ORIGINS Space Telescope

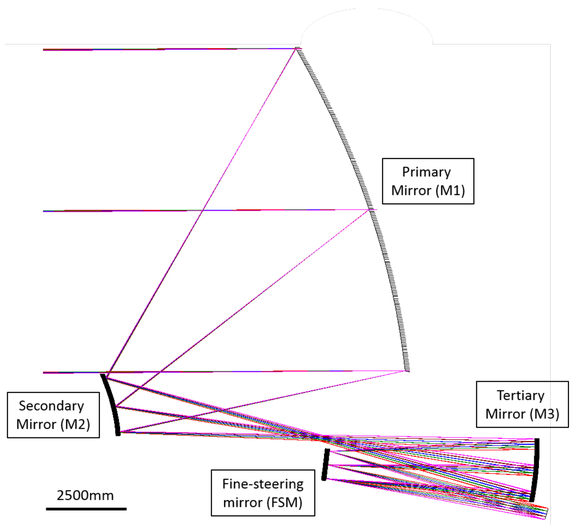
From the Rise of Metals to Water for Habitable Worlds

National Aeronautics and Space Administration

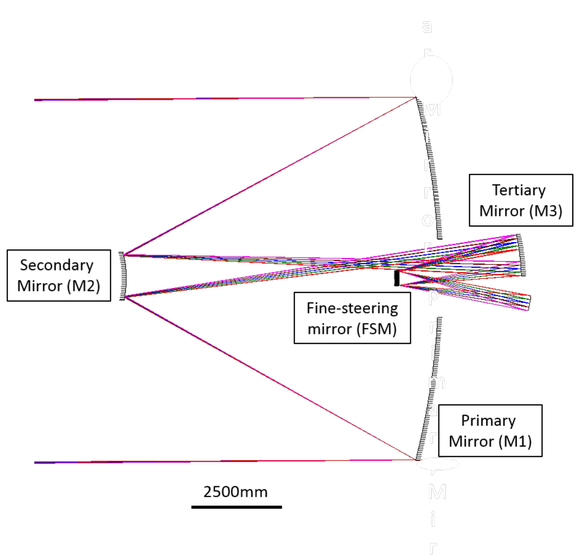
Origins Space Telescope: Telescope Design and Instrument Specifications

Margaret Meixner (STScI/JHU), R. Carter, J. Corsetti, M. DiPirro, A. Flores, J. Howard, A. Jones, J. Kellogg, L. Fantano, D. Leisawitz, and J. Staguhn (NASA Goddard), and T. Roellig (NASA Ames) for the Origins Space Telescope Science and Technology Definition Team

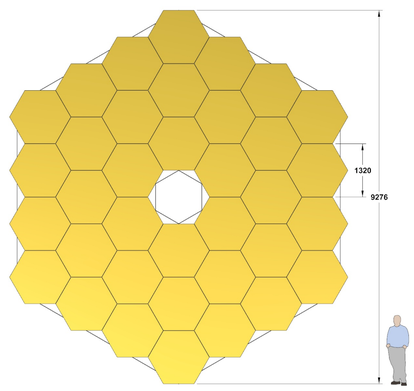
Telescope Design: Large cooled single apertures of 8 to 15 m diameters are under consideration for the Origins Space Telescope. On axis and off-axis designs have been explored. The on-axis telescope is easier to fabricate and test but has less collecting area and more diffraction at the image due to the secondary mirror obscuration. The off-axis telescope has less diffraction and more collecting area but can be more difficult to fabricate and test. Less diffraction gives a cleaner point spread function which enables better polarization and coronagraphy measurements envisioned by the mission. We are also looking at material trades, a spherical primary, and packing in both 5 m fairings and a larger SLS-based fairing. We have also begun thermal modeling to inform design choices on sun shades and cryocoler requirements. We are examining science-based field-of-regard requirements for the telescope.



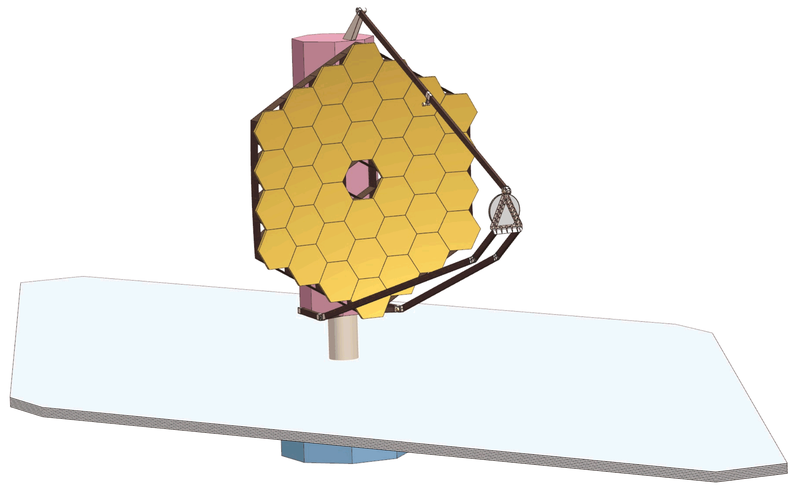
Three mirror OFF-axis design for a 10 m aperture primary.



Three mirror ON-axis design for a 10 m aperture primary.



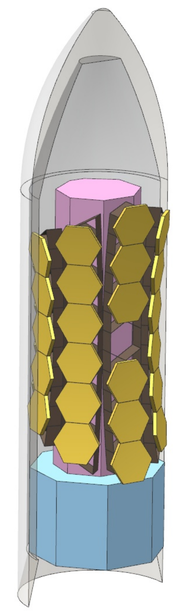
The primary mirror will be segmented for easy packing.



A sunshield will be an important part of the cooling system.

Instrument Specifications					
Instrument	**Wavelength Coverage μm**	**Spectral Resolution (λ/Δλ)**	**Field of view #spatial pixels**	**Typical Required Sensitivity:**	**Other**
Low-Res Spectrometer	35 to 500	low-res~500 high-res~10^4	100 per channel	10^{-21} W/m^2 (spectral line)	multi-channel
High-Res Spectrometer	50 to 500	low-res ~ $8x10^4$ high-res~$5x10^5$	100	10^{-21} W/m^2 5 σ (spectral line)	photo-counting
Heterodyne Spectrometer	150 to 500	~10^7	10 - 100	2 mK in 0.2 km/s @ 1 THz	polarized, background limited
Far-infrared imager	35 to 500	R~15	100,000	1 μJy - 10 mJy (confusion limit)	5 to 10 channels, polarimetry, spectral line filters
Mid-Infrared Instrument	6 to 40	imager: R~15, spectrometer: R>500	10^6	photometric: 1 μJy @10 μm	coronagraph~10^-6 @ 0.5" @ 10 μm

Telescope Parameters
Aperture Diameter: 8-15 m
FOV: 0.5-1 square degree
Diffraction Limited at 40 μm
Temperature ~4 K



A possible fairing packing for the primary aperture.

The **Origins Space Telescope** is the mission concept for the **Far Infrared Surveyor**, a study in development by NASA in preparation for the *2020 Astronomy and Astrophysics Decadal Survey*.

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