Predictive Thermal Control (PTC) Technology to enable Thermally Stable Telescopes

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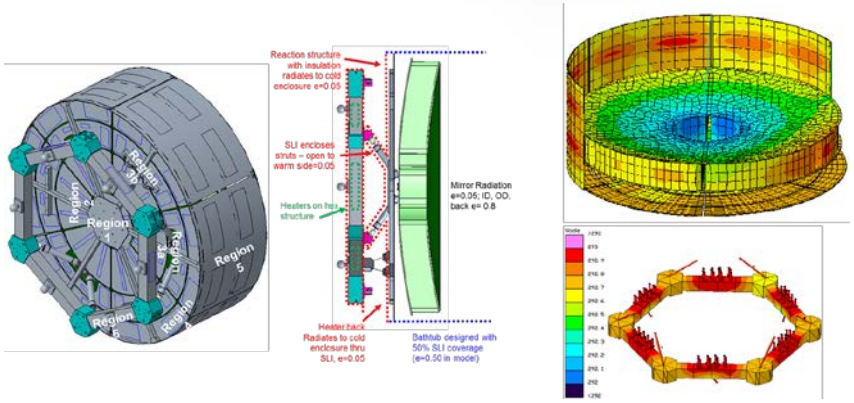
Objectives and Key Challenges:

- Validate models that predict thermal optical performance of real mirrors and structure based on their structural designs and constituent material properties, i.e. CTE distribution, thermal conductivity, thermal mass, etc.
- Derive thermal system stability specifications from science-driven wavefront-stability requirement
- Demonstrate utility of PTC system for achieving thermal stability

Significance of Work:

- Thermally stable space telescopes enable the desired science of potential HabEx and LUVOIR missions
- Integrated modeling tools enable better definition of system and component engineering specifications



Design of 'zonal' rear heater system to actively control mirror system thermal environment

Approach:

- Science-driven systems engineering
- Mature technologies required to enable highest-priority science and result in high-performance, low-cost, low-risk system
- Mature technology in support of 2020 Decadal process

Key Collaborators:

- PTC team at MSFC: Thomas Brooks, Richard Siler & Ron Eng
- Harris Corp: Carl Rosoti, Keith Harvey & Rob Egerman

Current Funded Period of Performance:

Jan 2017 – Sept 2020

Recent Accomplishments:

- ✓ Completed modal & optical analyses correlations.
- ✓ Completed design and fabrication of Harris rear heater.
- ✓ Correlated thermal model with 1.5m ULE® mirror test results.
- ✓ Presented progress results at Tech Days 2018.

Next Milestones:

- Complete PTC algorithm development (2/2019)
- Complete Aluminum Mirror fabrication (3/2019)
- Integrate PTC rear heater system at XRCF (5/2019)
- Conduct XRCF testing of aluminum mirror (6/2019)

Applications:

- Flagship optical missions; Explorer-type optical missions
- Department of Defense and commercial observations

$TRL_{In} = 3$ $TRL_{Current} = 3$ $TRL_{Target} = 4 - 5$
(values depend on specific technology)