

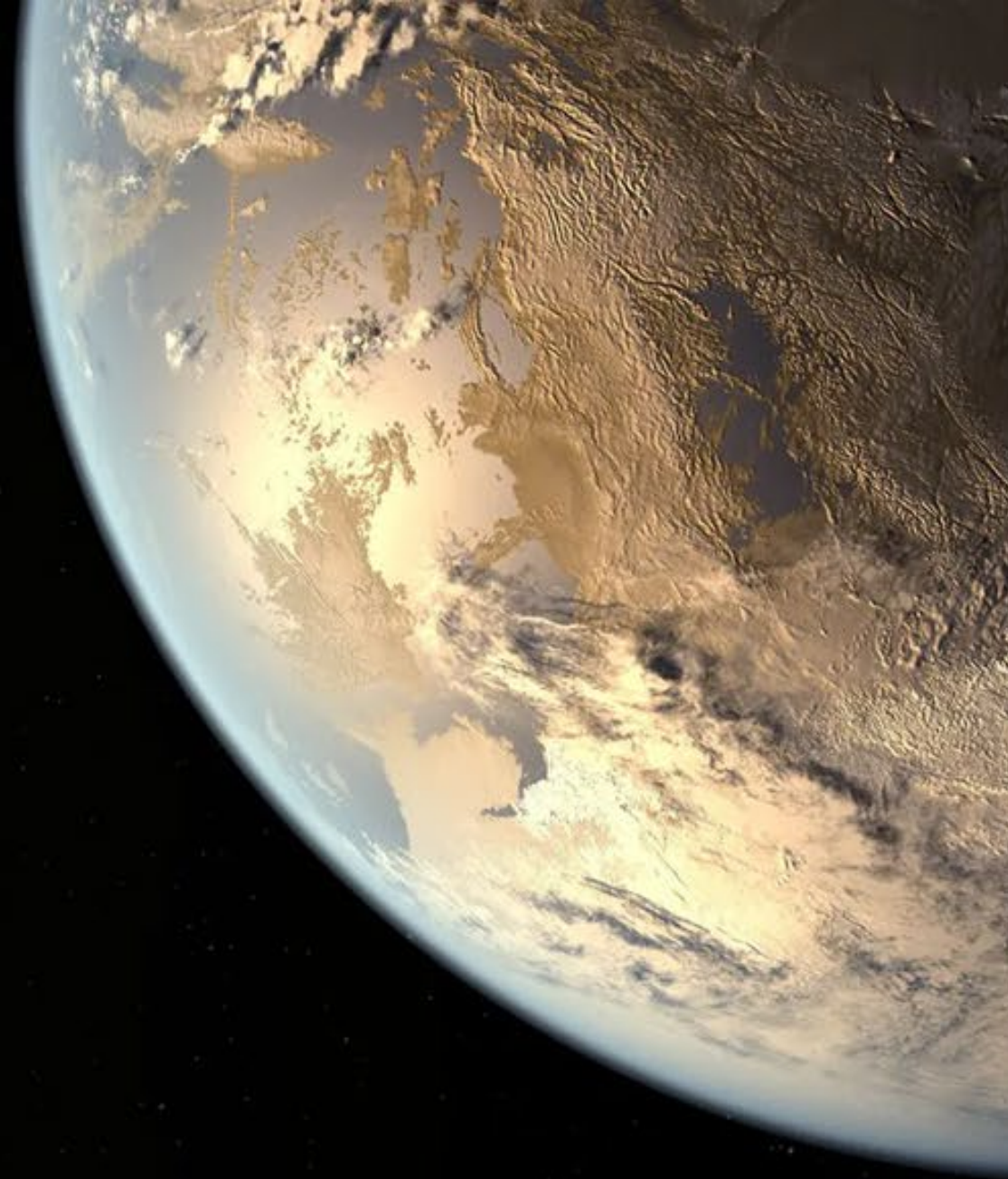


National Aeronautics and
Space Administration

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

HWO TMPO Status

Lee Feinberg,
HWO Principal Architect
NASA Goddard Space Flight Center



INTRODUCTION

- Habitable Worlds Observatory Technology Maturation Project Office (TMPO) officially started August 1st
- Leadership team met in-person for 2 days in late August at JPL
- Very first step was to establish a project culture and discuss how the team would operate
 - General summary: Badgeless team, open and transparent dialog, use “best athlete” approach as much as feasible, strong priority on inclusion and mentoring, respect Tier 1 capabilities
- Kickoff focused on the organizational structure, roles and responsibilities, communication and reporting, plan to MCR including key milestones and deliverables

HWO PROJECT OFFICE

Project Leadership:
L. Feinberg, Principal Architect
S. Smith, Project Manager[°]
J. Ziemer, Pre-Formulation Architect*

* JPL ex-officio
° Interim

Financial: P. Butler
Pub Affairs: C. Andreoli
Community Engagement:
Rob Zellem & Raissa Estrella*

Science
G. Arney, Project Scientist[°]
A. Roberge, Pre-formulation Scientist[°]
B. Mennesson, Pre-formulation Scientist*

Deputy PS: Mike McElwain
Deputy PFS: Erin Smith
Deputy PFS: Pin Chen*
Coronagraph Instr Sci: Vanessa Bailey*
High-Contrast Spectr. Sci: Neil Zimmerman
Camera Instr. Scientist: Tom Greene, Ames
UV Instrument Scientist: Paul Scowen
Exoplanet Theme Ld: Chris Stark
Exoplanet Theme Ld: Renyu Hu*
Astrophysics Theme Ld: Jason Rhodes*
Astrophysics Theme Ld: Allison Youngblood
Solar Systems Ld: Lynnae Quick

Testbeds/Demos
B Sitarski, Deputy Principal Architect
C. Baker*, JPL Testbed Lead*

M. McElwain, HOST
T. Groff, HOST Systems
M. Troy, Keck Demo*

Systems
M. Menzel, Mission System Engineer
A. Liu, Deputy MSE
Systems Modeling, M. Levine*

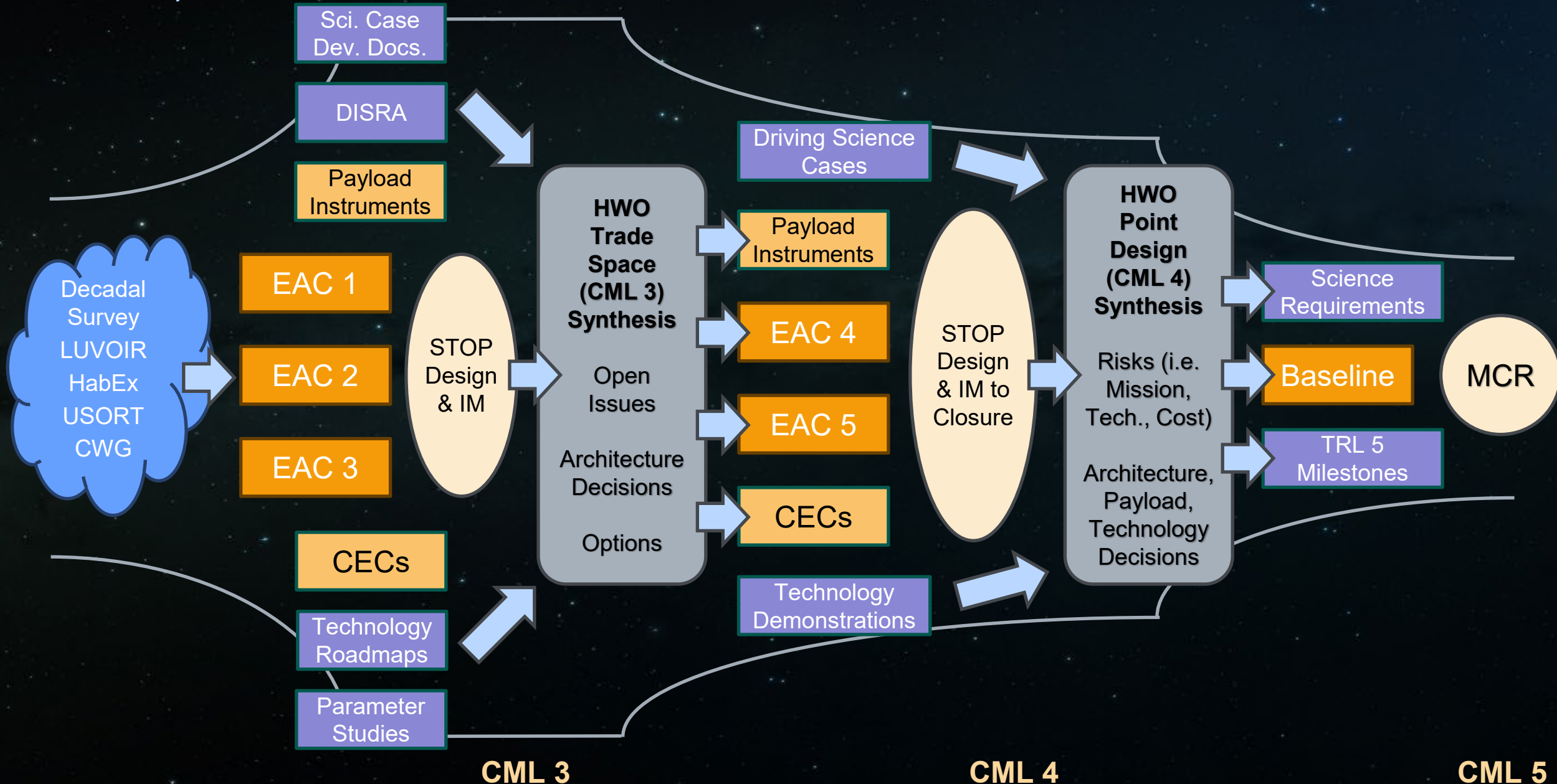
Servicing & Instrument Systems: J. Van Campen
High Contrast Sys: C. Noecker
Payload Systems: J. Abel
High Contrast Error Budgets: Brian Kern
Systems Design and Modeling teams

Technology
M Bolcar, Chief Technologist
F. Zhao, Deputy Chief Technologist*

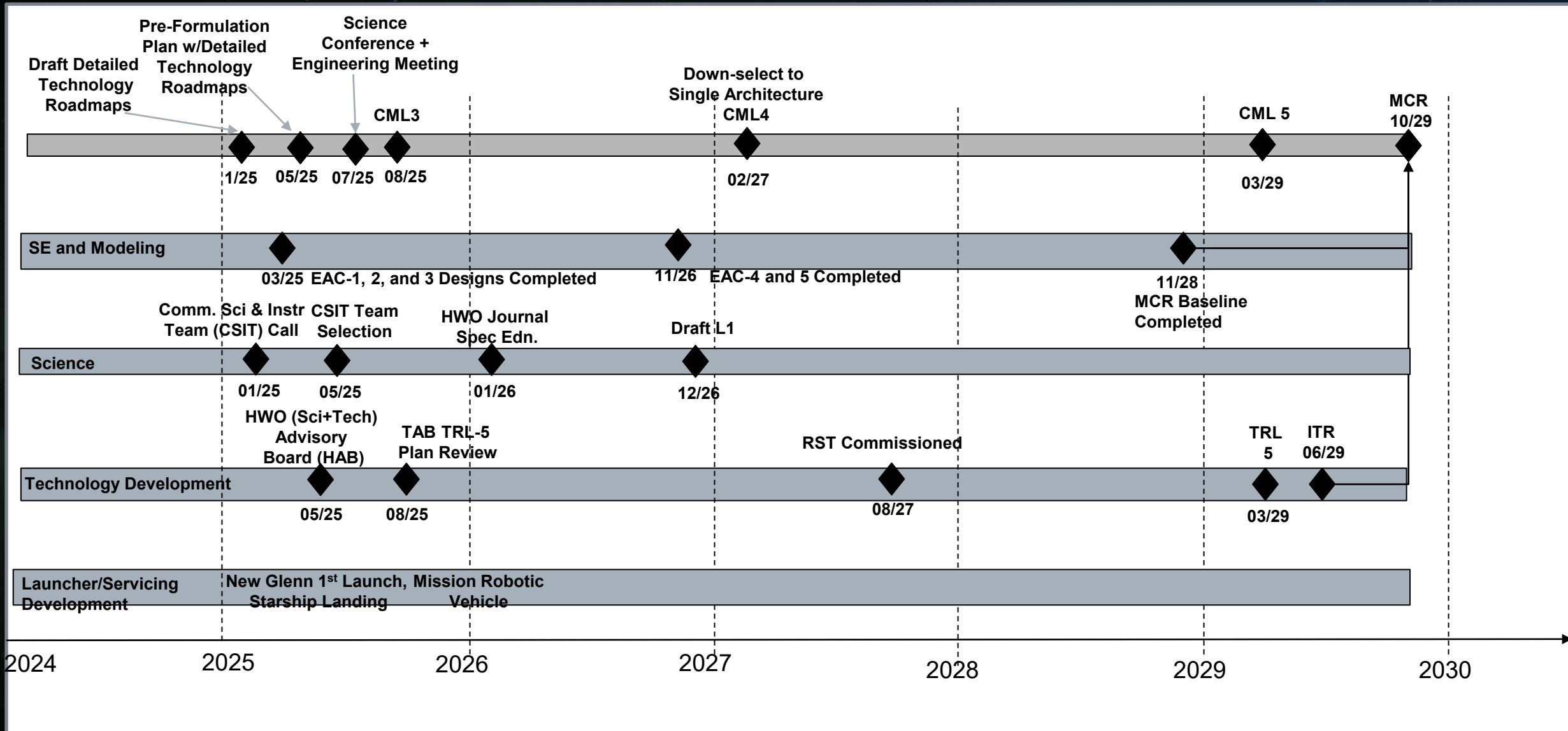
Coronagraph Technology: Ilya Poberezhskiy
Telescope Technology: TBD
UV/Instrument Technology: Paul Scowen
D. Redding, WFSC SME*
P. Stahl, Mirror Technology SME, MSFC
R. Belikov, Coronagraph system SME, Ames

The Pre-Formulation Project Development Team will encompass a broad group, including former START/TAG members.

CONTINUING TO FOLLOW DECADEAL SURVEY RECOMMENDATION OF ITERATING BETWEEN SCIENCE, ARCHITECTURE AND TECHNOLOGY:

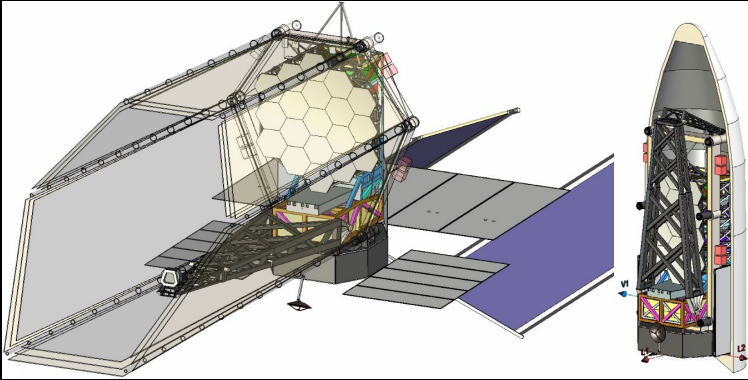


HWO TOP LEVEL SCHEDULE TO MCR* (DRAFT)

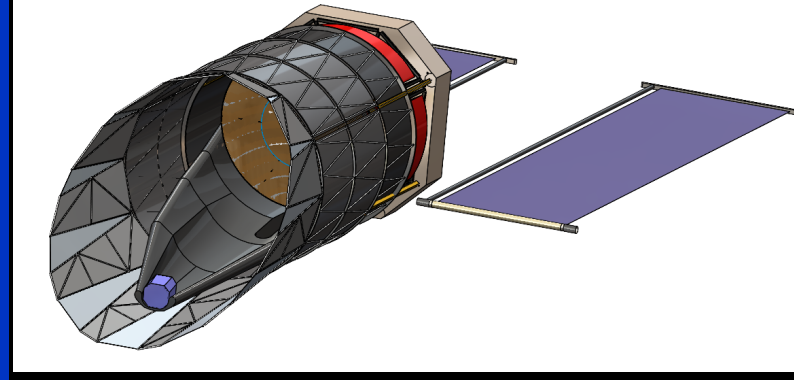


*Contingent on Funding

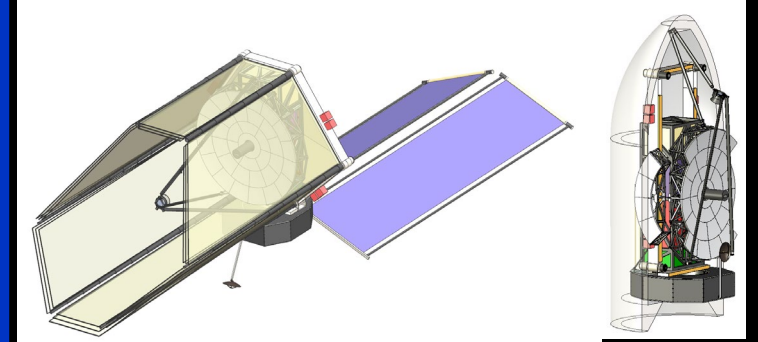
NOTIONAL EXPLORATORY ANALYTIC CASES



EAC1	Assumption	Comments
Launch Vehicle	New Glenn	7m diameter Fairing
Mass	Bottoms up estimate	
#of Mirrors	19 Hex Segments	1.65m point to point
Telescope Diam + Config	Off-Axis, 6M ID/7.2m OD	
Deployment	JWST-like Wings, Hinged tower	



EAC2	Assumption	Comments
Launch Vehicle	New Glenn or Starship	9m diameter Fairing
Mass	Bottoms up estimate	
#of Mirrors	6+1	3m central mirror, 6 Keystone
Telescope Diam+Config	Off-Axis, 6m Circ.	
Deployment	SM hinged, Barrel only	



EAC3	Assumption	Comments
Launch Vehicle	New Glenn or Starship	9m diameter Fairing
Mass	Bottoms up estimate	
#of Mirrors	34 Keystone	
Telescope Diam+Config	On-Axis, 8m Circ.	Large FOV Hybrid OOFs Guider
Deployment	JWST-like Wing, SM	

COMMUNITY SCIENCE INSTRUMENT TEAM (CSIT)

- TMPO will form a Community Science Instrument Team (CSIT), call to go out early next year
 - More details to come on this...
- Goal for CSIT to start prior to Science Conference
- Plan for it to extend until MCR, then a mission science team would be selected
 - Roughly half would stay until MCR, roughly half would refresh along the way
- Combine folks who are more science focused with those who are instrumentalists and science technologists
- In FY25, we are hopeful to support travel and meeting time
- FY26 and beyond we hope to support they can bring on students (TBD)

HWO ADVISORY BOARD (HAB)

- HWO TMPO will stand up a HWO Advisory Board for science, architecture and technology in time to attend the June Workshop
- The team will be modeled on the successful JWST Telescope Product Integrity Team (PIT) but focused on technology/pre-formulation phase
- Purpose of the team will be to provide independent advice to NASA (project but also to HQ) regarding science and technology and architecture
- HAB will conclude before the Independent Technology Review (ITR) Board is stood up (which will be a NASA HQ level review board)

WORKING GROUP PLANS

- We are going to extend the Science Working Groups and the reformed Engineering Working Groups through the Science and Engineering workshop next summer
 - Does not change schedule to finish SCDD's by end of year
 - Expect slightly lower cadence of meetings
- Working on plans for community working groups and will have that in place soon
- As before, working groups are only exploratory and do not make recommendations
- Beyond the science and engineering workshop, we are considering handing off aspects of the working groups to science community working groups (eg, non-driving science cases to SAGs/SIGs as an example)
 - CSIT will be on board

Current HWO Working Groups (as of 10/10)

SCIENCE					
Living Worlds	-	WG Co-Chair	Arney	Giada	NASA GSFC
Living Worlds	-	WG Co-Chair	Parenteau	Niki	NASA ARC
Living Worlds	Biosignature Possibilities	SG Co-Chair	Schwieterman	Eddie	UC Riverside
Living Worlds	Biosignature Possibilities	SG Co-Chair	Sara	Walker	Arizona State Univ.
Living Worlds	Biosignature Interpretation	SG Co-Chair	Olson	Stephanie	Purdue Univ.
Living Worlds	Biosignature Interpretation	SG Co-Chair	Krissansen-Totton	Josh	Univ. Washington
Living Worlds	Target Stars & Systems	SG Co-Chair	Mamajek	Eric	ExEP / JPL
Living Worlds	Target Stars & Systems	SG Co-Chair	Hinkel	Natalie	Louisiana State Univ.
Evolution of Elements	-	WG Co-Chair	Lee	Janice	STScI
Evolution of Elements	-	WG Co-Chair	Scowen	Paul	NASA GSFC
Evolution of Elements	Stars & Stellar Populations	SG Co-Chair	Senchyna	Peter	Carnegie Observatories
Evolution of Elements	Stars & Stellar Populations	SG Co-Chair	Barstow	Martin	Leicester
Evolution of Elements	Star Formation	SG Co-Chair	Salim	Samir	Indiana U
Evolution of Elements	Star Formation	SG Co-Chair	Paladini	Roberta	IPAC-Caltech
Evolution of Elements	Cosmic Explosions	SG Co-Chair	Burns	Eric	Louisiana State Univ.
Evolution of Elements	Cosmic Explosions	SG Co-Chair	Andrews	Jennifer	Gemini-North / NOIRLab
Galaxy Growth	-	WG Co-Chair	Ravindranath	Swara	COR
Galaxy Growth	-	WG Co-Chair	Postman	Marc	STScI
Galaxy Growth	IGM & ICM	SG Co-Chair	Borthakur	Sanchayeeta	Arizona State Univ.
Galaxy Growth	IGM & ICM	SG Co-Chair	Burchett	Joe	New Mexico State Univ.
Galaxy Growth	AGN	SG Co-Chair	Packham	Chris	UTSA
Galaxy Growth	AGN	SG Co-Chair	U	Vivian	UC Irvine
Galaxy Growth	Ionizing Photons	SG Co-Chair	McCandliss	Stephen	Johns Hopkins Univ.
Galaxy Growth	Ionizing Photons	SG Co-Chair	Strom	Allison	Northwestern U
Galaxy Growth	Dark Sector	SG Co-Chair	Rhodes	Jason	JPL
Galaxy Growth	Dark Sector	SG Co-Chair	Massey	Richard	Durham Univ.
Solar System in Context	-	WG Co-Chair	Robinson	Tyler	Univ. Arizona
Solar System in Context	-	WG Co-Chair	Shkolnik	Evgenya	Arizona State Univ.
Solar System in Context	Characterizing Exoplanets	SG Co-Chair	Hu	Renyu	JPL
Solar System in Context	Characterizing Exoplanets	SG Co-Chair	Min	Michiel	ESA
Solar System in Context	Solar System Observations	SG Co-Chair	Quick	Lynnae	NASA GSFC
Solar System in Context	Solar System Observations	SG Co-Chair	Cartwright	Richard	JHU-APL
Solar System in Context	Demographics & Architectures	SG Co-Chair	Christiansen	Jessie	Caltech/IPAC-NExScI
Solar System in Context	Demographics & Architectures	SG Co-Chair	Rice	Malena	Yale Univ.
Solar System in Context	Birth & Evolution	SG Co-Chair	MacGregor	Meredith	Johns Hopkins Univ.
Solar System in Context	Birth & Evolution	SG Co-Chair	Hasegawa	Yasuhiro	JPL

JOINT					
Science Case Simulation	Merging with Science Data Simul	WG Co-Chair	Batalha	Natasha	NASA ARC
Science Case Simulation	Merging with Science Data Simul	WG Co-Chair	Osten	Rachel	STScI
Science Case Simulation	Astrometry	SG Co-Chair	Gaudi	Scott	Ohio State Univ.
Science Case Simulation	Astrometry	SG Co-Chair	Reylé	Céline	Besaçon Obervatory
Science Case Simulation	Exoplanet Yields	SG Co-Chair	Savransky	Dmitry	Cornell
Science Case Simulation	Exoplanet Yields	SG Co-Chair	Stark	Chris	GSFC
Science Case Simulation	UV Galaxy Evolution	SG Co-Chair	Hodges-Kluck	Edmund	NASA GSFC
Science Case Simulation	UV Galaxy Evolution	SG Co-Chair	Boquien	Médéric	Université Côte d'Azur
Science Case Simulation	Exoplanet Characterization	SG Co-Chair	--	--	--
Science Case Simulation	Exoplanet Characterization	SG Co-Chair	--	--	--
Science Data Simulation	Merging with Science Case Simul	WG Co-Chair	Greene	Tom	NASA ARC
Science Data Simulation	Merging with Science Case Simul	WG Co-Chair	Tumlinson	Jason	STScI
Science Data Simulation	High-Contrast	SG Co-Chair	Krist	John	JPL
Science Data Simulation	High-Contrast	SG Co-Chair	Macintosh	Bruce	UC Observatories
Science Data Simulation	UV	SG Co-Chair	France	Kevin	CU Boulder
Science Data Simulation	UV	SG Co-Chair	Tuttle	Sarah	Univ. Washington
Science Data Simulation	Wide-Field Imaging	SG Co-Chair	Malhotra	Sangeeta	NASA GSFC
Science Data Simulation	Wide-Field Imaging	SG Co-Chair	Pierre-Olivier	Lagage	Commissariat à l'Energie A
Sci-Eng Interface	-	WG Co-Chair	Morrissey	Patrick	JPL
Sci-Eng Interface	-	WG Co-Chair	Sitarski	Breann	NASA GSFC
AI/ML	-	WG Co-Chair	Ansdell	Megan	NASA HQ
AI/ML	-	WG Co-Chair	Dean	Bruce	NASA GSFC
COMMUNITY					
Inclusion-Mentoring	-	WG Co-Chair	Scannapieco	Evan	Arizona State Univ.
Inclusion-Mentoring	-	WG Co-Chair	Beaton	Rachael	STScI
Inclusion-Mentoring	Inclusion	WG Co-Chair	Mahadevan	Suvrath	Pennsylvania State Univ.
Inclusion-Mentoring	Inclusion	WG Co-Chair	Miles	Drew	CalTech
Inclusion-Mentoring	Inclusion	Emerging Leader	Washington	Robert	Howard Univ.
Inclusion-Mentoring	Mentoring	WG Co-Chair	Tran	Kim-Vy	Center for Astrophysics
Inclusion-Mentoring	Mentoring	WG Co-Chair	Renaud	Joe	NASA GSFC
Inclusion-Mentoring	Mentoring	Emerging Leader	Gonzalez Quiles	Junellie	Johns Hopkins Univ.
Ground-based Astro	-	WG Co-Chair	Miyazaki	Satoshi	JAXA
Ground-based Astro	-	WG Co-Chair	Lopez-Morales	Mercedes	Center for Astrophysics
Space-based Astro	-	WG Co-Chair	Petre	Rob	NASA GSFC
Space-based Astro	-	WG Co-Chair	Kataria	Tiffany	JPL
Space-based Astro	-	WG Deputy Co-Chair	Louden	Emma	Yale Univ.
GOMAP Synergies	-	WG Co-Chair	Gaskin	Jessica	NASA MSFC
GOMAP Synergies	-	WG Co-Chair	Oschmann	Jim	Marinus Consulting LLC
TECHNOLOGY					
Integrated Modeling Stan	Model Standards & Uncertainty Q	SG Co-Chair	Bailey	Erik	JPL
Integrated Modeling Stan	Model Standards & Uncertainty Q	SG Co-Chair	Govern	James	NASA GSFC
Integrated Modeling New	New Methods & Collaborative En	SG Co-Chair	Derleth	Jason	NASA GSFC
Integrated Modeling New	New Methods & Collaborative En	SG Co-Chair	Kuan	Gary	JPL
Servicing	-	WG Co-Chair	Grunsfeld	John	Self
Servicing	-	WG Co-Chair	Van Campen	Julie	NASA GSFC
High-Contrast Post-Proce	High-Contrast Post-Processing &	SG Co-Chair	Mawet	Dimitri	JPL
High-Contrast Post-Proce	High-Contrast Post-Processing &	SG Co-Chair	McElwain	Mike	NASA GSFC

TECHNOLOGY:

- Industry:
 - Northrop Grumman, L3 Harris/BAE, and Lockheed are now all under contract for the D19 FY23 ROSES efforts.
 - We will be inviting them to speak at the AAS HWO session
 - Next FY24 D19 ROSES Draft is out, Q+A will be made available to everyone per the call
- Deformable mirror studies awarded (first phase)
- Next SAT call will include HWO = opportunity for academia etc
- Detailed Technology Roadmaps are being written and will lead to HWO specific investments
 - This will include discussion of testbeds, Keck demo, facilities

TECHNOLOGY ROADMAP



2025

Coronagraph Testbeds Available For Use

Keck Sensing & Control Demo

Ultra-stable & System Testbeds Available For Use

Critical Technology Demonstration Milestone

MCR

Ultra-stable Telescope System



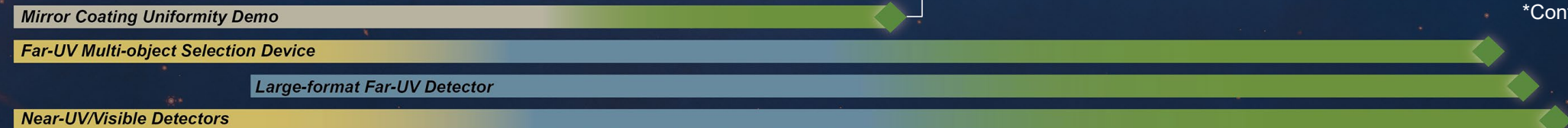
Coronagraph System



Near-UV Coronagraph Science & Technology Investigation

Currently Funded	Development / Fabrication
Design and Analysis	Characterization / Demonstration

High-Sensitivity UV & Instrument Technologies



*Contingent on Funding

INTERNATIONAL

- HQ has set up up quarterly meetings with JAXA, ESA, CSA reps
 - Will be focal point for coordinating activities
- Astrometry workshop in France had good HWO participation
- UK workshop planned in June
- 3 day Science Conference and 2-day Engineering Meeting expected in Washington DC in late June or July (plug!)

SUMMARY

- New Project Office is staffed up and has an initial plan to MCR
- Excellent collaboration particularly with JPL leadership team
- Following HQ HWO Big Picture principles
 - Deep JWST and RST/CGI experience
- Plan to keep community engaged short and long term
- Detailed Technology Plan is in works
- Next big milestone is the AAS