Origins Space Telescope Mirror Needs

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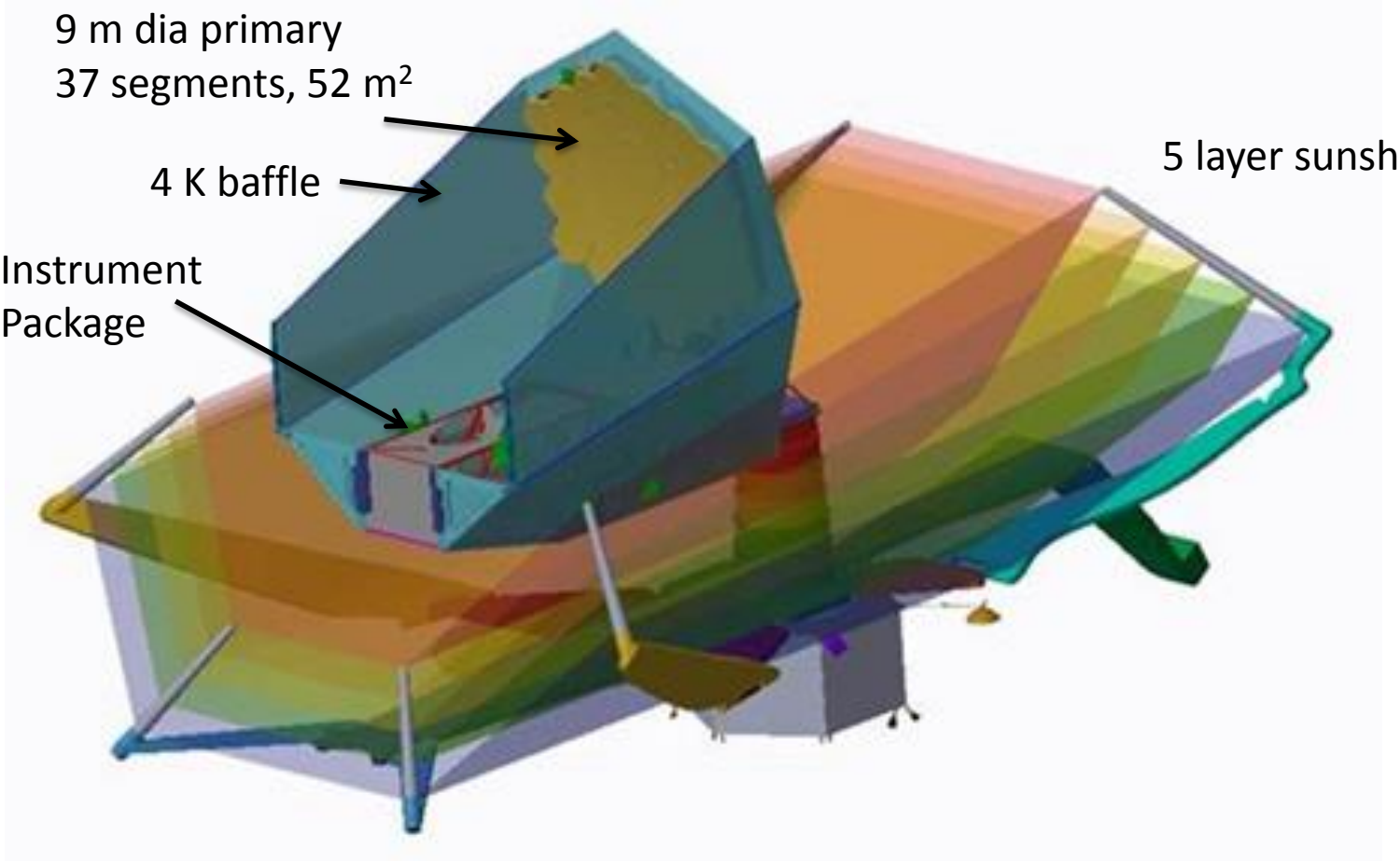
ORIGINS Space Telescope

Introduction

- OST is a flagship mission study for the wavelength range of 6-600 µm
- Operates at 4 K to be sky background limited
- Primarily driven by photon collecting and not by spatial resolution

OST Concept 1



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OST Concept 1

- 3 mirror unobstructed
- 37 JWST-size segment primary with overall area = 52 m^2
- Athermal design
  - Backplane and mirrors are the same material
- Huge size, especially of instrument package, requires SLS with 8.4 m fairing to launch

Concept 1 Mirror Material

- Uses Al alloy for high TRL and high thermal conductivity
  - Expect that at 30 micron diffraction limit that no cryo-figuring will be required
  - But, high mass material
    - Primary is 90 kg/m^2 compared to 68 kg/m^2 on JWST

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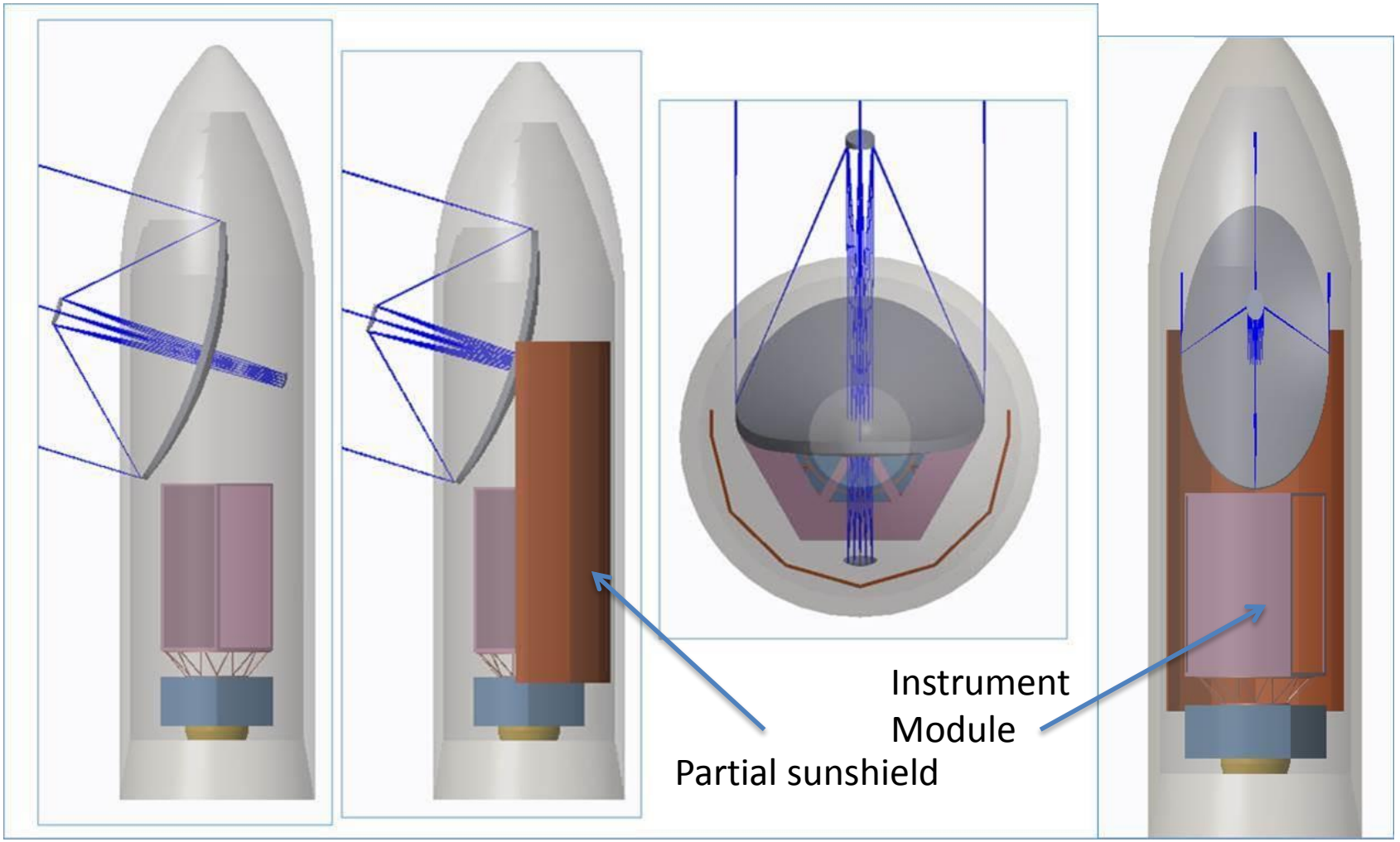
Concept 2 Requirements

- 5 m diameter equivalent area (> 19.6 m^2)
  - Photon collector driven rather than angular resolution
- Smaller, fewer deployments than Concept 1
- Lighter and lower cost challenge
  - Target is <35 kg/m^2 (half of JWST) for OTE
  - Target is $3B for mission
- May use figure actuators to overcome flexibility of structure and to decrease ground testing
- May have backplane and mirror as same structure

OST Possible Concept 2 Stowed

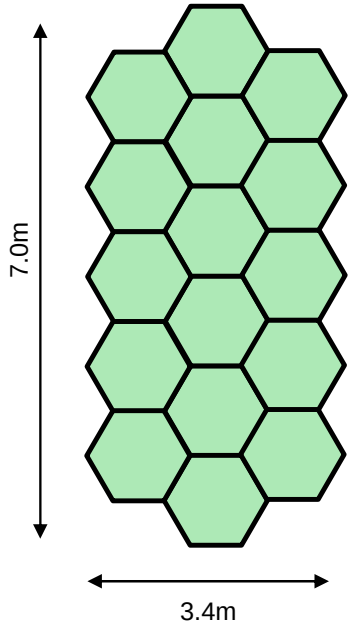


Concept 2 Primary

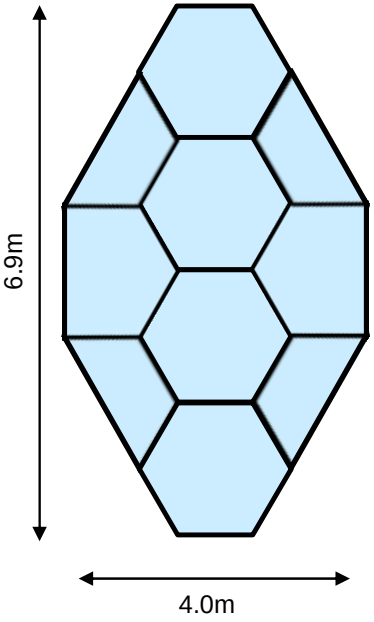
OST Concept 2 – Primary Mirror Options

Note: Options drawn to scale

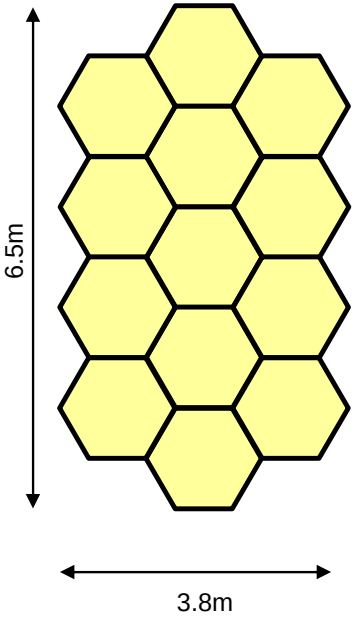
1.35m segments (18.9 m^2)
Current JPL segment size (easily scaled)



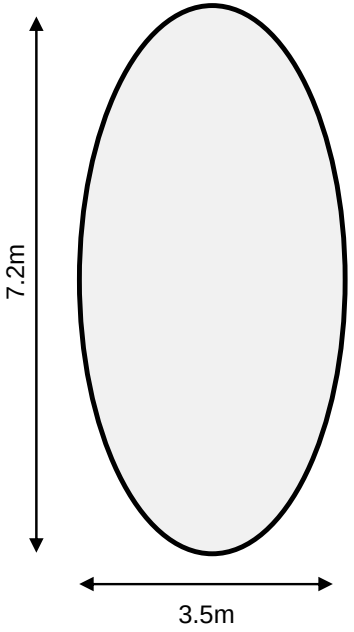
2.0m segments (19.9 m^2)



1.5m segments (19.5 m^2)
JWST size



3.5 x 7.2m monolith (19.8 m^2)



JPL

Concept 2 Mirror Material

- SiC is leading candidate
  - Herschel heritage
    - 3.5 m diameter, 22 kg/m^2
  - Still need separate segments to assemble large enough primary
- Other ideas welcome!

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Summary

- Concept 1 used Al alloy and backplane
  - 52 m^2 collecting area with 37 segments in hex shape
  - Athermal
  - Low material cost
  - High mass per area (90 kg/m^2)
- Concept 2 will have lighter weight design
  - 20 m^2 collecting area minimum
  - Athermal is desired with thermally conductive 4 K materials
  - May have mirror figure actuators
  - Non-deployable primary (TBD) in elliptical/rectangular shape
  - Low mass per area (35 kg/m^2)