Servicing ATLAST!

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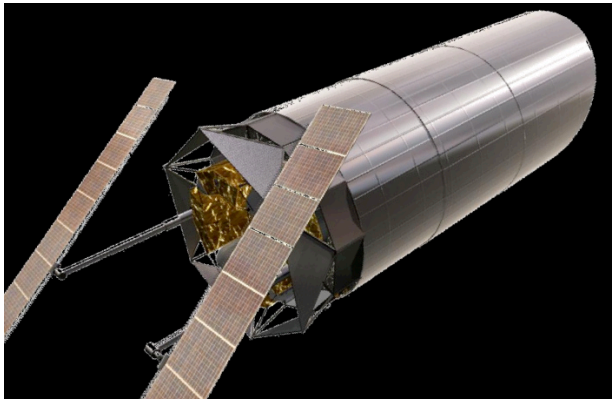
ATLAST is the "Advanced Technology Large Aperture Space Telescope"

Postman (STScI), PI

- Envisioned as the next-generation UVOIR telescope after HST and JWST
- 3 point-designs considered:
  - 8-m diameter monolithic mirror design for launch on Heavy Lift LV (Stahl/MSFC, lead)
  - 9.2-m segmented mirror design for launch on EELV (Delta-IV Heavy) (Oegerle/GSFC, lead)
  - 16-m segmented mirror design for launch on Heavy Lift LV (Unwin & Traub/JPL & NGST lead)
- All operate at SEL2 Lagrange Point
- Submitted in 2009 for consideration to the National Academy's Astro2010 Decadal Survey (results to be published in Sept 2010)

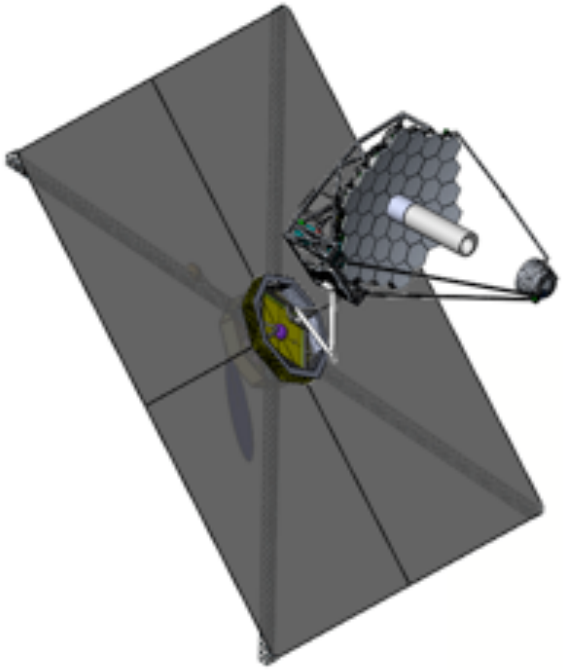
3 Designs for ATLAST

(not to scale)

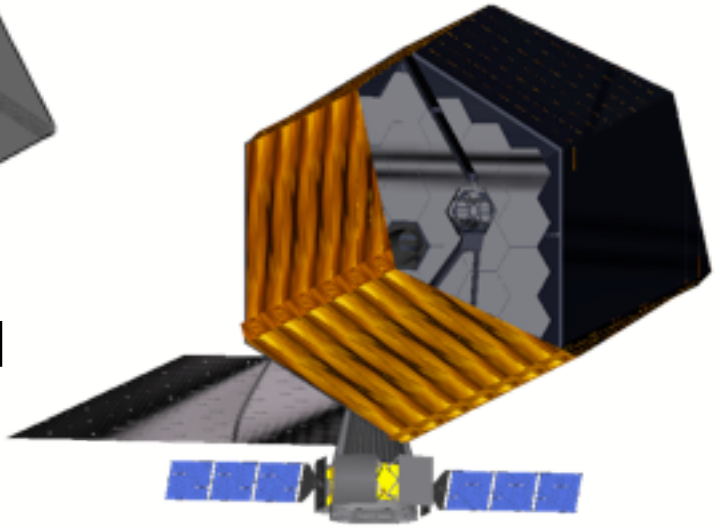


8-m monolith
(Hubble-like)

All concepts were designed with servicing in mind



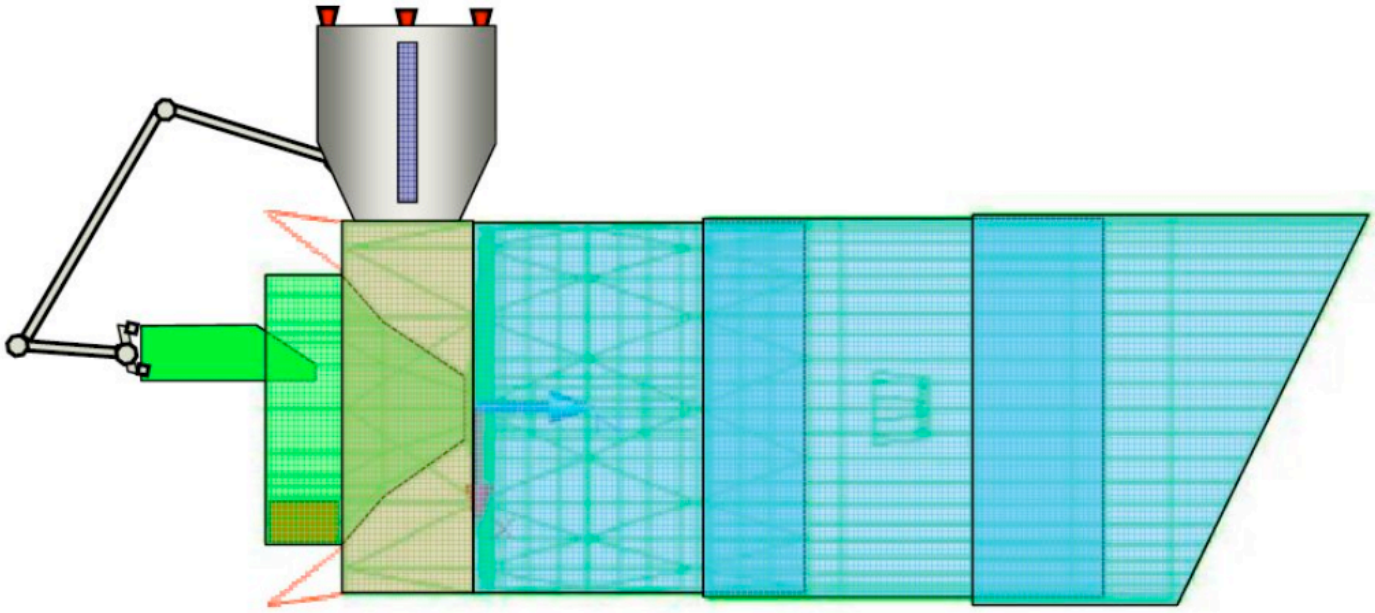
9.2m segmented
(JWST-like)



16m segmented
(JWST-like)

Servicing ATLAST-8m

The instruments in ATLAST-8m are easily accessible in a bay below the OTA by an autonomous rendezvous vehicle such as Orbital Express (Stahl, 2009)

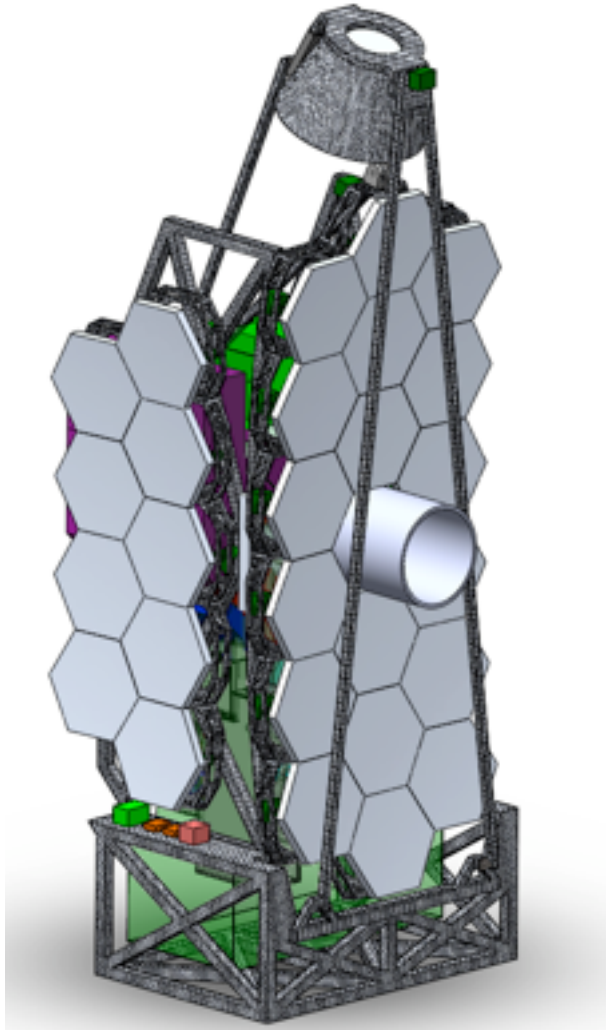


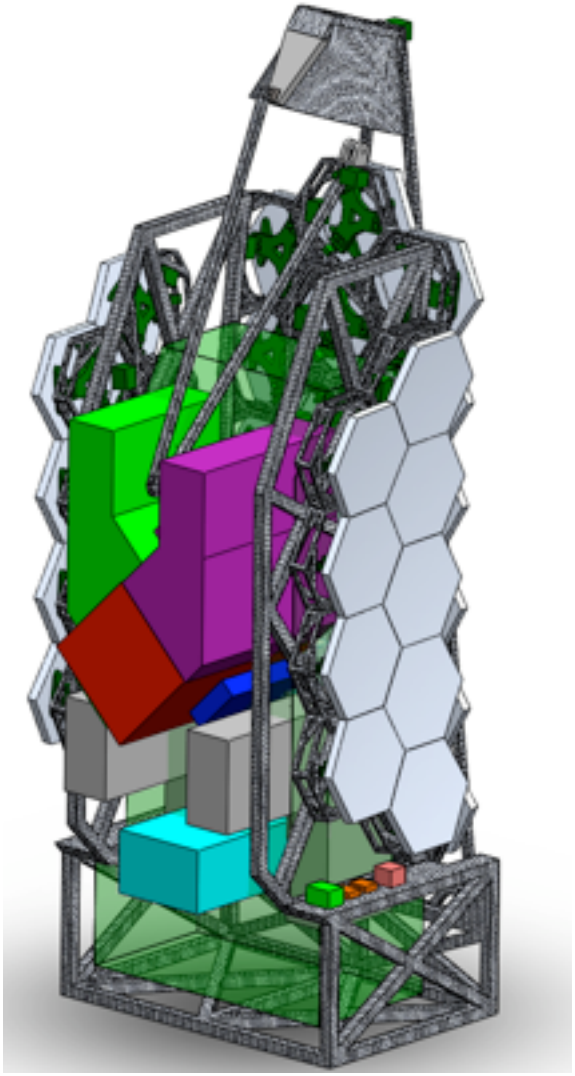
The ATLAST-9.2m design features

Similar to JWST, but different in many ways

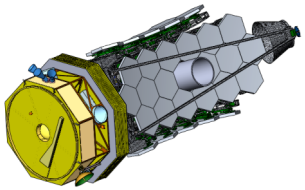
- Primary mirror has 36 segments (instead of JWST's 18).
- ULE glass mirrors (not Be); room temperature optics (easier ground testing)
- Wavelength range 110nm to 1700nm (useful response to 2500nm)
- Diffraction limited at 500nm - 4 times tighter specs on wavefront error than JWST
- Modified TMA design with Cassegrain channel for UV instruments and high contrast imager.
  - Cassegrain: Al+MgF2 coating on PM and SM for high UV throughput
  - TMA: ~ 8 x 20 arcmin Wide field cameras in (silver coatings on pickoff flat and TMA optics after PM and SM)
- Guider and wavefront control combined in one TMA sensor - active mirror control every 5 minutes
- Pointing control with active hexapod isolator/pointing arm/reaction wheels
- Simple Sunshield - meant to block sunlight not provide thermal control
- Designed for servicing

ATLAST-9.2m - Stowed configuration

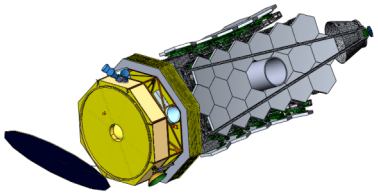




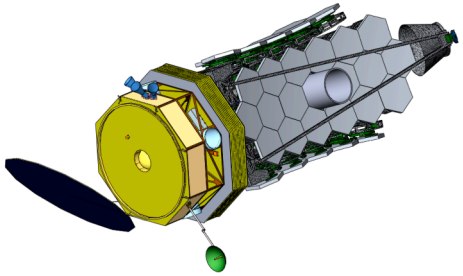
Deployment Sequence



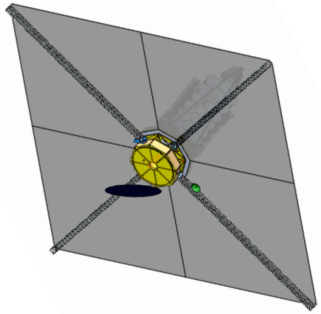
RELEASE FROM
LAUNCH VEHICLE



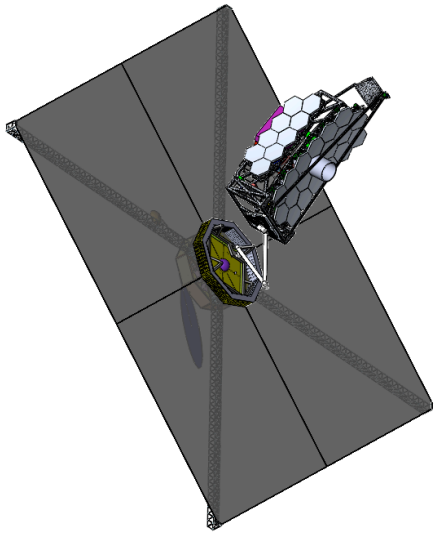
DEPLOY
SOLAR ARRAY



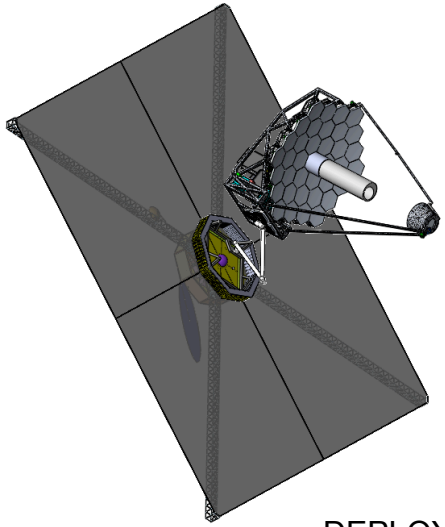
DEPLOY HI-GAIN
ANTENNA



DEPLOY
SUNSHIELD

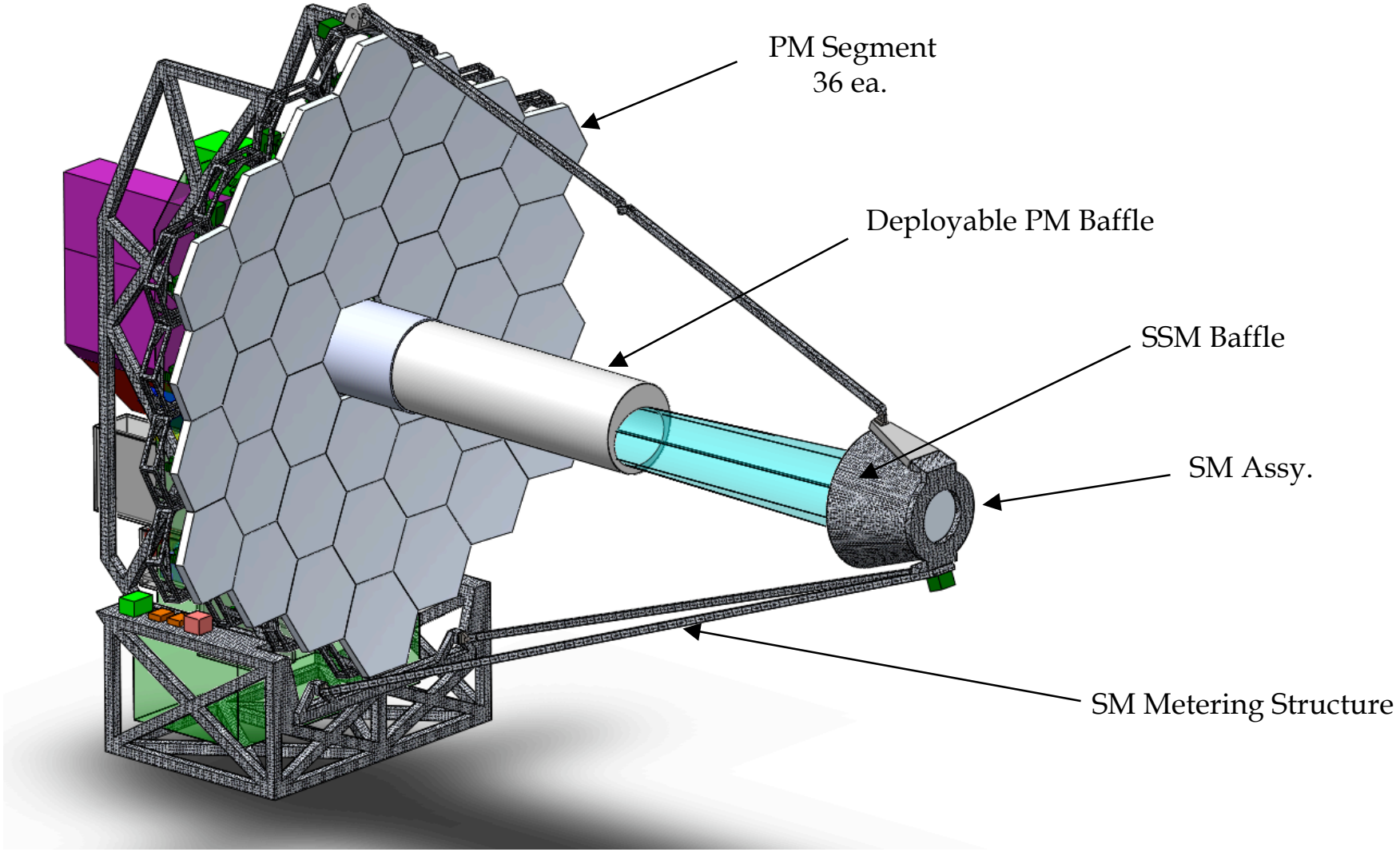


RELEASE/DEPLOY
POSITIONING ARM

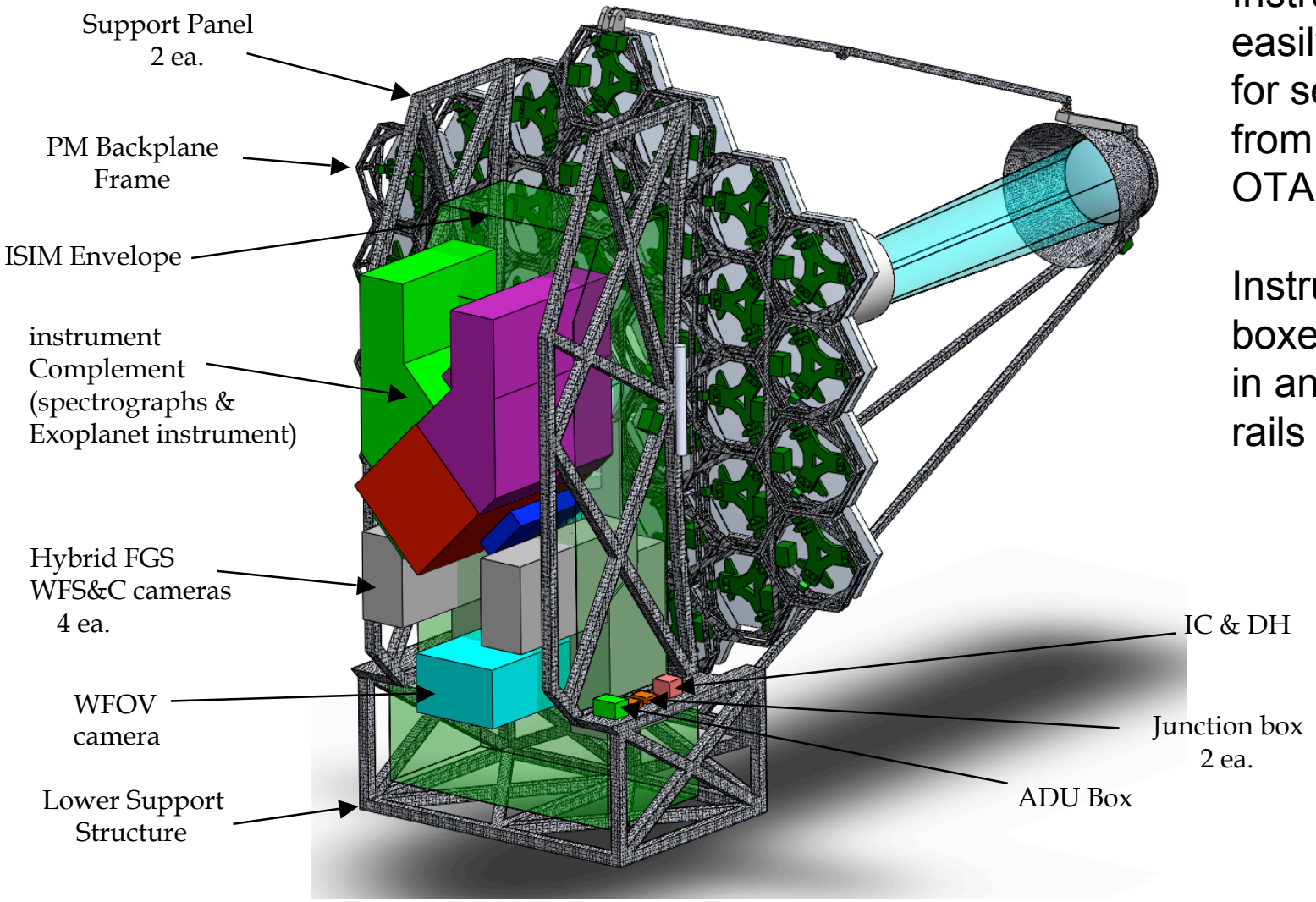


DEPLOY MIRROR
ARMS

ATLAST-9.2m - Deployed Configuration



ATLAST-9.2m Deployed Configuration

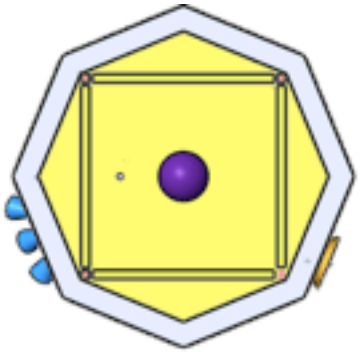


Instruments are easily accessible for servicing from behind the OTA.

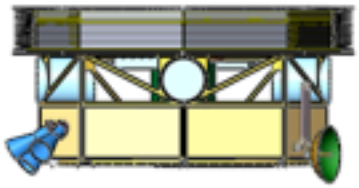
Instrument boxes can slide in and out on rails

ATLAST-9.2m Spacecraft Bus layout

Top view

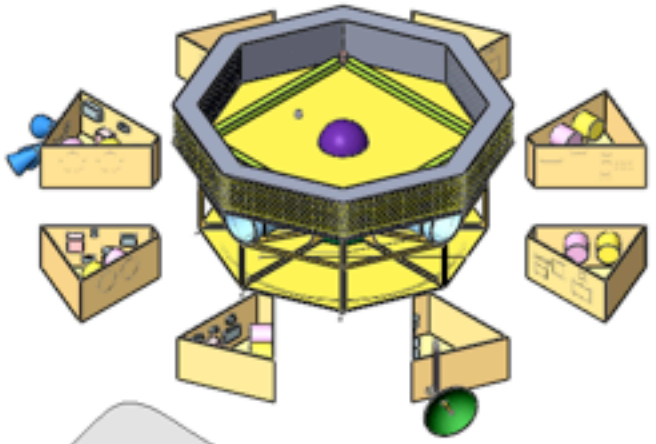


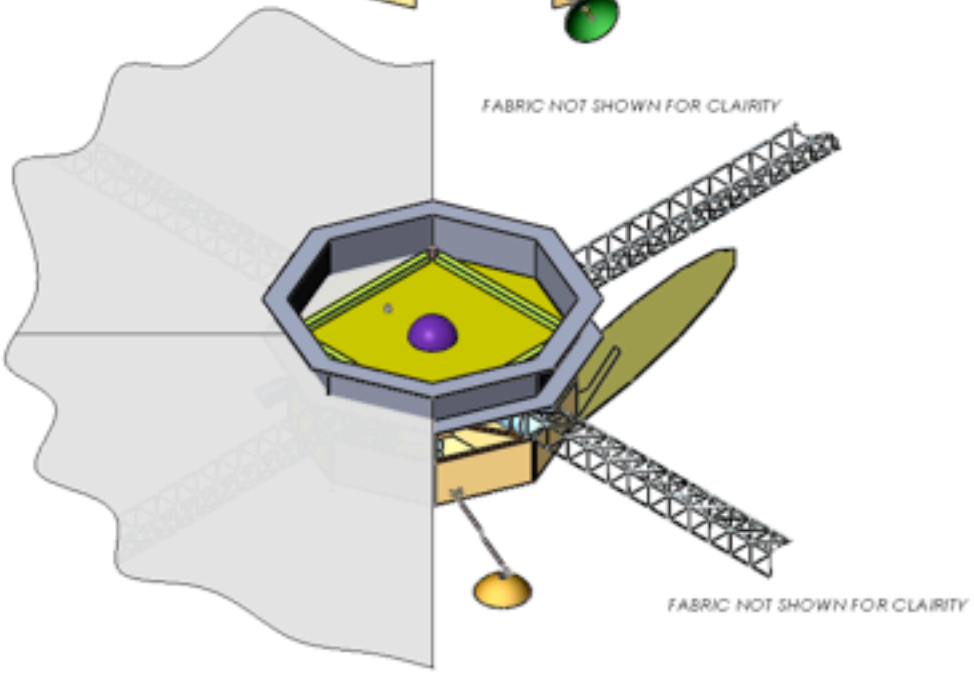
Side view



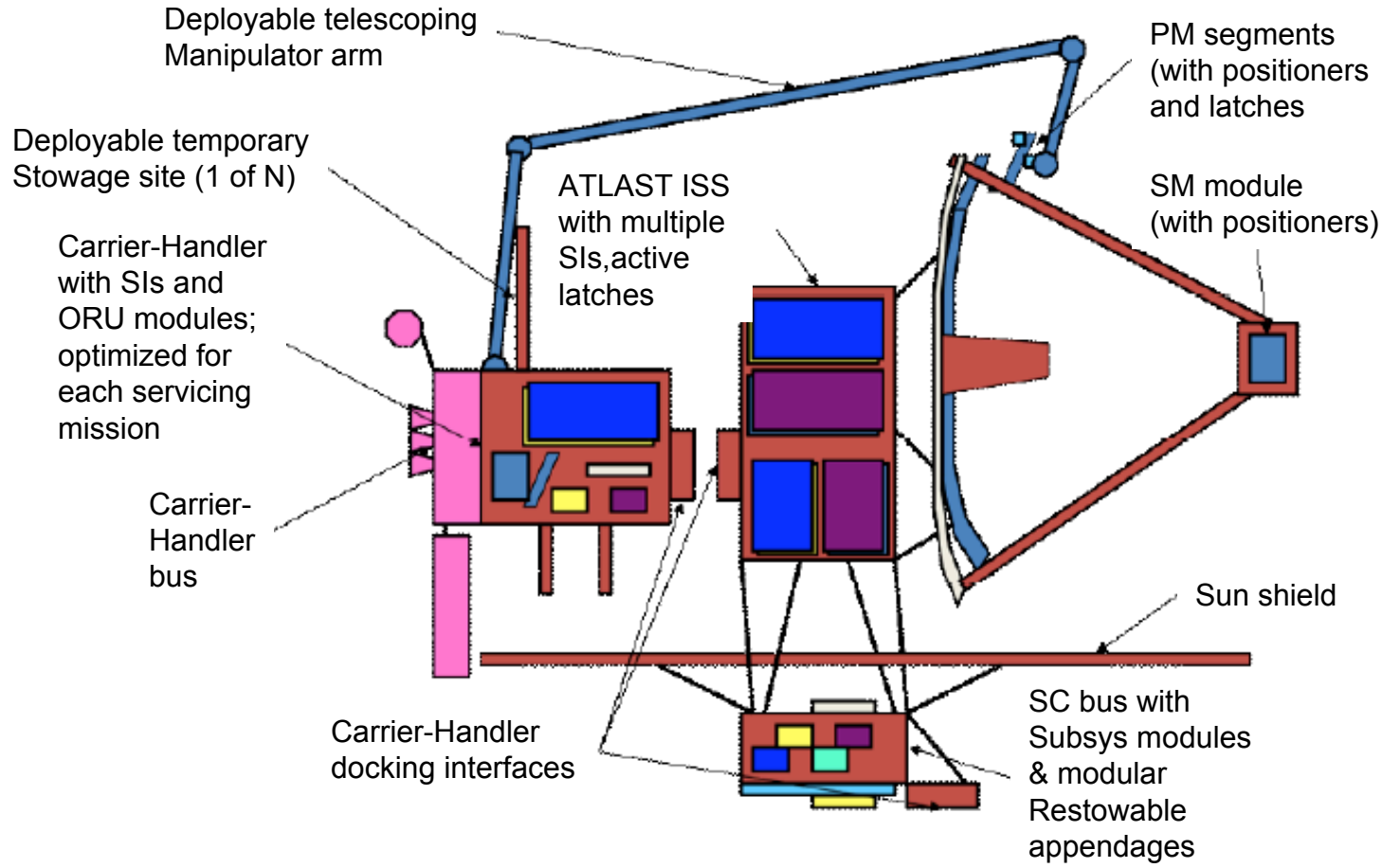
Bottom view

SC components replaceable





Servicing ATLAST-9.2m



ATLAST 9.2 Servicing Vehicle Carrier-Handler concept and notional upgrade maintenance operation.

Servicing Thoughts

- Servicing required for large national space-based assets
- Replaceable items should have easy access for robots or humans as part of mission design
- Observatory should have access ports or fixtures to allow capture and maintenance by rendezvous service vehicles.
- Highly desirable to have a “standard” plug and play method of removing and inserting “replaceable boxes” (instruments or S/C components) - ie. standard rails, fixtures etc.
- For robotic servicing: in situ at SEL2 - replace whole instruments - don’t try to repair them
- For human servicing: bring observatory back to EML1/2. Could remove instruments and do intricate repairs inside servicing depot
- Need consideration of how to replace non-standard items - eg. mirror segments