



# Starshade Rendezvous Technology for WFIRST

## JPL-MPIA at KISS - Caltech

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# Agenda



Exoplanet Exploration Program

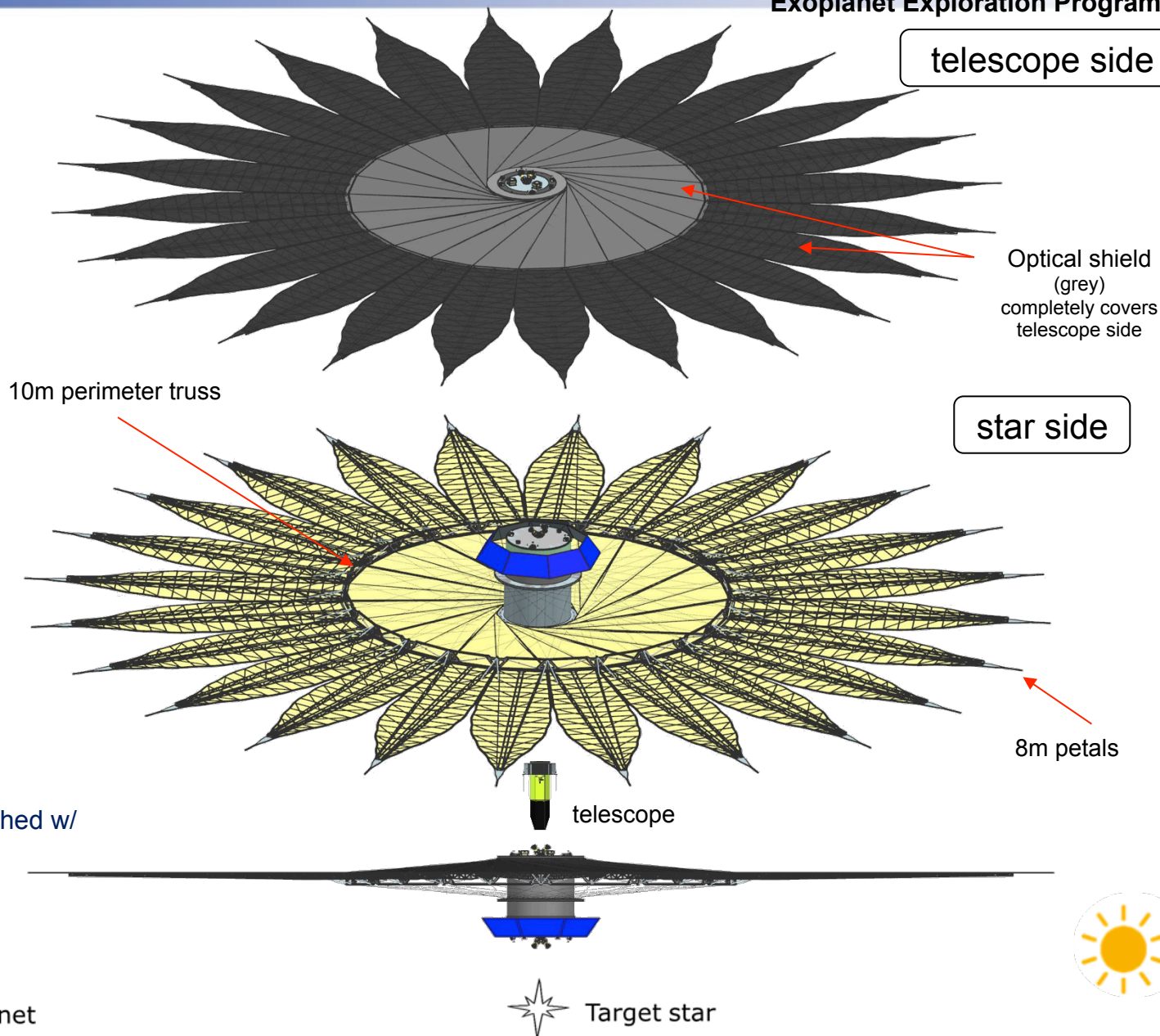
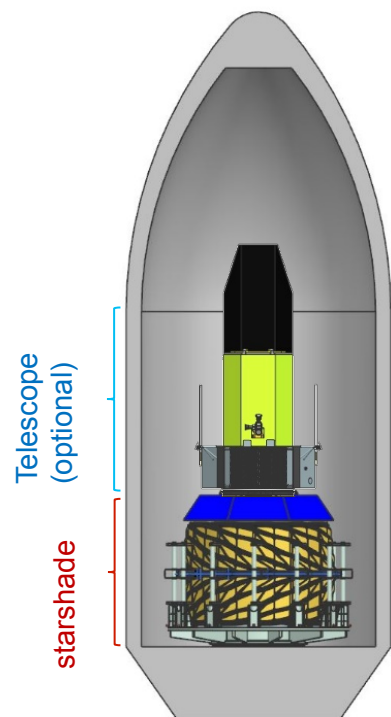
- **Starshade Mechanical Technology**
  - Mechanical architecture and deployment sequence
  - Mechanical technology development and status
- **WFIRST Starshade Accommodations**
  - Overview
  - CGI accommodations



# Wrapped Petal Starshade Mechanical Architecture

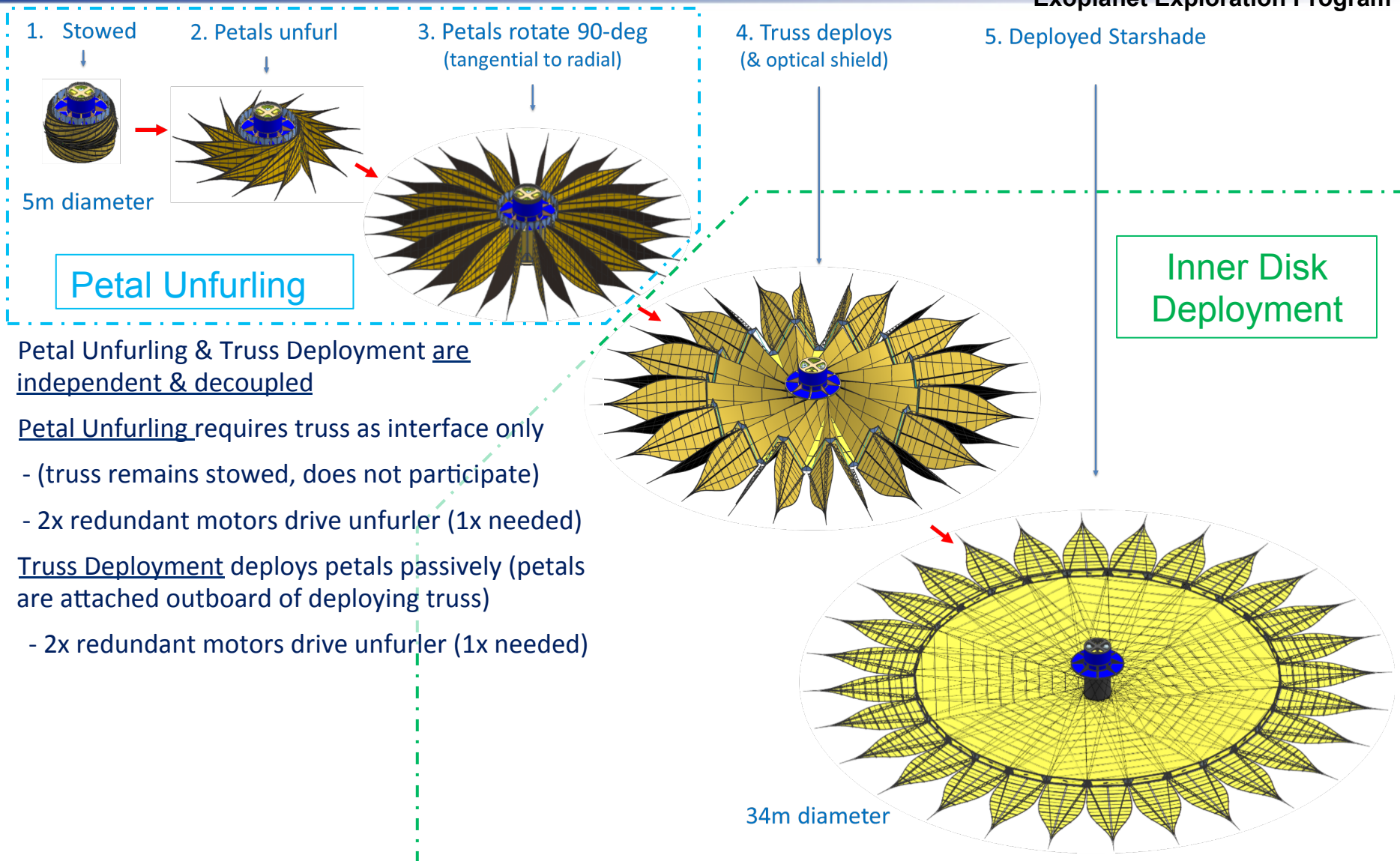


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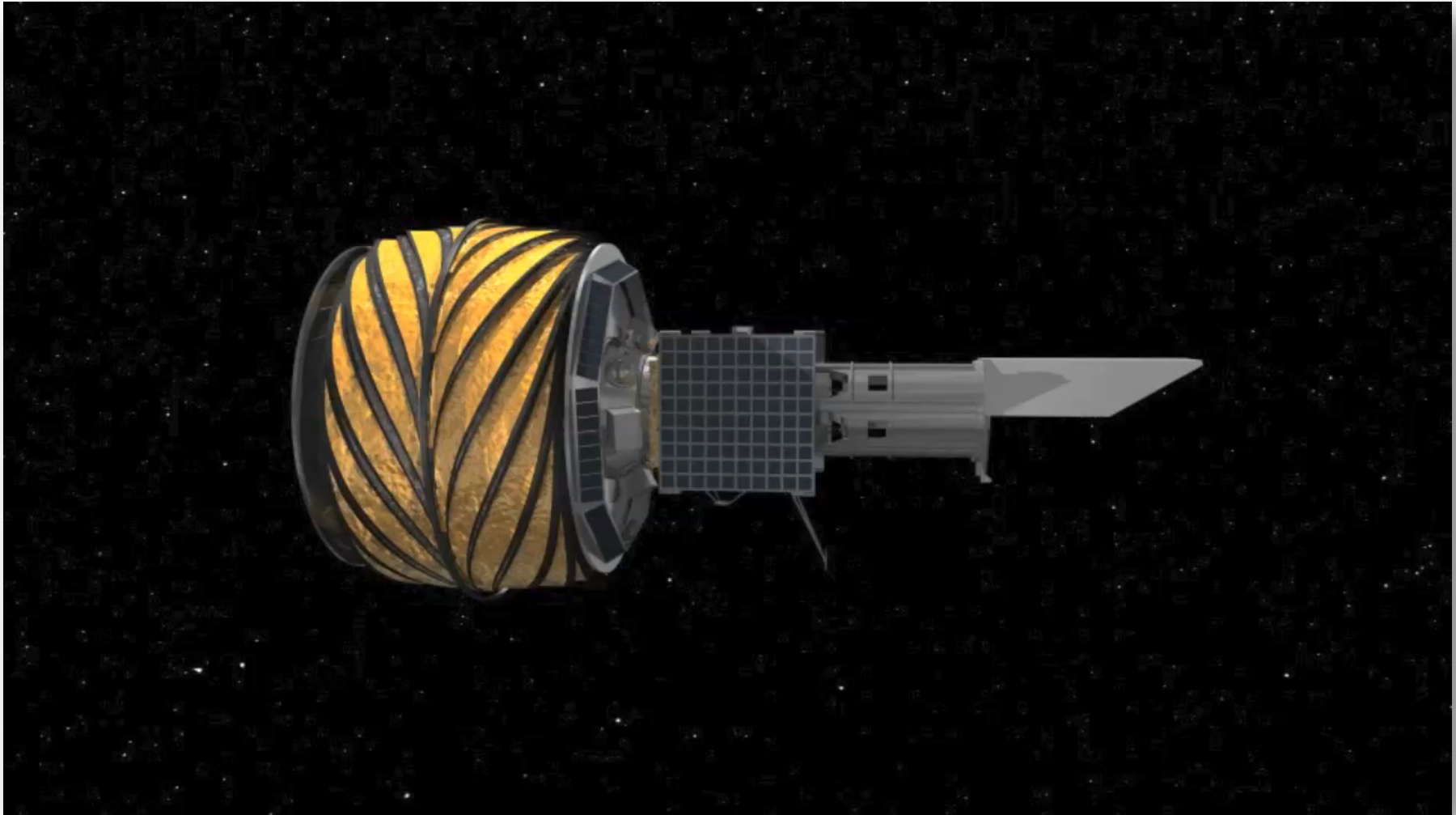
# Wrapped Starshade 2-Step Deployment

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\*\*\* 34m starshade shown here





# Starshade Mechanical Development Status

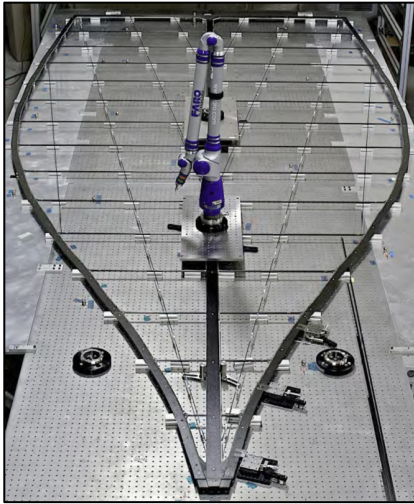
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Past efforts demo tolerances for:

Ongoing efforts demo how to:

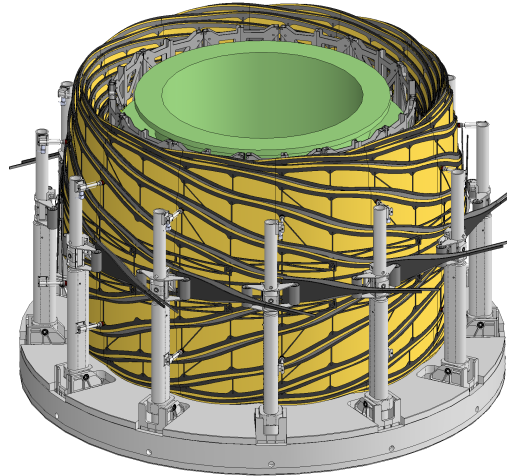
Future efforts need to demo:

Petal Manufactured Shape



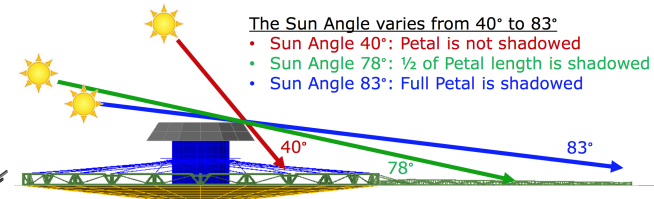
TDEM-09: J. Kasdin, PI

Unfurl Petals



Jettisoned rotating carousel

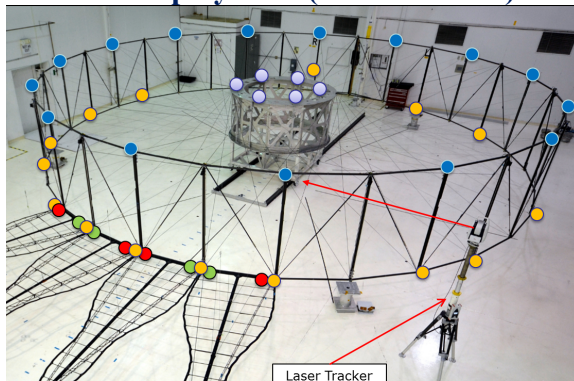
On-orbit stability over temperature



*Performance is fortunately insensitive to uniform shape change.*

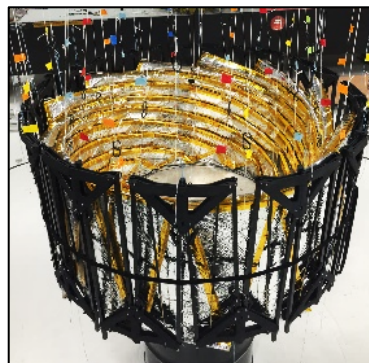
*Non-uniform thermal shape changes contribute less than 10% of the total max expected instrument contrast.*

Disk Deployment (Petal Position)



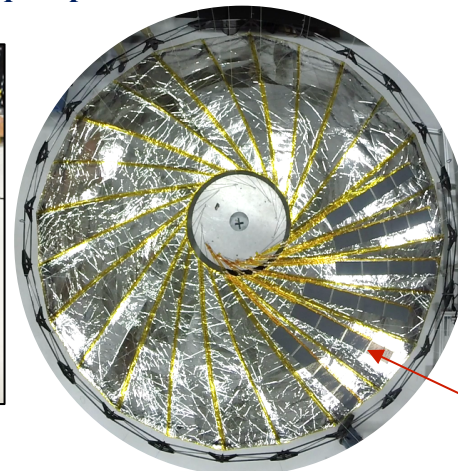
TDEM-10: J. Kasdin, PI

Co-deploy an opaque optical shield



Wrapped spiral gores

Disk deploy tolerances with optical shield installed.

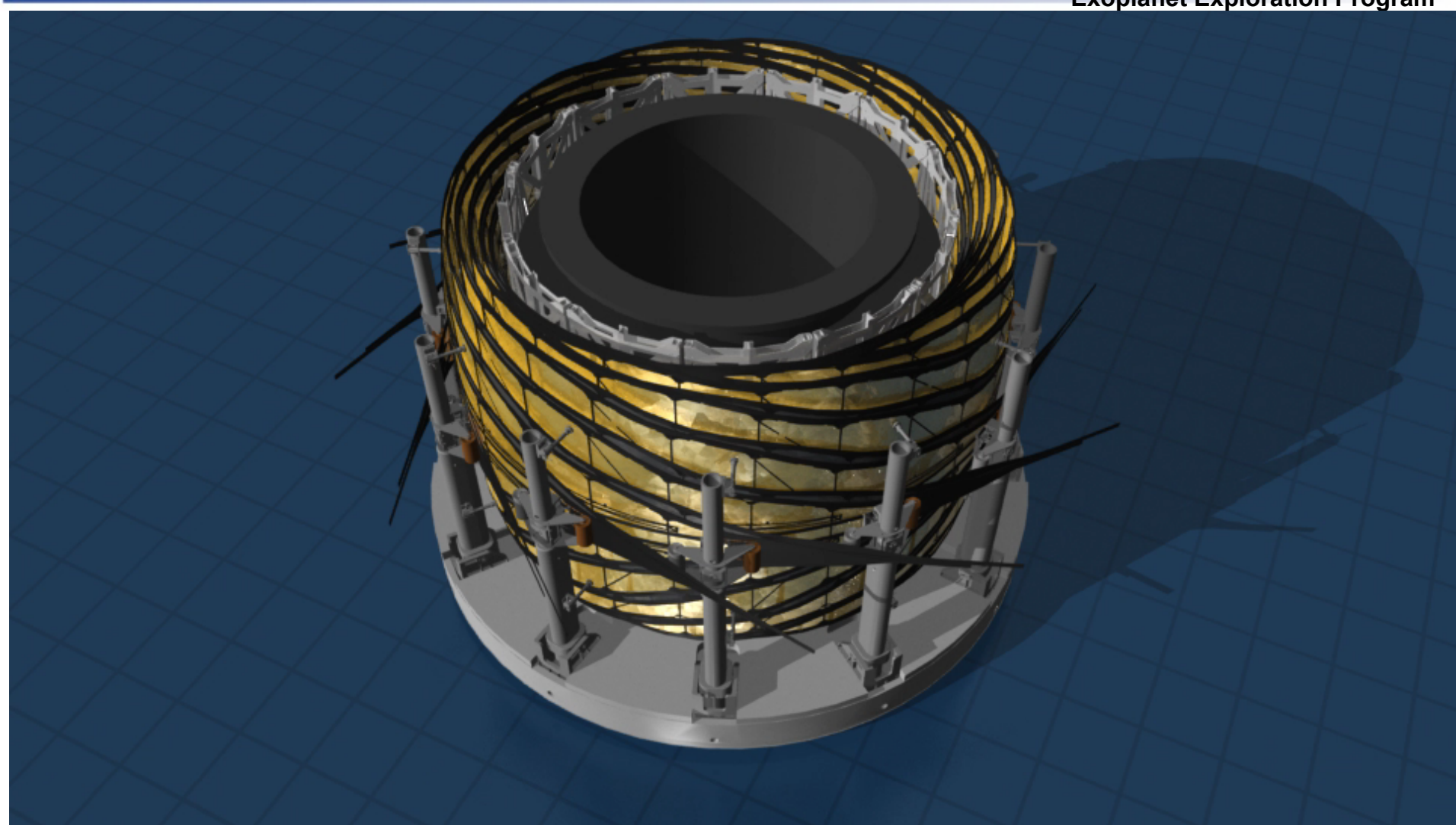


*Thin-film solar cells could power SEP*

# Petal Unfurl Animation



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# Petal Unfurl Testbed



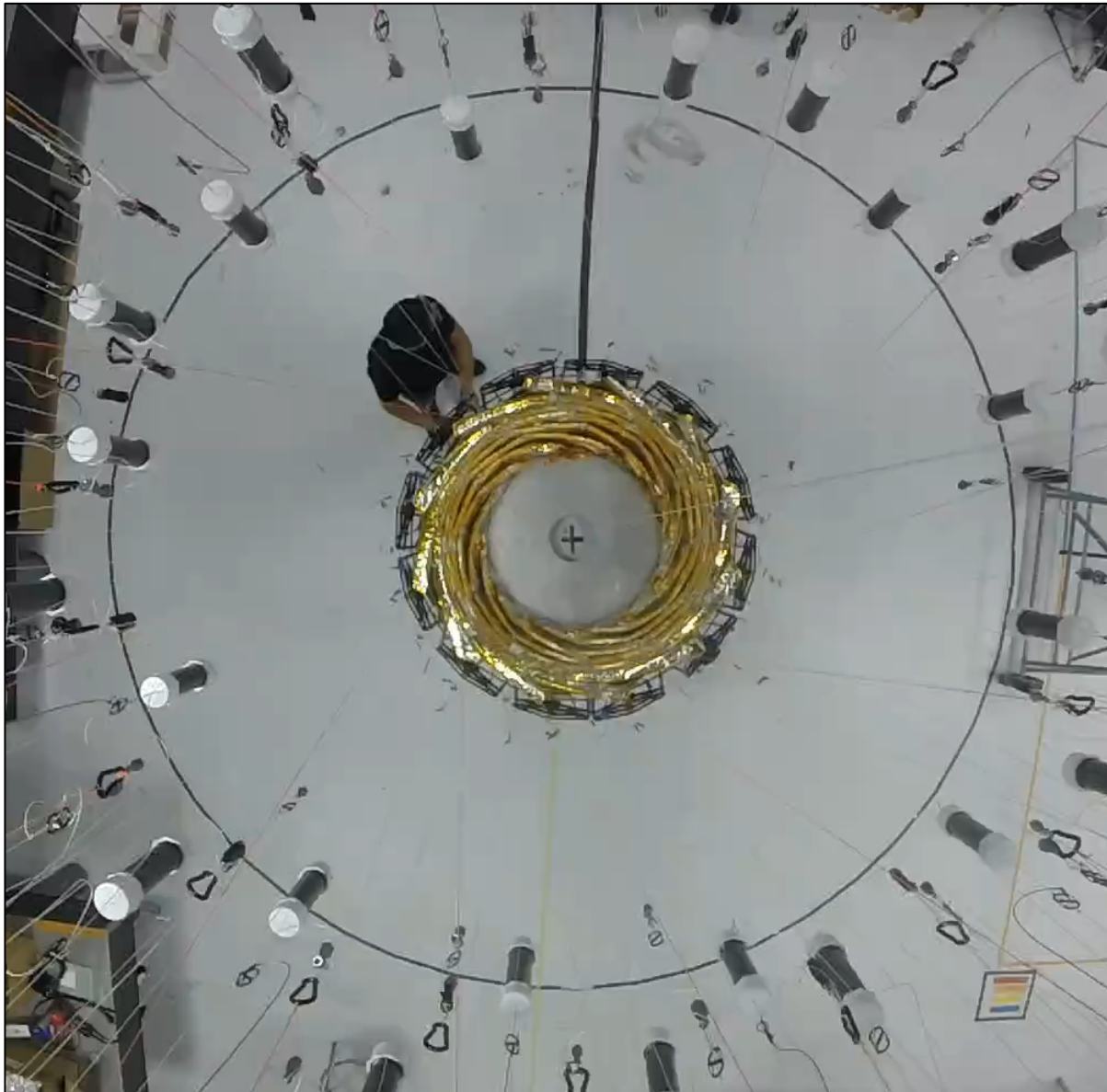
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# Disk Opaque Shield Deployment Video



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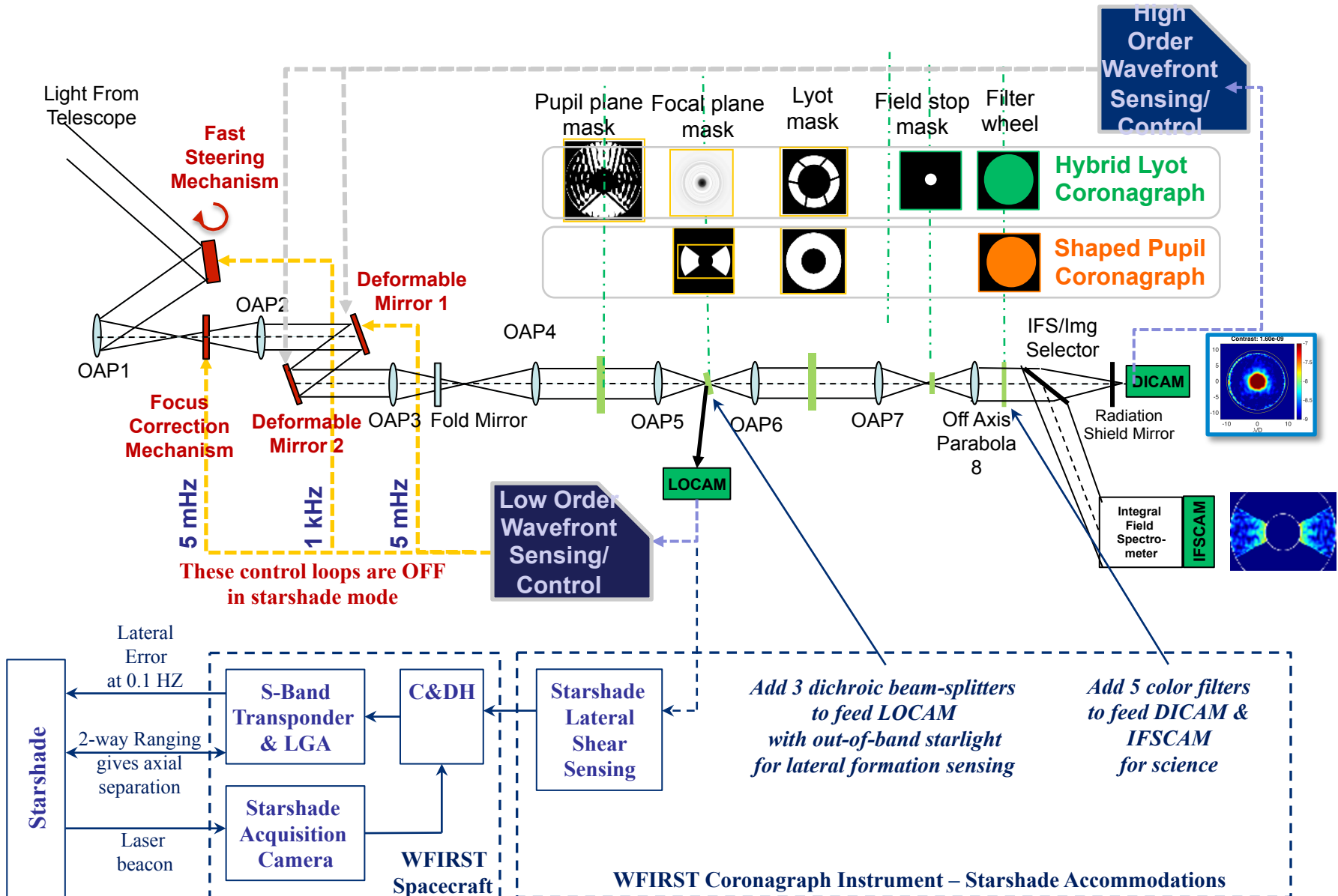


# WFIRST Accommodation Overview



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- **WFIRST baseline includes Starshade accommodation, but implementation is only funded through calendar 2020**
  - Coronagraph instrument (CGI) provides science instrumentation and lateral formation sensing with no additional focal planes
  - WFIRST spacecraft provides a starshade acquisition camera (a customized star tracker)
  - WFIRST spacecraft provides a S-Band transponder for inter-spacecraft communications and 2-way ranging to measure the telescope-starshade separation distance (copy of direct to Earth transponder)
- **CGI accommodations are primarily adding filters and a formation sensing algorithm**



# Preliminary Starshade Filter Concept

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