Orbiting Wide-angle Light-collectors (OWL)

Thermal Subsystem

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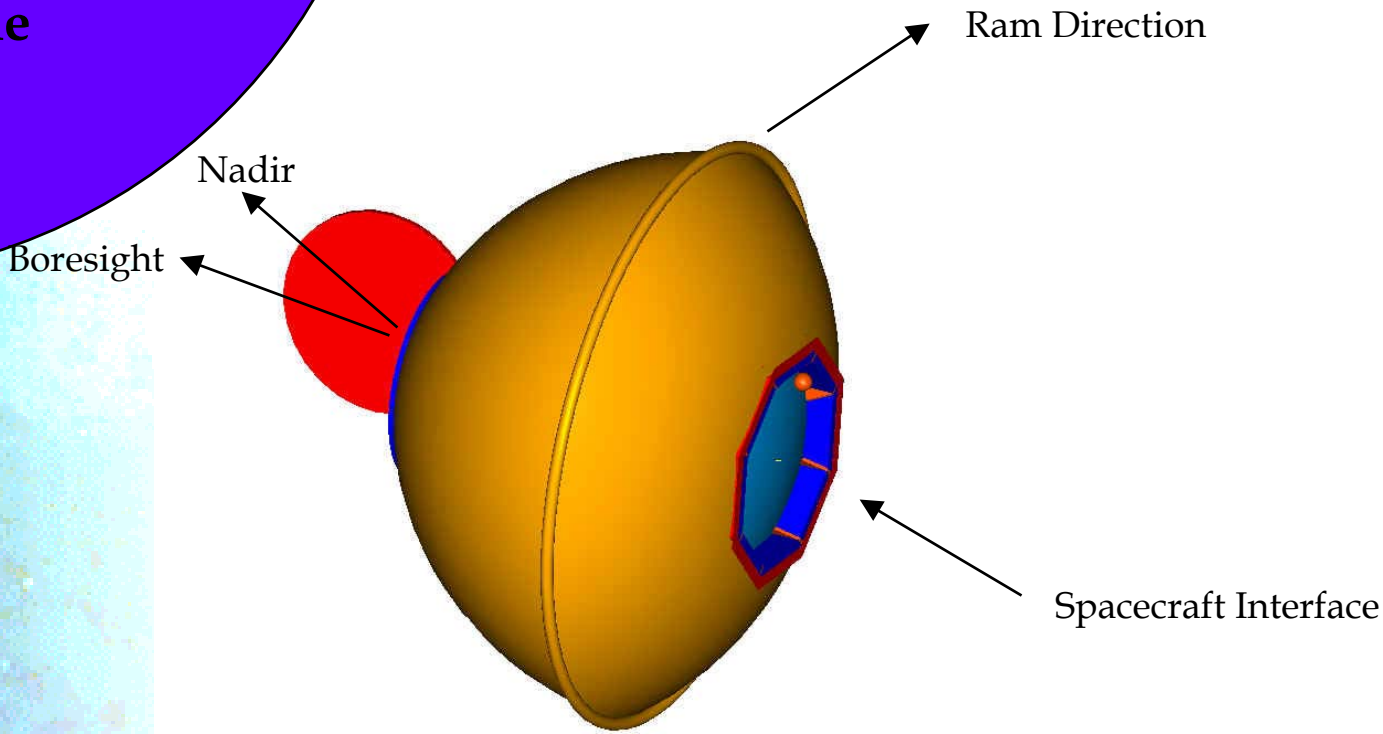
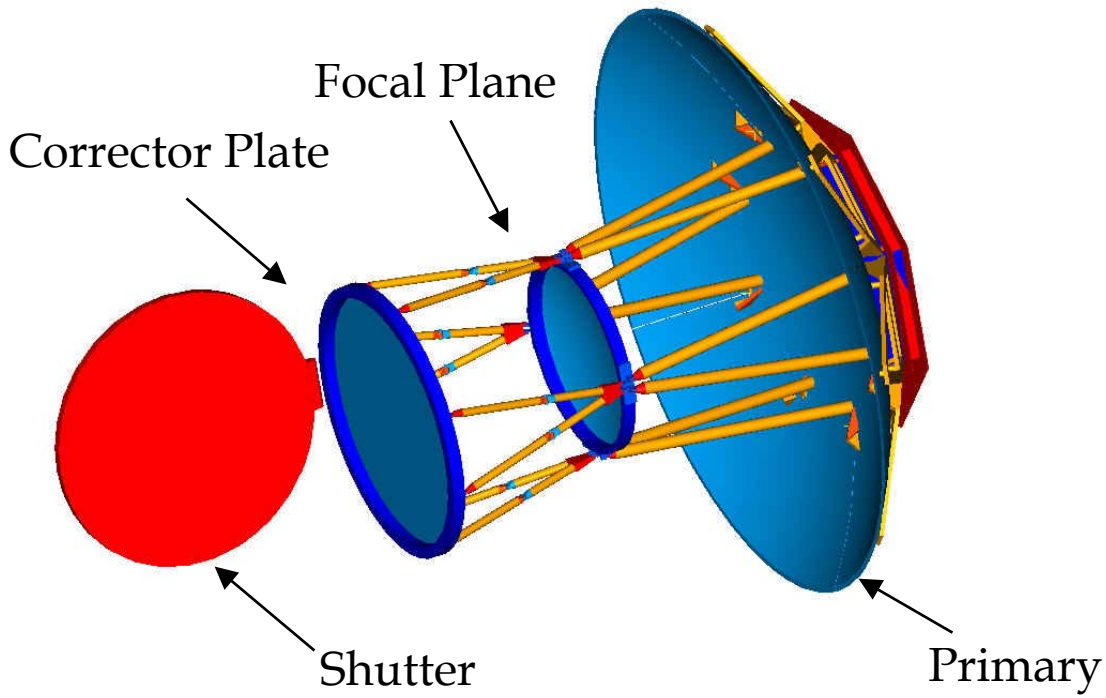
Mission

- Equatorial Orbit 1000 - 400 km altitude
- Inclination of 0°
- Beta angle anticipated +/- 23.5° (@ Summer/Winter Solstice)
- Telescope Boresight could be up to 14° (1000 km) or 32° (400 km) off of nadir (thru changing the pitch), but will rotated in the orbital plane



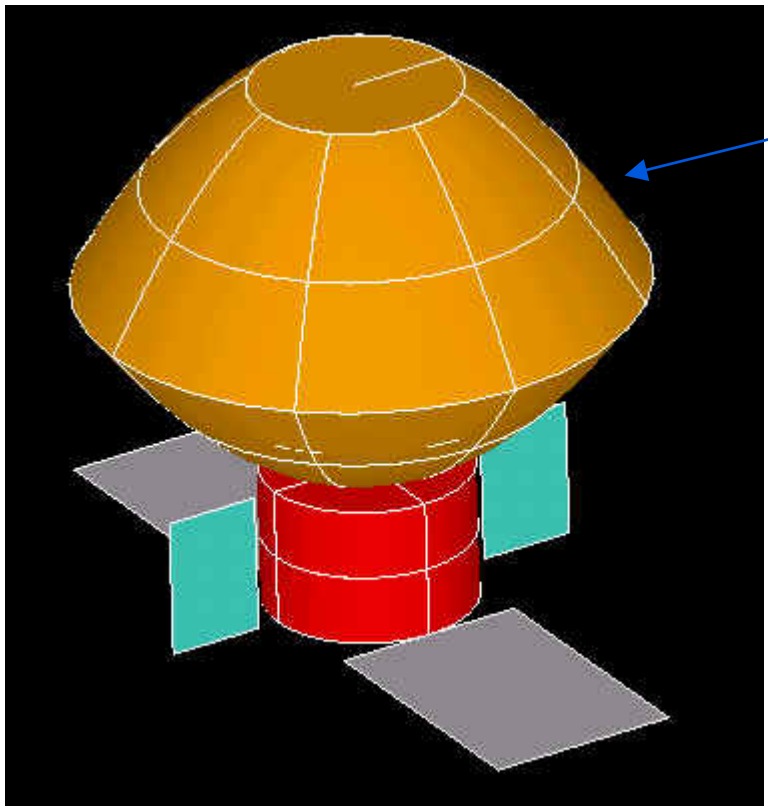
Thermal Requirements

- **Operating:**
  - **Maintain Focal Plane Components at <30°C**
- **Survival:**
  - **Maintain Focal Plane Components at >-20°C**



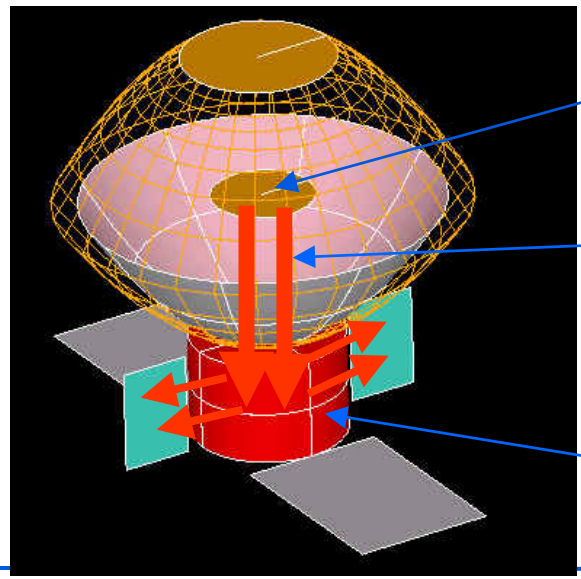
Thermal Design

- **Outer Light Shield/Thermal MLI Blanket (3 mil Kapton outside layer): Blanket either inside or outside the Micrometeoroid Shield**



Thermal Design

- Spherical Focal Plane will be conductively coupled to a embedded heat pipe-honeycomb structure with aluminum blocks
- Heat Transfer from Focal Plane to Spacecraft via 2 Ammonia LHPs (redundant)
  - Baselined to minimize testing constraints
- Heat Transfer from Spacecraft to Radiators
  - baselined (redundant) LHPs because orientation insensitive, deployable radiators are essential for the compact bus construction



Thermal Design: Power Estimates

- Spacecraft (600 Kg): 190 - 270 W Components + Thermal
- Focal Plane (300 Kg):
  - 318 - 705 W Detectors and Electronics
  - 30 W Thermal for LHPs
- Telescope (500 Kg):
  - 50 W Thermal for all 8 Telescope Petals
- Corrector Plate/Shutter (200 Kg):
  - 20 W Thermal

Thermal Design: Resource Estimates

- Power
  - Thermal Operating: 100 W ROM with 6 active + 6 redundant controllers
  - Thermal Startup: 6 x 50 W = 300 W ROM
  - Survival: 300 W ROM
- Mass
  - 100 Kg ROM (6 LHPs, 2 Radiators, Saddles, HPs)
- Cost (for 2 Instruments)
  - 2 LHP Evaporator Designs + 5 Condenser Designs: 2 x $XXX k + 5 x $XXXk = $XX Million
  - Manufacture of 12 LHPs: 12 x $XXk = $XX Million
  - 21 x 2 CCHPs + Focal Plane coupling to CCHPs = $XX Million
  - Misc Hardware + Blankets = $XX Million
  - Labor: 4 years x 3.5 Thermal Engineers x $XXX k = $XX Million
  - Total: $XX Million for 2 Instruments

Issues and Concerns

- Are there Gradient Requirements across Large Optics (primary, focal plane, corrector plate, shutter)?
- Operational and Survival requirements for primary, corrector plate and shutter
- Difficulty in Testing such a large Instrument. Will it fit in the SES (GSFC Largest TV Chamber) with GSE for Testing?
- Considerable difficulty in making a micrometeoroid shield light enough to deploy that remains light tight and is good thermally
- There will be some testing limitations resulting from using heat pipes on focal plane (cold plate must be level)
- IR Detectors for cloud cover have not been designed or located
- Any temperature stability requirements? (Not anticipated to be an issue, but as the design matures, some components may be sensitive.)