

Jet Propulsion Laboratory
California Institute of Technology

WFIRST Coronagraph Status

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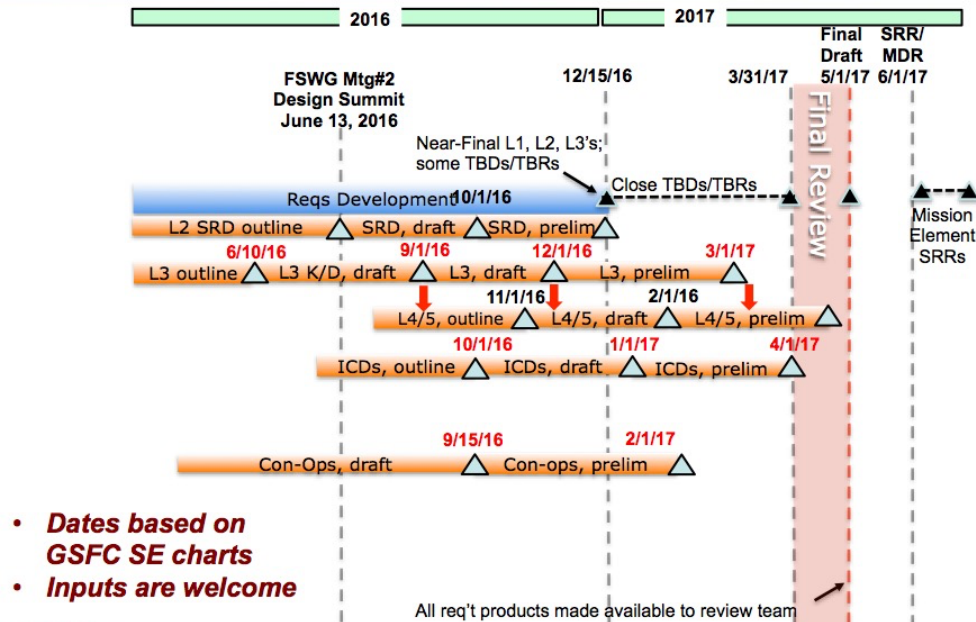
- **Programmatic updates**
- **Requirement development**
- **Technology maturation**
- **Flight design update**
- **Star-shade ready status**
- **Next steps**

Programmatic update








- **Wes Traub has been on leave since June, expect to return in January. Jason Rhodes is acting proj scientist at JPL**
- **Phil Barela is transitioning off WFIRST at JPL (end of October). Ben Parvin is the acting proj manager at JPL**

Coronagraph Requirement Development

- **SRD being worked by the science teams, led by Kerri Cahoy**
<https://wfirst.wikispaces.com/CGI+Requirements+Documentation>
 - SRD L2a as the science requirements
 - Associated SRD L2b as the “engineering requirements”, mapped to L2 MRD
 - L3 CGI requirements will be linked to L2 MRD
 - CGI team have proposed a notional L3 capabilities
 - Next step is to reconcile between L2 and L3 CGI requirements through Simulation WG
- **A series of requirement walkthroughs are being planned in November**
- **Next Stanford Meeting scheduled December 7, at IPAC**



Coronagraph Technology Milestones

MS #	Milestone	Date
1	First-generation reflective Shaped Pupil apodizing mask has been fabricated with black silicon specular reflectivity of less than 10^{-4} and 20 μm pixel size.	7/21/14 
2	Shaped Pupil Coronagraph in the High Contrast Imaging Testbed demonstrates 10^{-8} raw contrast with narrowband light at 550 nm in a static environment.	9/30/14 
3	First-generation PIAACMC focal plane phase mask with at least 12 concentric rings has been fabricated and characterized; results are consistent with model predictions of 10^{-8} raw contrast with 10% broadband light centered at 550 nm.	12/15/14 
4	Hybrid Lyot Coronagraph in the High Contrast Imaging Testbed demonstrates 10^{-8} raw contrast with narrowband light at 550 nm in a static environment.	2/28/15 
5	Occulting Mask Coronagraph in the High Contrast Imaging Testbed demonstrates 10^{-8} raw contrast with 10% broadband light centered at 550 nm in a static environment.	9/15/15 
6	Low Order Wavefront Sensing and Control subsystem provides pointing jitter sensing better than 0.4 mas and meets pointing and low order wavefront drift control requirements.	9/30/15 
7	Spectrograph detector and read-out electronics are demonstrated to have dark current less than 0.001 e/pix/s and read noise less than 1 e/pix/frame.	8/25/16 
8	PIAACMC coronagraph in the High Contrast Imaging Testbed demonstrates 10^{-8} raw contrast with 10% broadband light centered at 550 nm in a static environment; contrast sensitivity to pointing and focus is characterized.	9/30/16
9	Occulting Mask Coronagraph in the High Contrast Imaging Testbed demonstrates 10^{-8} raw contrast with 10% broadband light centered at 550 nm in a simulated dynamic environment.	9/30/16

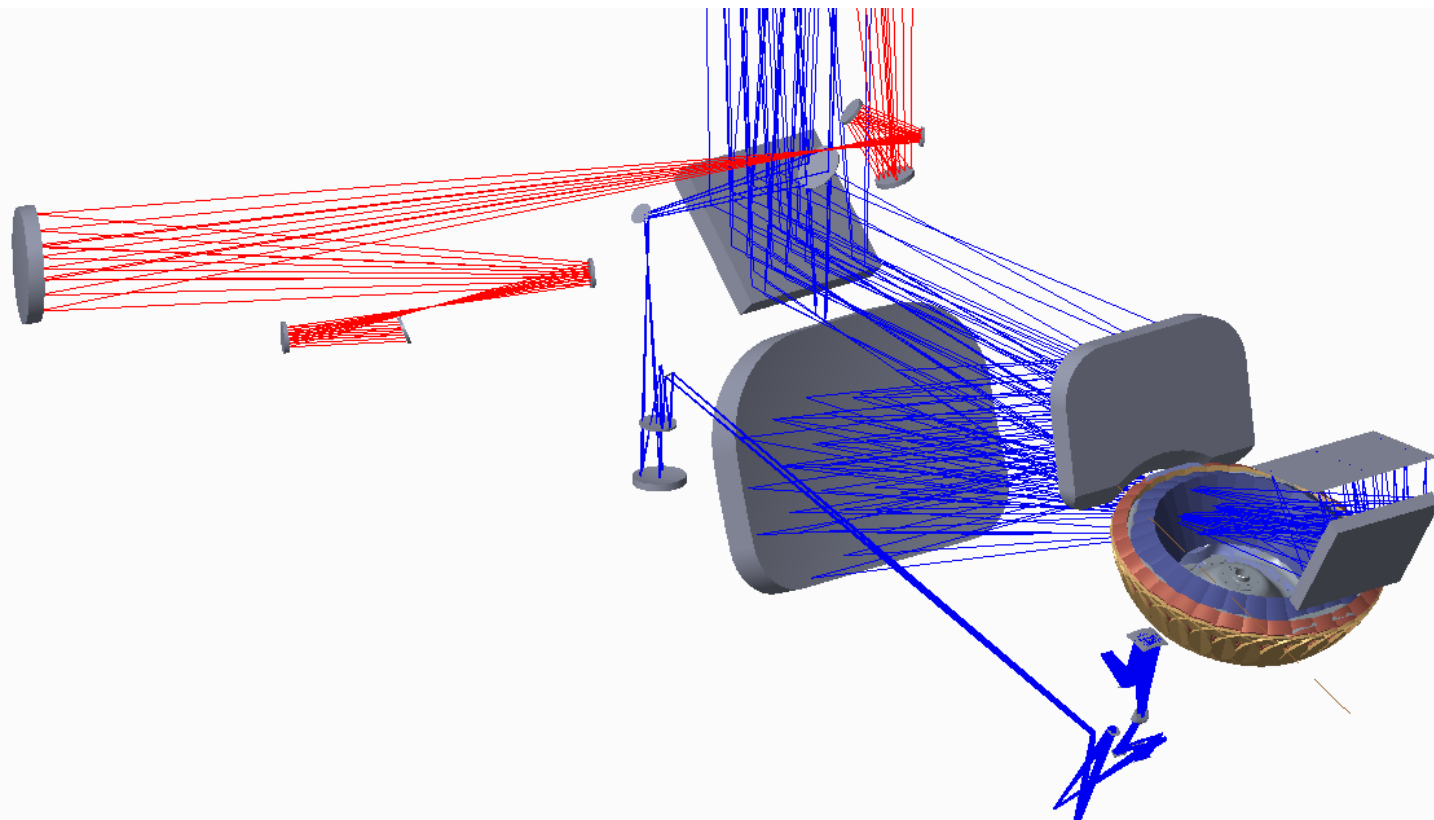
Submitted, review with TAC pending

Summary of Technology Progress

- In 2013 ,OMC was chosen as the primary architecture for WFIRST, and PIAACMC as the backup architecture (ACWG recommendation and Paul Hertz direction)
- Both architectures have gone through ~2.5 years of design improvements, and testbed demonstrations, per Technology Plan approved by APD in 2014
- Coronagraph technology team have made remarkable progress, demonstrated appropriate technology readiness levels to the WFIRST mission
- Milestones 1 through Milestone 8 (PIAACMC) and Milestone 9 (OMC) clearly confirm that current OMC architecture is more mature, and thus lower risk.
- Recommendation:
 - Continue OMC as the primary architecture for WFIRST coronagraph
 - Wrap up PIAACMC testbed and document PIAA results in a white paper (per TDEM), and return the PIAA effort to ExEPO to support future technology and mission studies

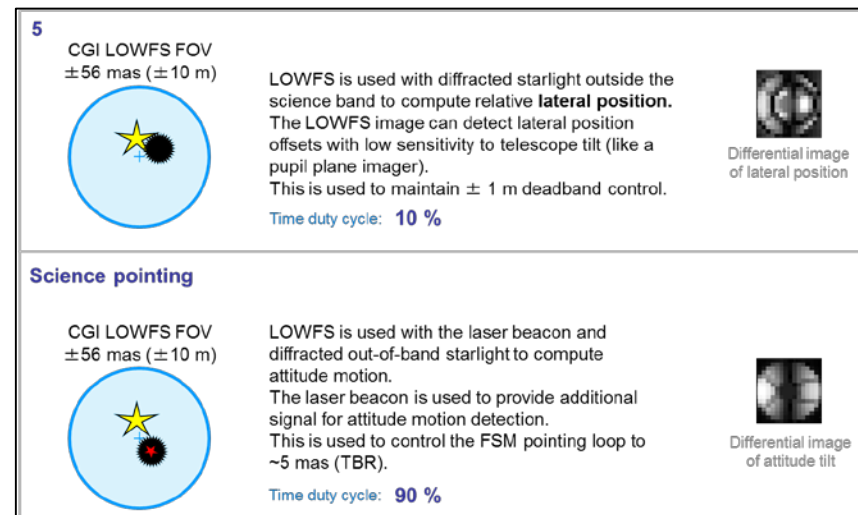
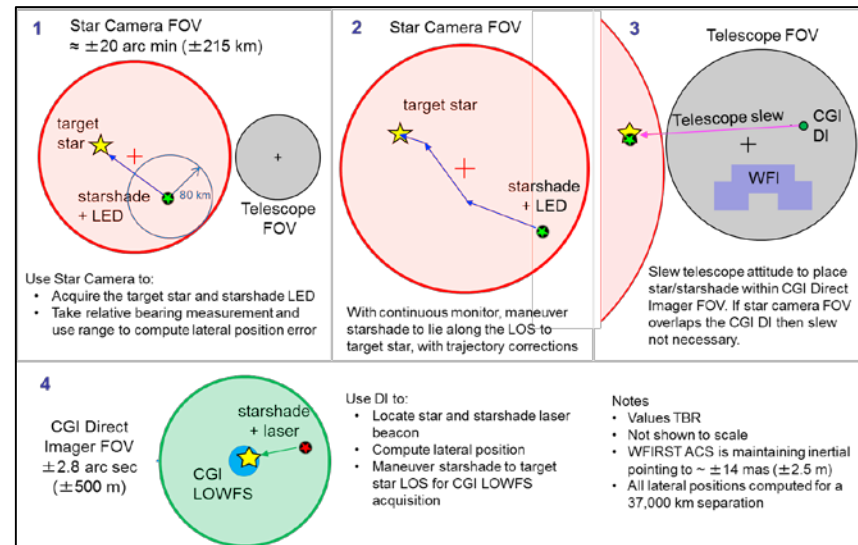
Flight CGI Design Status

- Supported F1/M3 location trade
 - Excellent team effort, led by Tom Casey!
- New coronagraph TCA (tertiary collimator assembly) resulted in one more fold mirror ☹️
- TCA structure to be re-designed
- CGI appears not impacted (from Cycle #6)



CGI Starshade Ready Status

- **Agreed a baseline concept:**
 - “AA Option”
 - Broader IFS bandwidth
 - Use existing CGI Imager for starshade acquisition (new function)
 - Use existing LOWFS sensor for starshade (1) lateral sensing and (2) pointing sensing and control
- **Have developed a draft “Starshade Mode parameters”, for science yield estimate**
 - Under review, to be released to IPAC website by end of October
- **Working with WFIRST project to come up first-cut cost/schedule impact**



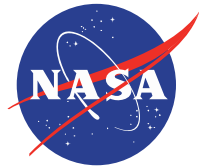
Summary and Next Steps

Summary:

- **Team is making excellent progress on technology maturation**

Next Steps:

- **Requirements L2 SRD, and L2MRD: 12/2016**
 - Series of walkthroughs in November
 - Stanford Meeting: 12/7/2016
- **Starshade readiness initial briefing: 12/2016**
- **Revised flight design model: 1/2017**
- **SRR/MDR: 6/1/2017**
- **Life-cycle cost: 3/1/2017**



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