



HabEx Design Status

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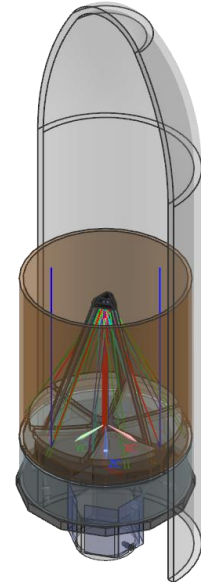
August 2, 2017

HabEx Status

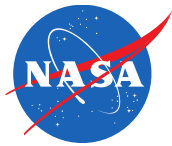


- Completed several design trades before the 4m architecture trade
 - Polarization driven contrast vs. telescope F#
 - Coronagraph sensitivity to telescope induced wave front error
 - Starshade sizing vs bandwidth and inner working angle
 - Instrument sizing, cost and technical risk studies were conducted
 - Technologies were assessed to allow the STDT to evaluate technical risk within different architectures
- 4m Architecture trade is settled
 - Evaluated 4 architectures: starshade only, coronagraph only, starshade and coronagraph and two starshades
 - Baseline design is an unobscured telescope with a coronagraph and starshade
 - Primary general astrophysics instrument is a UV spectrograph with a wide field “workhorse” camera as a possible second contributed instrument
 - Received input from JPL’s National Security Program Office on a 4m segmented telescope design for starshade use only. We will use it as the notional on-axis design in our alternative starshade-only architectures.

TRADE STATEMENT: Instrument × 4m. assignment effect		detection probability		for HabEx & study concept development		10	
Requirements and Figures of Merit (WFT, WFTs, WFTs and WFTs)		Assigner/Working Group	High	Small (V) Starshade (V to WFT)	Coronagraph Only (V to WFT)	Large Starshade Only (V to WFT)	WFT
WFTS DESCRIPTION (TOI)		Science Team	High	800	824	832	842
W1	Measure science of all observed sources with periods < 3x mission	AEMWG	High	10	10	10	10
W2	Maximize the number of objects measured for habitable zones	WQ2	High	5	10	8.8	10
W3	Maximize spectral characterization of all planet types	WQ2	High	5	10	5	10
W4	Can detect transits and measure orbits of any potential stars. Excess characterized in the field of as many nearby stars as possible around the Sun	WQ1	High	5	10	5	5
W5	Spectrally characterize up to 1000 stars in W1	WQ1 & 2	High	4	10	5	10
W6	Parallax search capability for binary stars	WQ2 & 5	Med	4	10	5	10
W7	Spectrally characterize to 200 nm for habitable zone	WQ1 & 2	Med	2	10	10	10
W8	Spectrally characterize as many planets as possible to 200 nm or below in W1	WQ2	Med	2	10	10	10
W9	Maximize number of stars	Design Team	Med	2	3.4	2.3	1.2
W10	Spectrally characterize measure orbits for exoplanets as possible for given elements and consumables for variety of planet sizes	WQ2	Med	2	10	5	5
W11	Maximize the number of objects measured for habitable zones	WQ1	Med	2	10	10	10
W12	Maximize the number of objects measured for habitable zones	WQ1	Med	2	10	10	10
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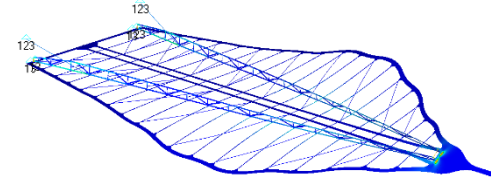


HabEx Status



- JPL and NGAS Starshade designs have been completed
- The telescope and instrument optical layouts have been completed
- Telescope and starshade designs have been completed
- Team X designs of the starshade and telescope buses are complete
- Currently pursuing a telescope bus design without reaction wheels
 - Micro-thruster technology is flight proven
 - Simplifies the design and reduces risk
- Submitted HabEx technology gap list to O2 delivery
- RFI responses are in. We will be contacting UTAS and two micro-thruster developers for added expertise to the study.
- Ongoing work to complete UVS Team X design, micro-thruster/telescope stability modeling, and starshade thermal performance simulations

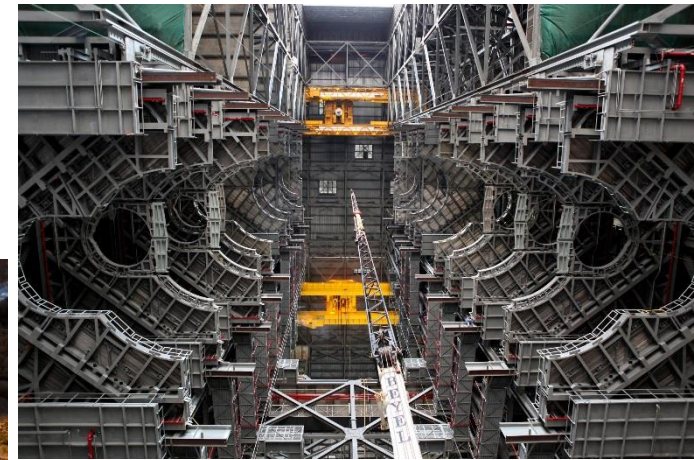
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SLS



- SLS is baselined in the HabEx 4m design
 - Co-launching starshade and telescope
- SLS is moving forward in development
 - No reduction in funding for core rocket
 - Launch site in development
- 12 planned missions from 2019-2033
- First launch was scheduled for FY18 but delayed until FY19
 - Lightfoot to make an announcement on specifics about the delay this month



CORE STAGE 101*

* Or: What you need to know about the Space Launch System Core Stage, the backbone of the rocket.

Inside the Core Stage

- Forward Skirt
- Intertank
- Liquid Oxygen Tank
- Liquid Hydrogen Tank
- Engine Section

How Big is the SLS Core Stage?

- 212 Feet tall
- 27.8 Feet in diameter
- ~2.8M Pounds with propellant
- Largest rocket stage ever built
- Fuels world's most powerful rocket
- Fast ride – reaches Mach 23, faster than 17,000 MPH in 6.5 min

#JourneyToMars @NASA_SLS

1 Engine Section

- Delivering propellants from LH₂ and LOX tanks to 4 RS-25 engines
- Avionics to steer the engines
- Booster attach point

2 Liquid Hydrogen (LH₂) Tank

- Holds 537,000 gallons of LH₂ cooled to -423 °F

3 Intertank

- Joins LOX and LH₂ tanks
- Booster attach point
- Houses avionics and electronics

4 Liquid Oxygen (LOX) Tank

- Holds 196,000 gallons of LOX cooled to -297 °F

5 Forward Skirt

- Houses flight computers, cameras, and avionics – the “brains” of the rocket

LH₂ & LOX Tanks

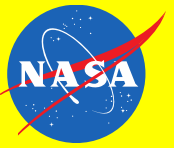
- Fuels 4 engines to produce a total of 2M pounds of thrust
- Holds 733,000 gallons of propellant, enough to fill 63 large tanker trucks.

BIGGER TANKS. BOLDER MISSIONS.

#SLSFiredUp

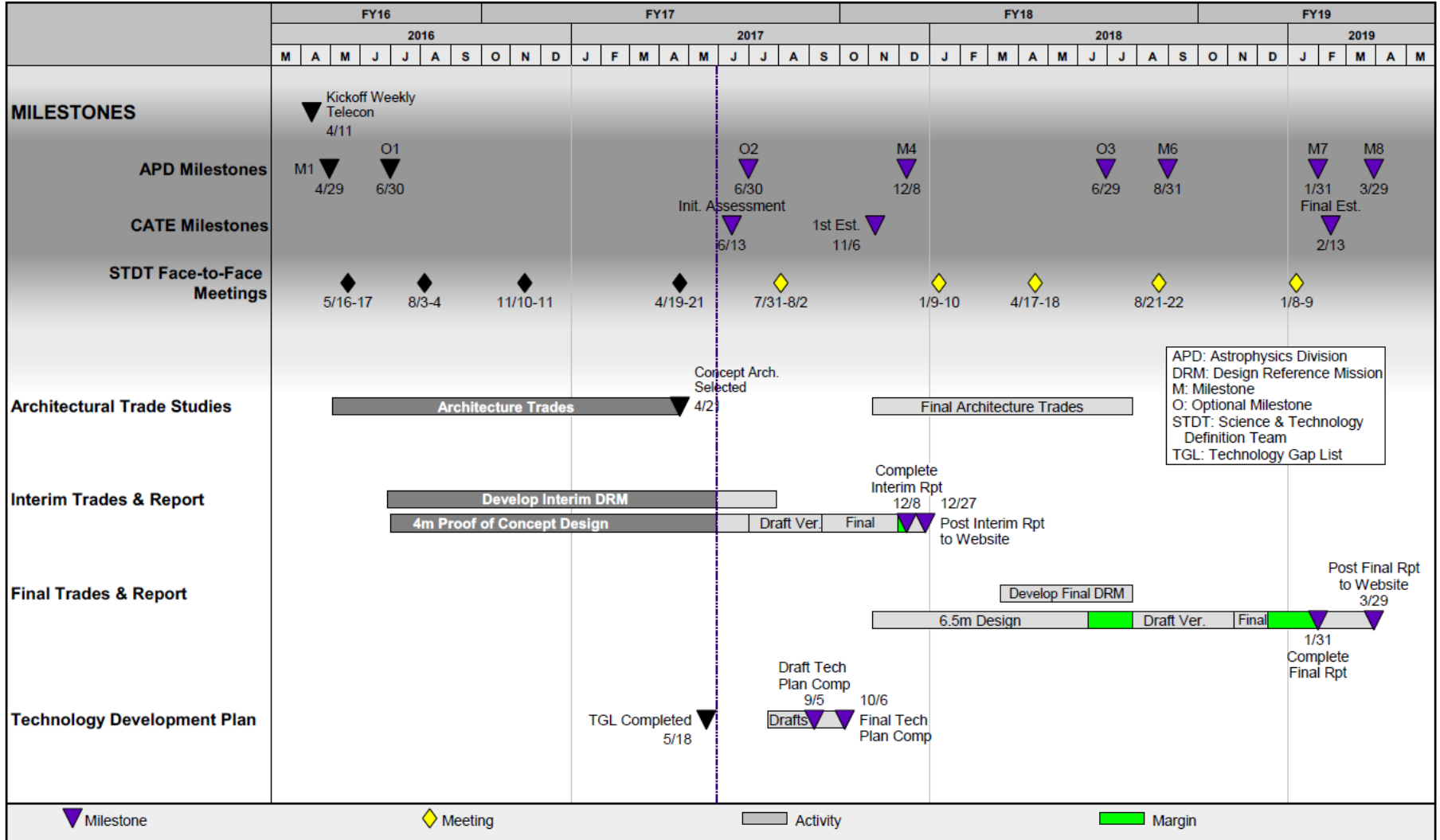
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HabEx: Habitable Exoplanet Imaging Mission Study

5/28/17



APD: Astrophysics Division
 DRM: Design Reference Mission
 M: Milestone
 O: Optional Milestone
 STDT: Science & Technology Definition Team
 TGL: Technology Gap List

HabEx Work Ahead



- FY17

- CATE critique of the 4m architecture
- Get telescope and micro-thruster industrial participants on the Design Team

- FY18

- Deliver Interim Report
- Discuss Interim Design at AAS
- Deliver Interim CATE inputs
- Settle the 6.5m architecture and design
 - Option identification and cost, risk and performance assessments will begin in FY18 with selection around January. Design work will run to July
 - MSFC will oversee the telescope design. Will likely get help from GSFC and JPL NSPO .
 - Starshade may not require much more design work but we may choose a different design
- Team X study on the 6.5m bus design
 - Another Team X study will be run to design a bus for the 6.5m telescope
- O3 delivery on the 6.5m option and any update on the 4m option

- FY19

- Deliver the final report
- Deliver the final CATE inputs