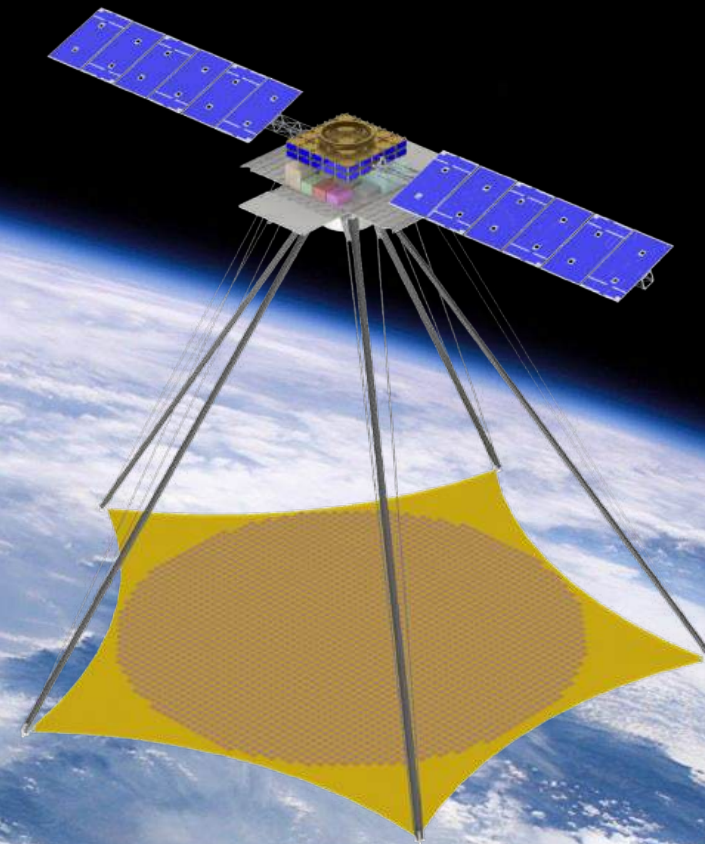
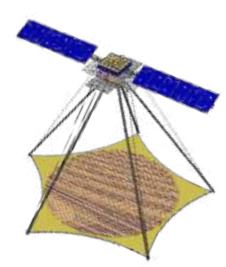


High Resolution L-band Wind Speeds from the Global L-band Observatory for Water Studies (GLOWS)

David Long, Rajat Bindlish,
Jeff Piepmeier, Mark Bailey

IOVWST Meeting
29 May 2024





GLOWS Objectives

- **SMAP continuity with SMAP-like capability at lower cost**
 - Science (resolution/swath/accuracy etc.)
 - L-band Radar and radiometer
 - Similar CONOPS to SMAP, but with ocean coverage, too
- Lost cost achieved by:
 - Use meta-material lens as a refractor
 - Use multi-element patch array feed
 - Update radiometer to reduce volume and improve performance
 - Small size: stow within a rideshare volume
 - Leverage modern SOA commercial radar technologies



GLOWS High Resolution Wind Speeds

- GLOWS will provide both radar & radiometer measurements
 - Polarimetric radiometer (1.4 GHz)
 - ~40 km footprint resolution, UHR processing to ~20 km
 - L-band wind emission signal not affected by rain, can measure high winds
 - Particularly useful in tropical cyclones (< 3 m/s std*)
 - SMAP being ingest at Joint Typhoon Warning Center
 - Quad-pol synthetic aperture radar (1.2 GHz)
 - ~ 1 km SAR & 5x36 km slice, fore and aft looks
 - L-band wind backscatter not affected by rain, can measure high winds
 - Effective in tropical cyclones** (only very limited SMAP radar data)
 - GLOWS will have global coverage
 - Dual mode retrievals possible***

*Meissner, Ricciardulli & Wentz, 2017. Capability of the SMAP Mission to Measure Ocean Surface Winds in Storms, *Bulletin of the American Meteorological Society*.

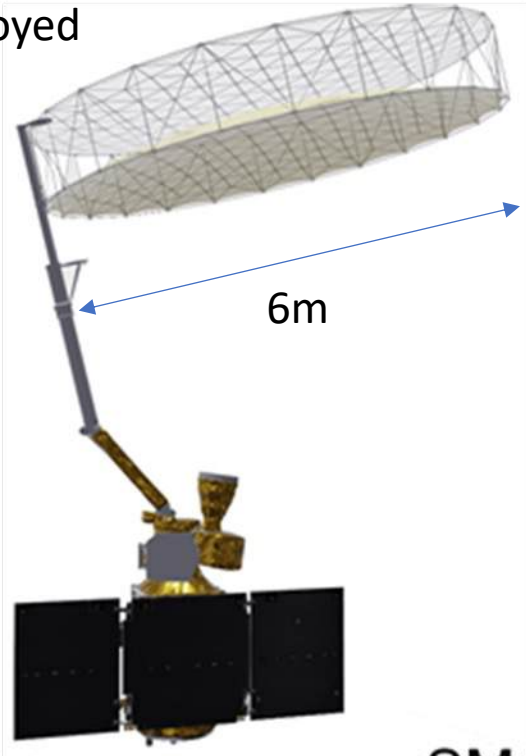
** A. Fore, S. Yueh, B. Stiles, W. Tang & A. Hayashi, 2019. On Extreme Winds at L-Band with the SMAP Synthetic Aperture Radar, *IGARSS 2019*.

*** S. H. Yueh et al., 2013. L-Band Passive and Active Microwave Geophysical Model Functions of Ocean Surface Winds and Applications to Aquarius Retrieval, *IEEE Transactions on Geoscience and Remote Sensing*



Comparing GLOWS and SMAP Spacecraft

Deployed



6m

SMAP
\$\$\$

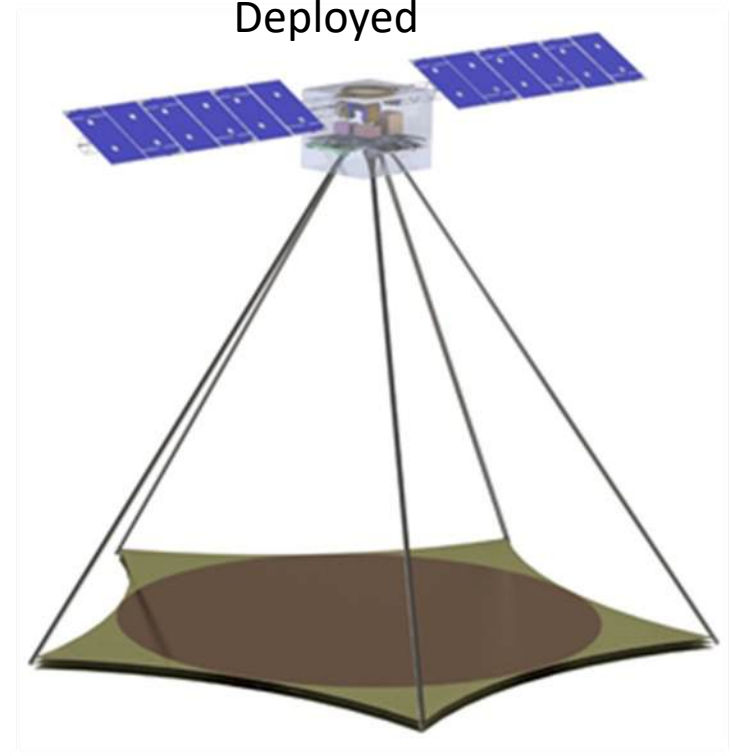


stowed



GLOWS
\$

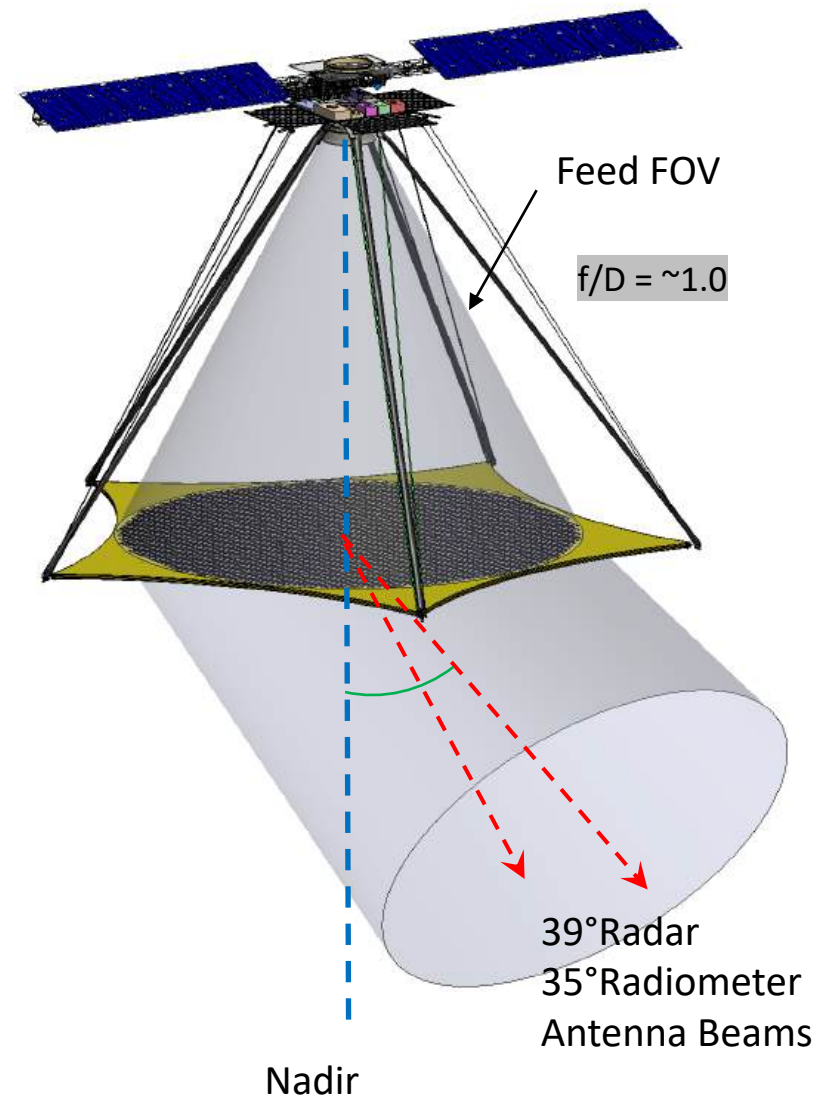
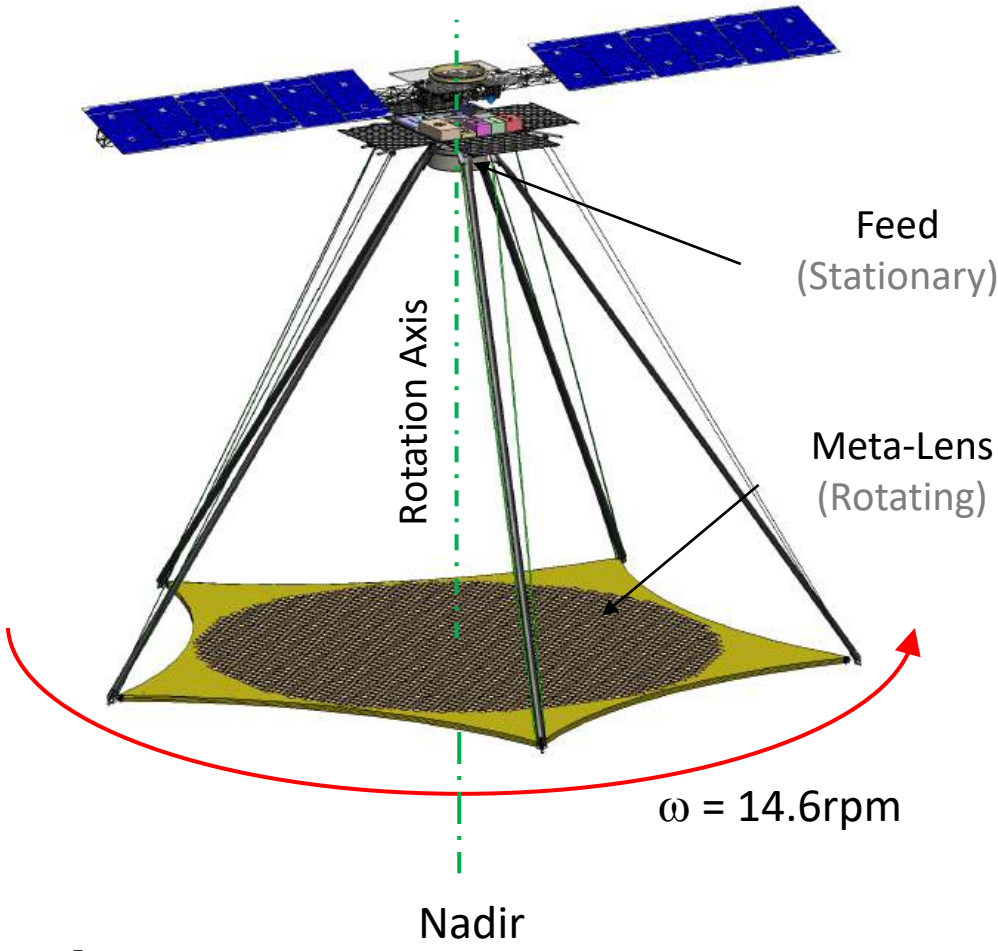
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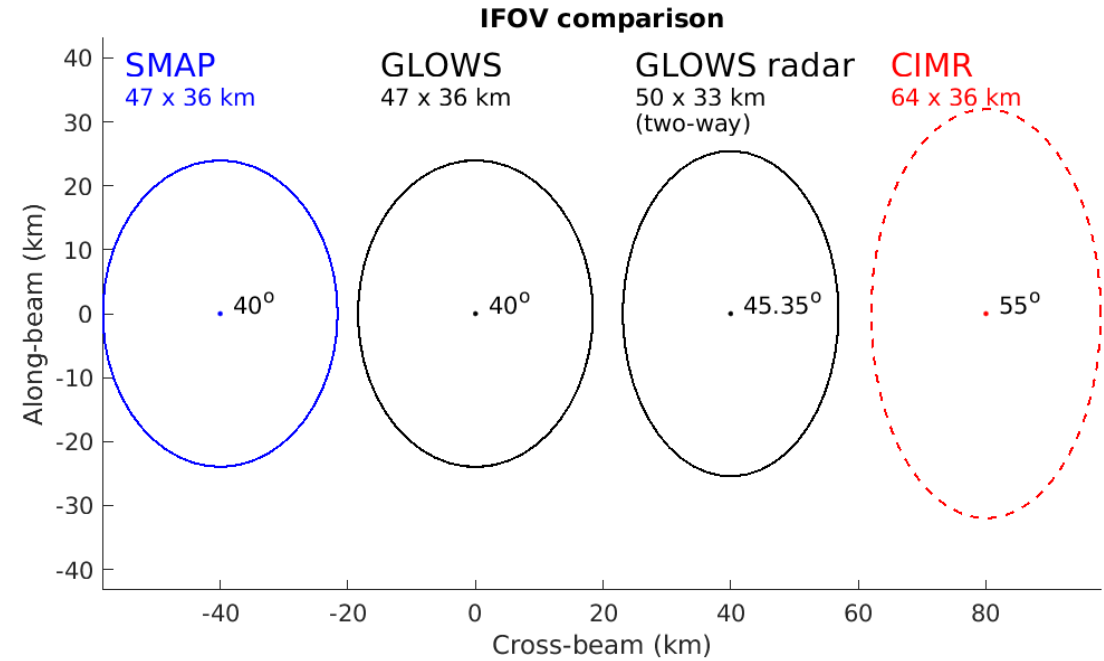
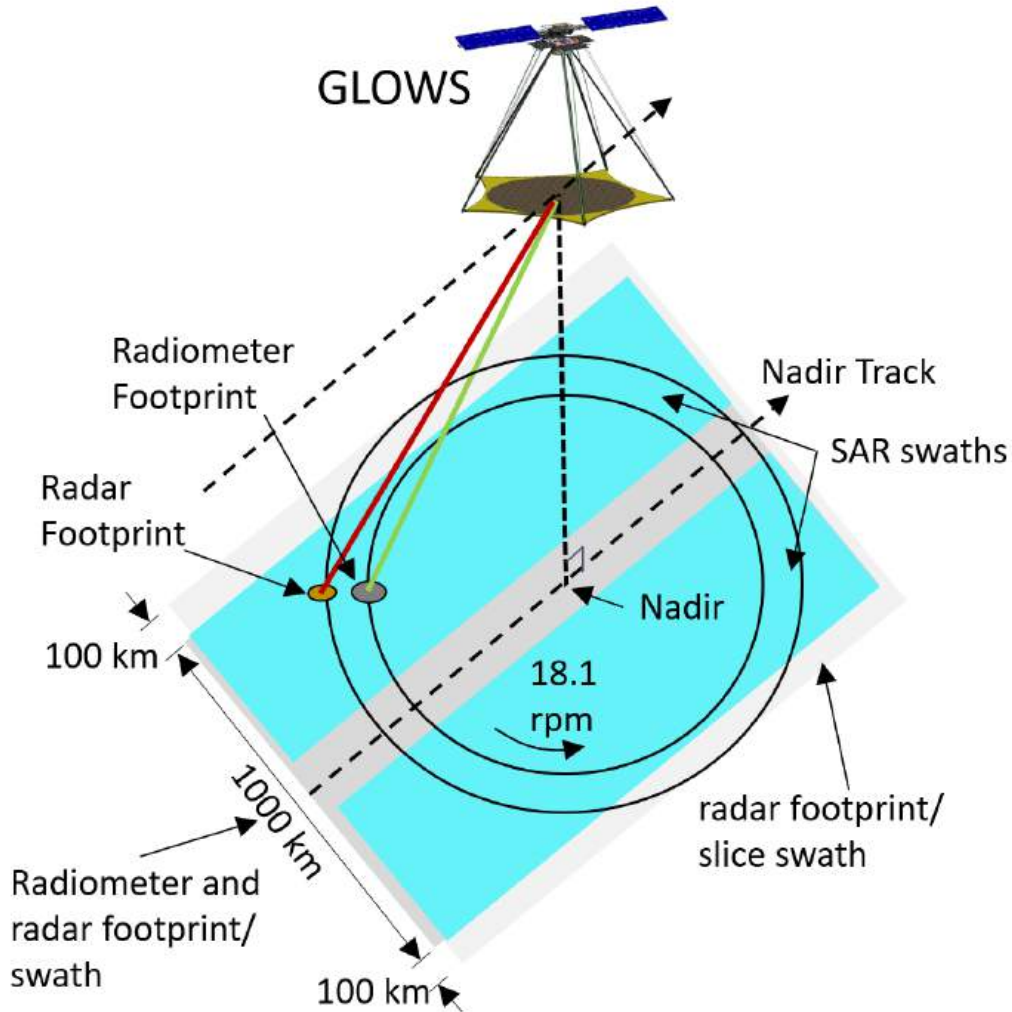
7m



GLOWS Meta-Material Lens Antenna



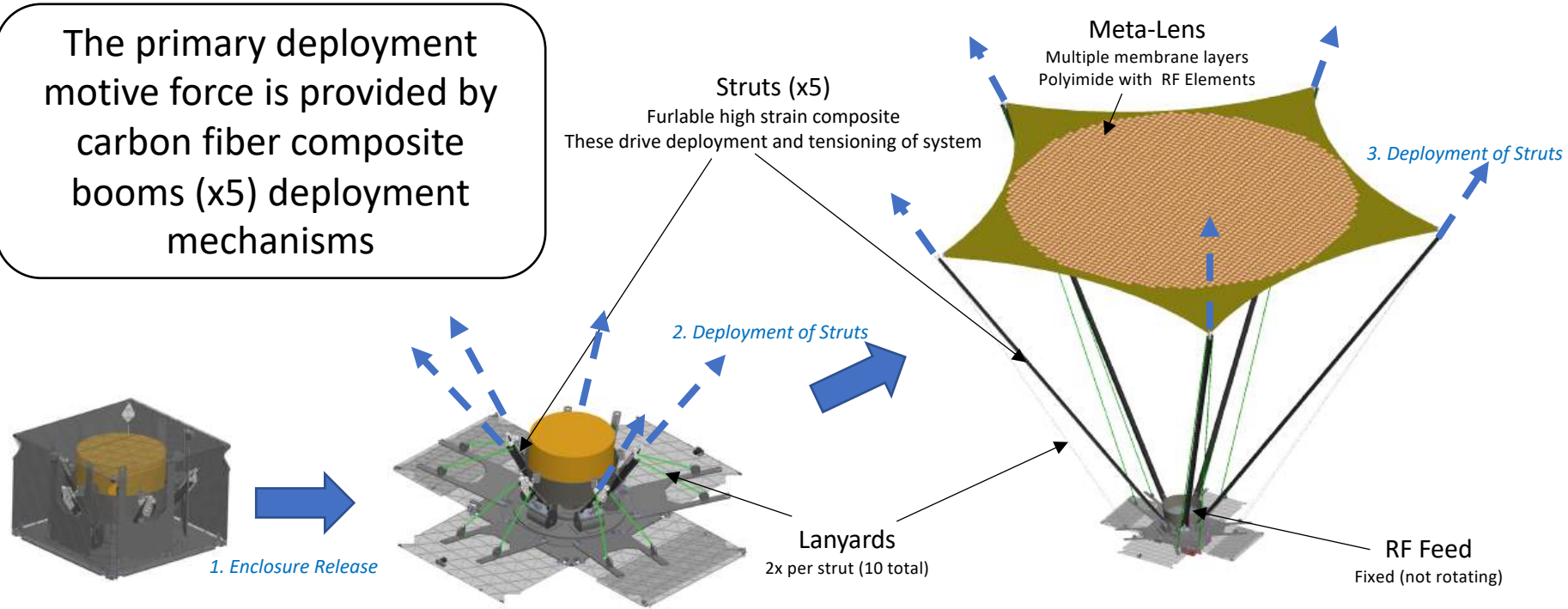
GLOWS Swath and Resolution



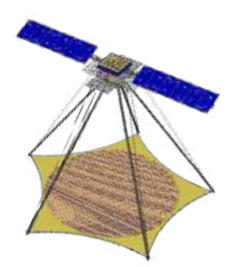
- GLOWS swath
 - Radiometer: 1000 km (same as SMAP)
 - Radar: 1200 km (200 km wider than SMAP)
- GLOWS radar resolution of ~1-3 km after SAR processing
 - 3 km resolution -- middle third of the swath
 - 1 km resolution -- outer thirds of the swath

Membrane Lens Deployment

The primary deployment motive force is provided by carbon fiber composite booms (x5) deployment mechanisms

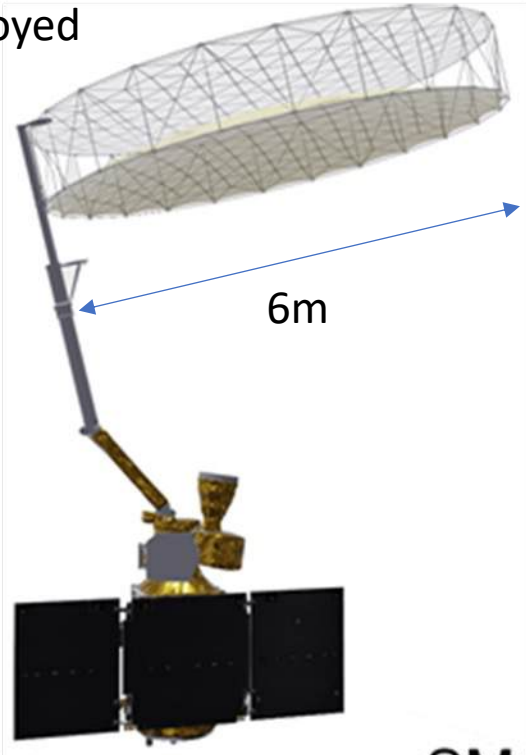


Antenna Deployment Testing



Comparing GLOWS and SMAP Spacecraft

Deployed



6m

SMAP
\$\$\$

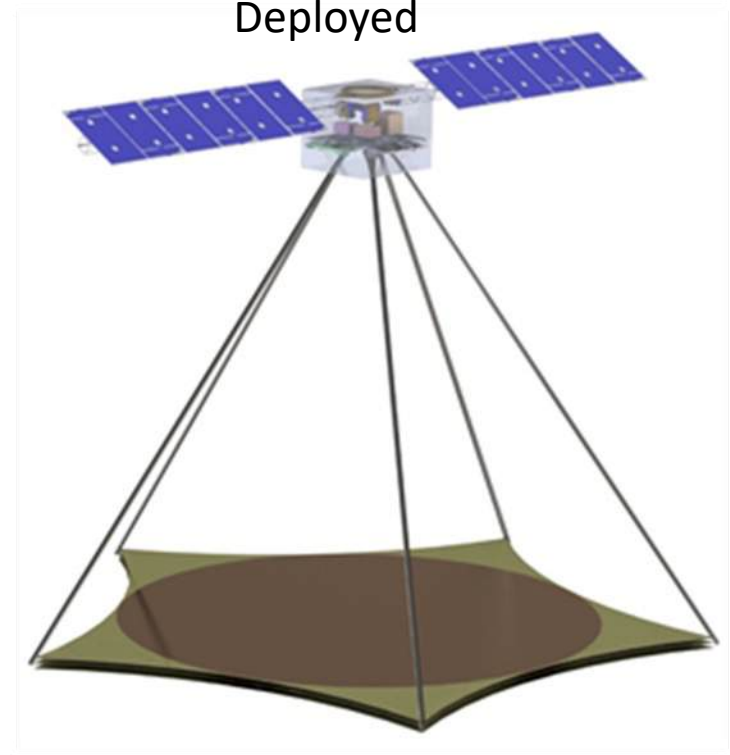


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GLOWS
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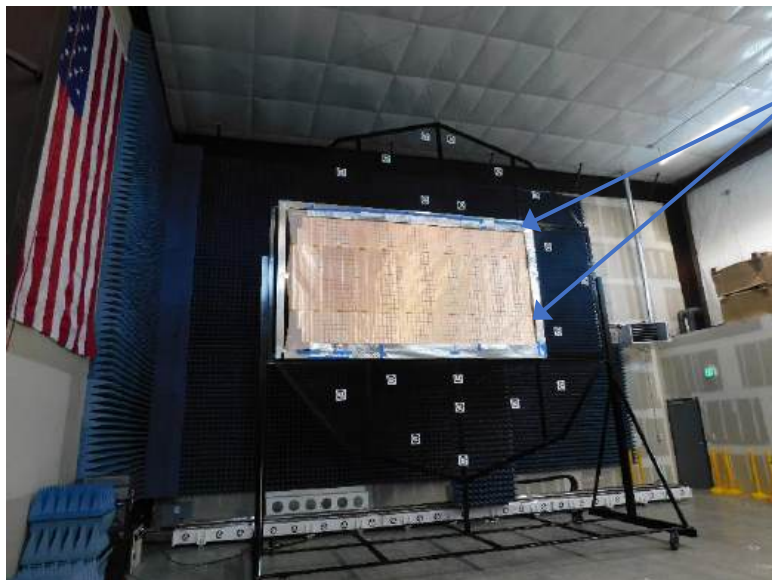
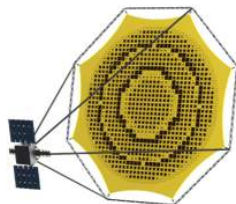
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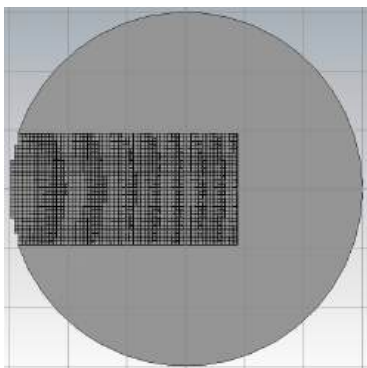
7m



Lens Validation Testing – 2 Meter x 4 Meter slice



Transition to ground plane has gaps not captured in the Ticra model



Ticra QUPES Simulation Model

