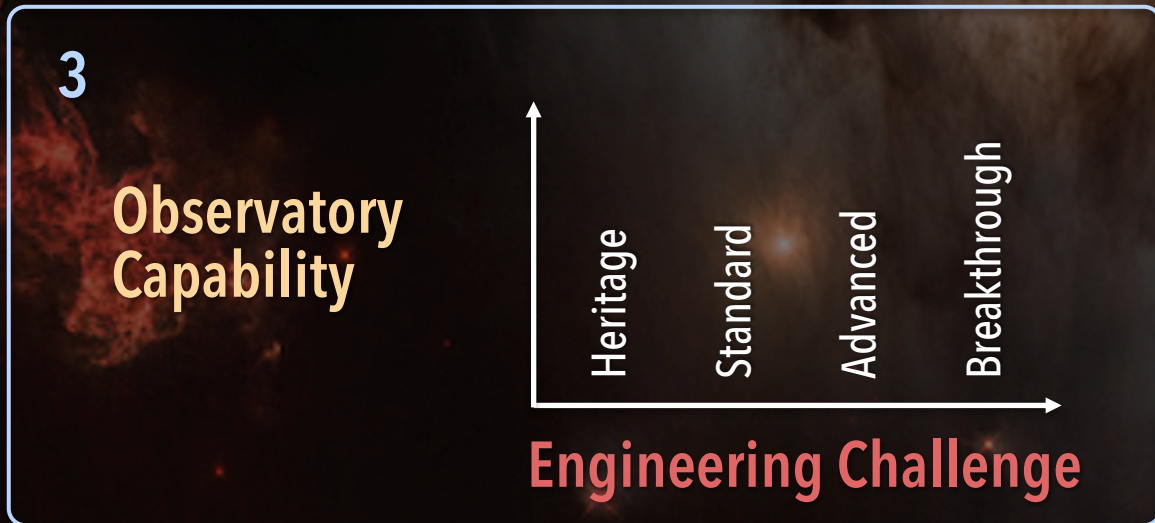
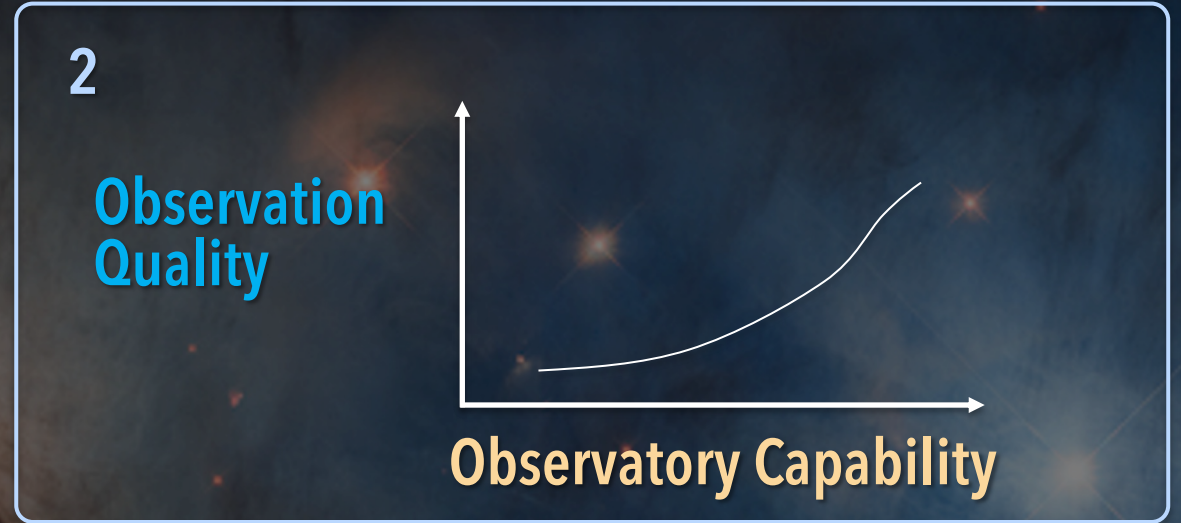
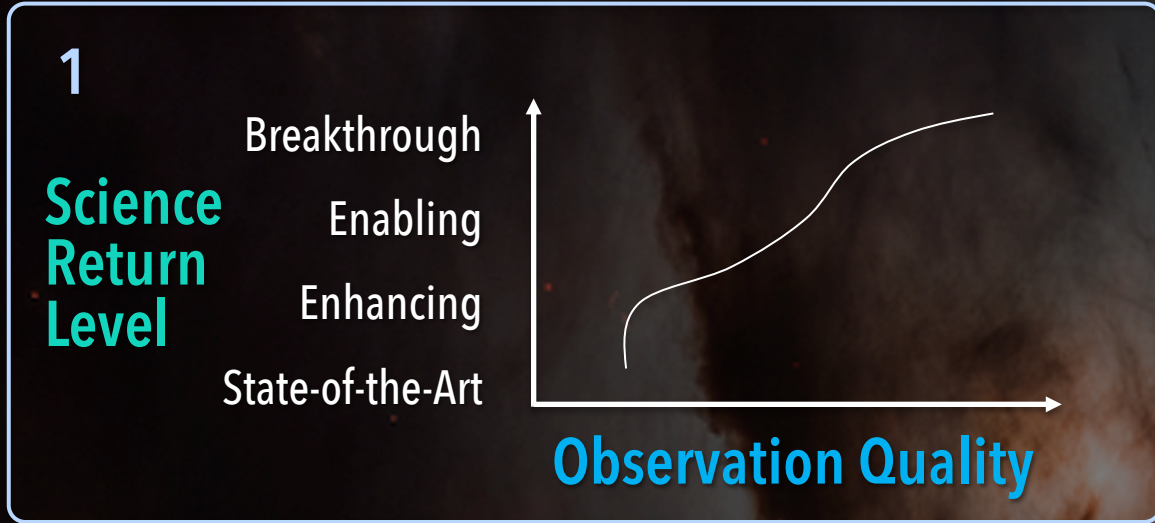
**Science and
Engineering
Trade Space
Exploration
Synthesis**

Planning [2023✓]

Exploring the Trade Space [2024-2025]

EXPLORING THE TRADE SPACE

Credit: John Ziemer



IMPROVED TOOLS TO EXPLORE THE TRADE SPACE

Dynamic Integrated Science Return Analysis (DISRA)

Enable rapid analysis of total science returns from a mission architecture

Integrate multiple science case code modules provided by community scientists

Draw from consistent set of astrophysical & observatory parameters for all science cases

Determine sensitivities of science returns to changing astrophysical & observatory parameters, and correlations between them

Identify driving hardware performance parameters to guide technology development

DISRA STRUCTURE

Layer 1 - Science Case Modules

Explore science metrics & needed observations
(python notebooks)

Layer 2 - Exposure Time Calculators (ETCs)

Link the observations to the observatory

Layer 3 - Science / Engineering Interface

Hold unified set of astrophysical parameters &
telescope / instrument parameters

1

Science
Return
Level

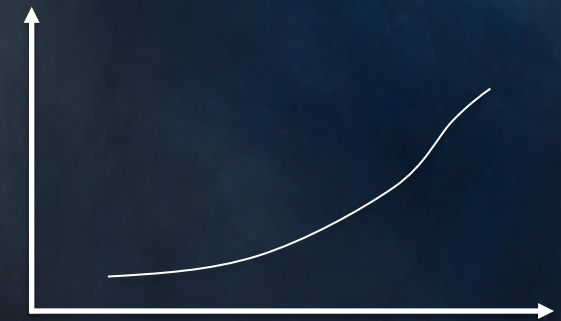
Breakthrough
Enabling
Enhancing
State-of-the-Art



Observation Quality

2

Observation
Quality



Observatory Capability

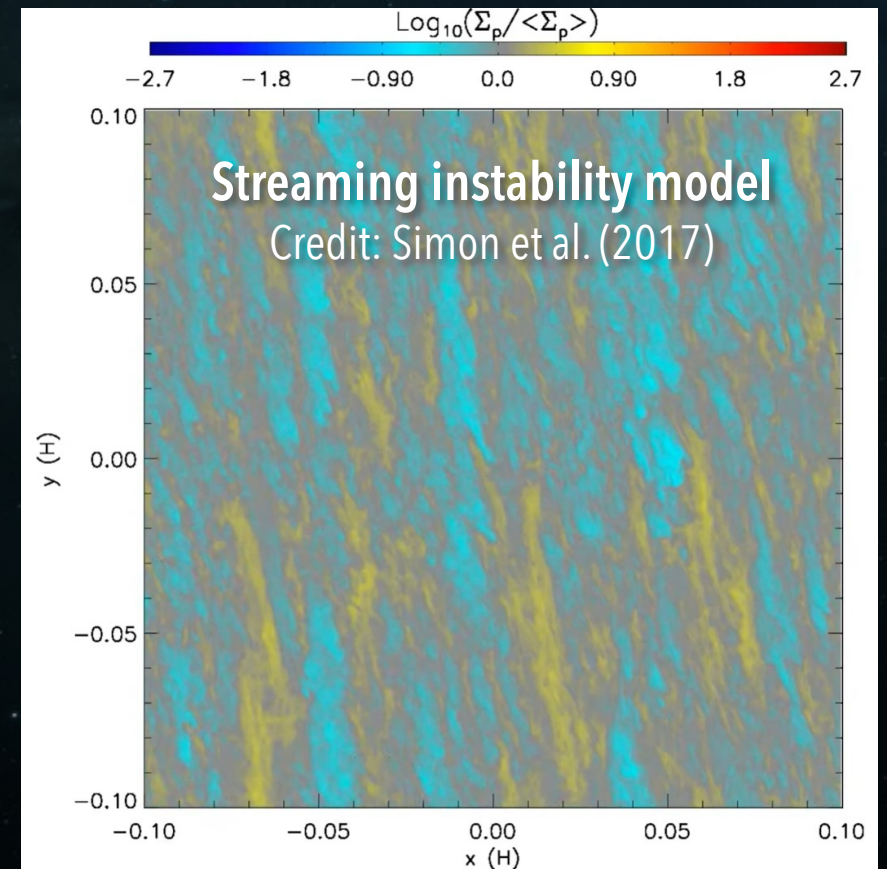
EXAMPLE SCIENCE CASE

Goal: How did the seeds of Solar System planets first come together?

Major uncertainties in planet formation's first steps –
the growth of planetesimals

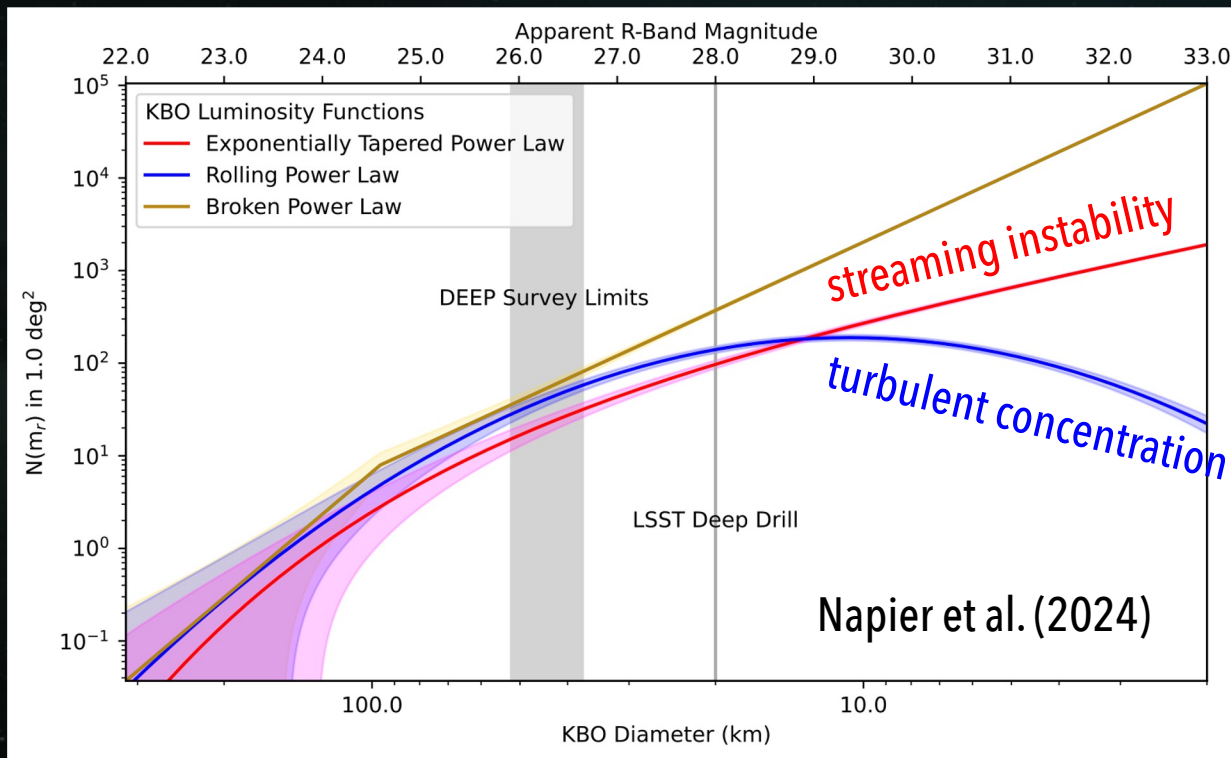
The planet formation process is robust, but our models
of it are not

Objective: Discover primordial KBOs in the outer
Solar System to distinguish between planetesimal
formation models

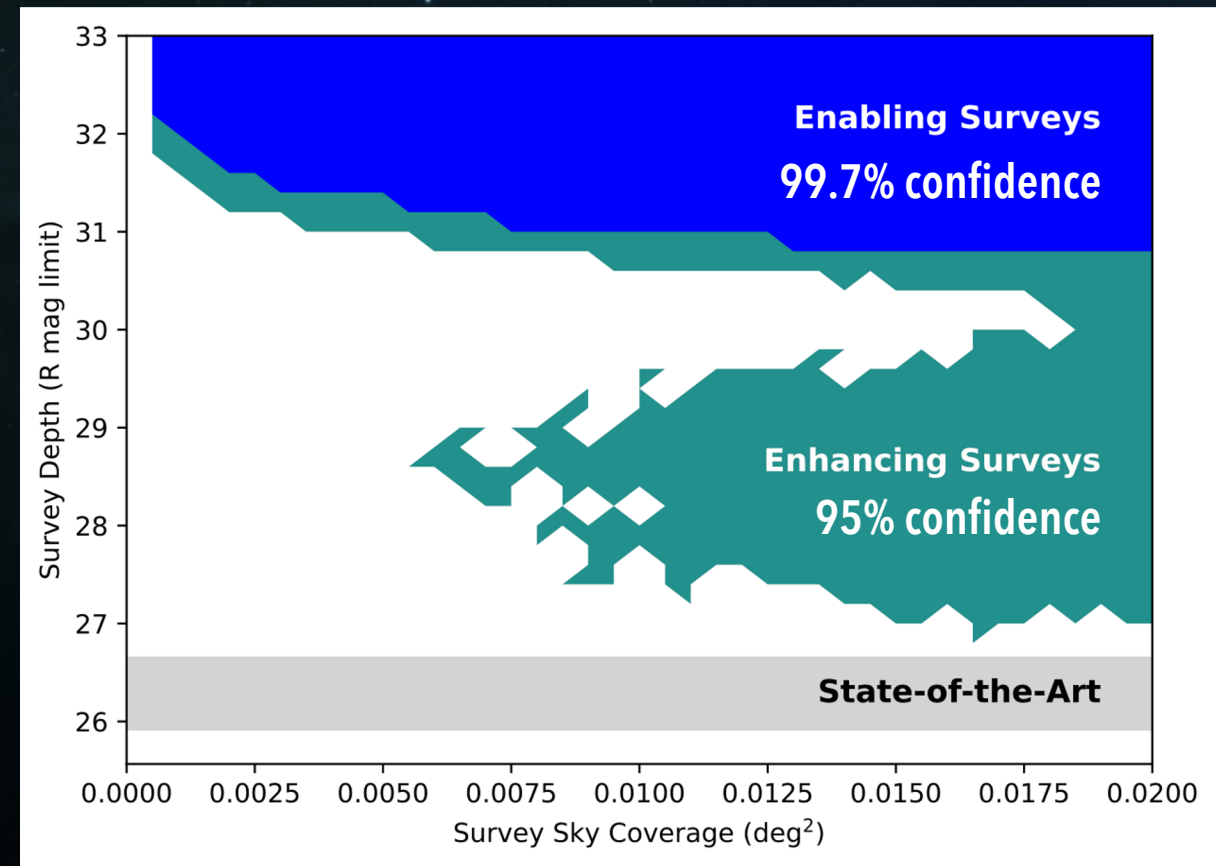


SCIENCE RETURN LEVELS VS. OBSERVATIONS

Best-fit KBO luminosity functions from DEEP Survey
(current state-of-the-art)



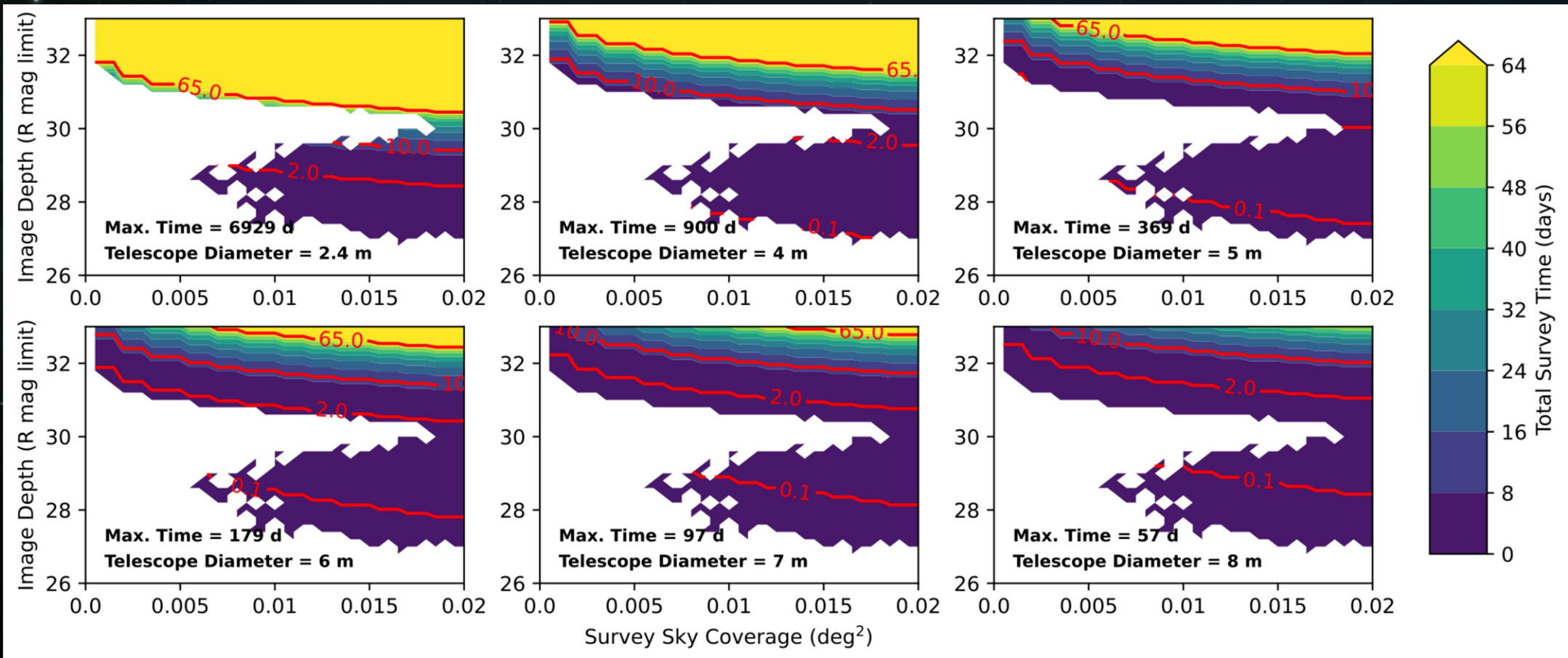
Ability of R band imaging surveys to distinguish between models (Panel 1)



OBSERVATIONS VS. OBSERVATORY CAPABILITY

Enabling survey with Hubble would take **~65 days** (~six Ultra-Deep Fields)

Same survey with 6-m HWO would take **~2 days** (~1 small proposal)



ONWARD

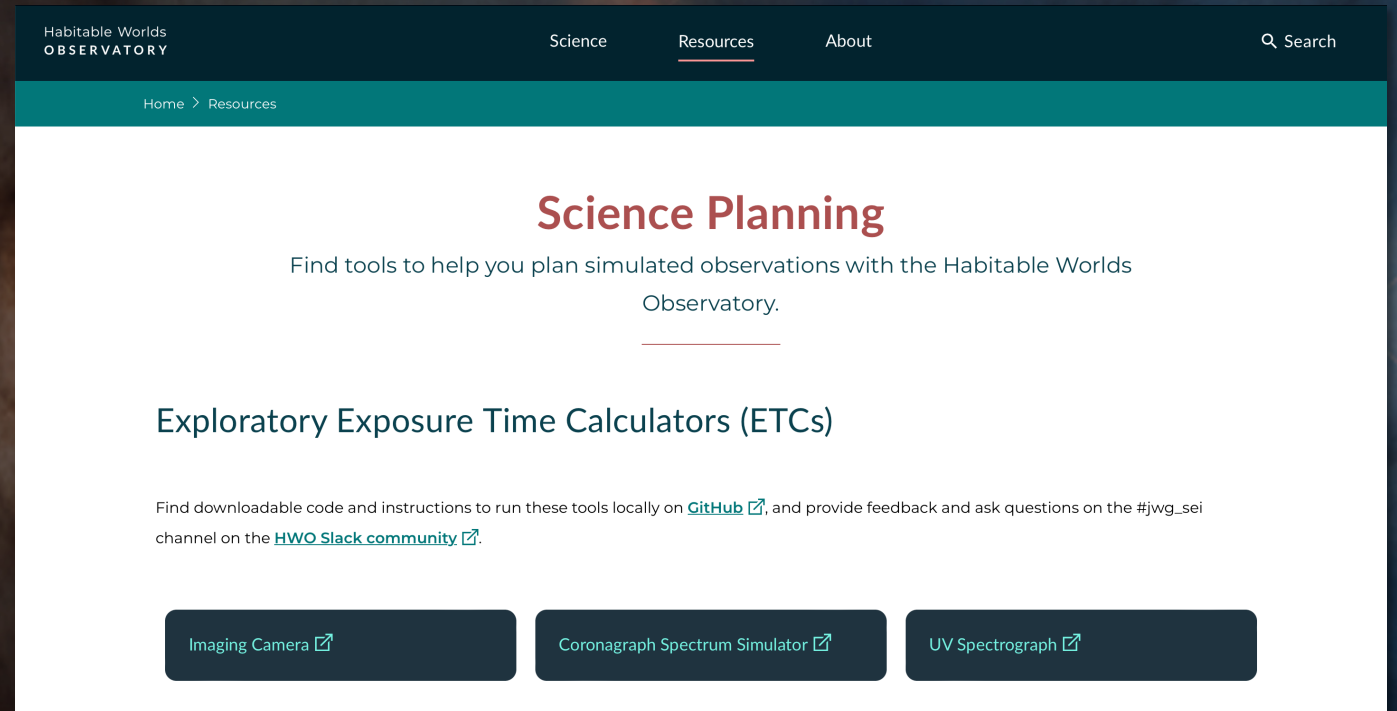
Working Groups and Project Science Team collaborating to turn more science cases into DISRA modules

HWO exposure time calculators are maturing

- ETCs also available via web interface for quick calculations

Higher fidelity simulations in the works

Our goal is to empower **YOU** to create your own DISRA modules



The screenshot shows the 'Science Planning' page on the Habitable Worlds Observatory website. The page has a dark teal header with the logo 'Habitable Worlds OBSERVATORY' on the left, navigation links 'Science', 'Resources', and 'About' in the center, and a search icon on the right. Below the header is a teal breadcrumb trail 'Home > Resources'. The main content area is white and features the title 'Science Planning' in a large, bold, dark red font. Below the title is a subtitle: 'Find tools to help you plan simulated observations with the Habitable Worlds Observatory.' Underneath is a section titled 'Exploratory Exposure Time Calculators (ETCs)' in a dark teal font. A paragraph of text follows: 'Find downloadable code and instructions to run these tools locally on [GitHub](#), and provide feedback and ask questions on the #jwg_sei channel on the [HWO Slack community](#).' At the bottom, there are three dark teal buttons with white text and external link icons: 'Imaging Camera', 'Coronagraph Spectrum Simulator', and 'UV Spectrograph'.

<https://habitableworldsobservatory.org/resources/science-planning>