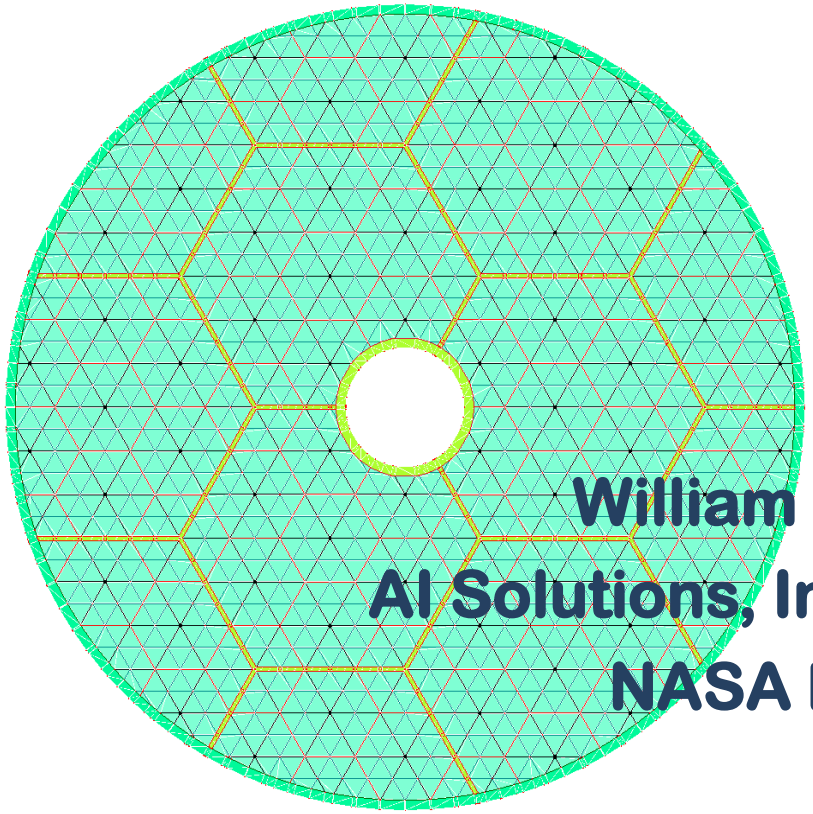
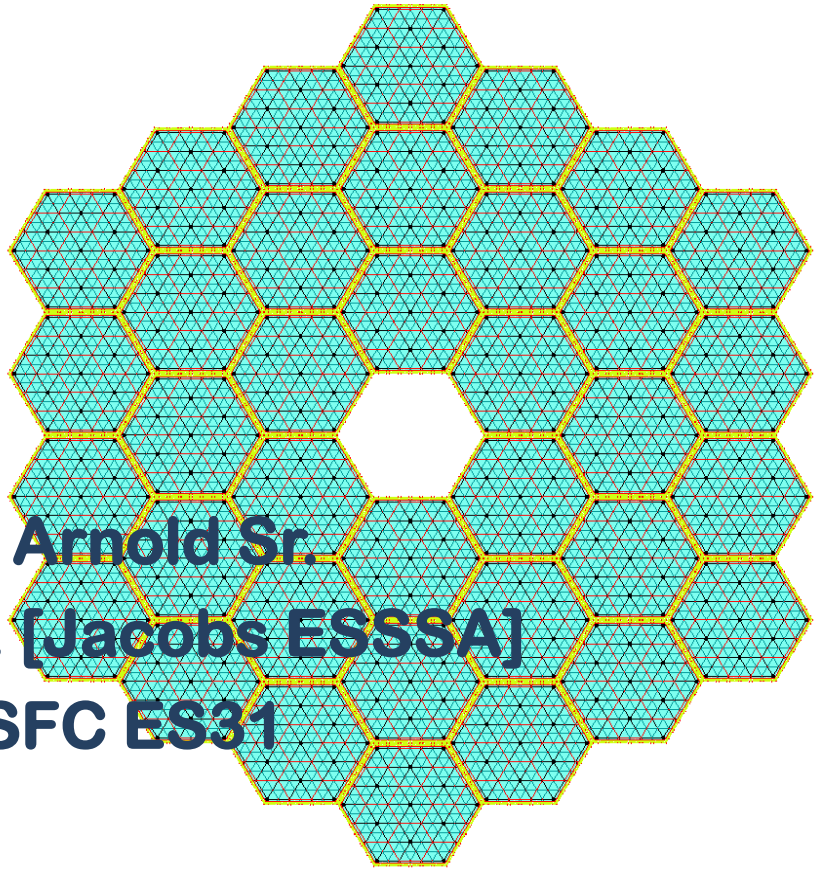
AMTD Design Process





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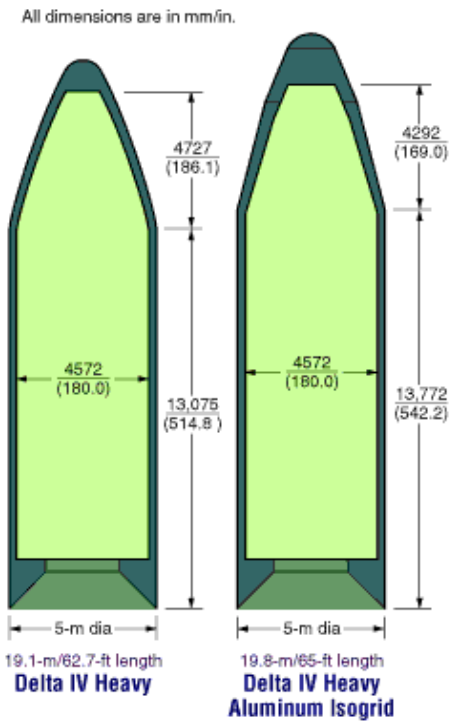
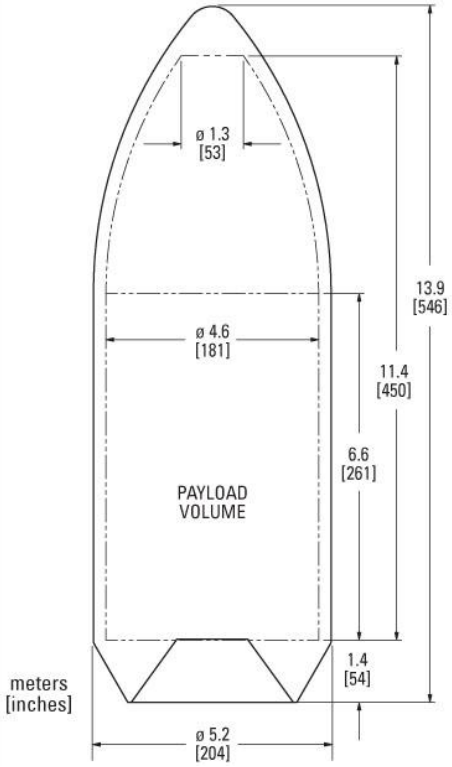
Define the AMTD Design Process

- Objectives of AMTD (why are we doing this?)
- Influences of available launch vehicles
- What constitutes an “point design”?
- How manufacturing capabilities influence the design process.
- Mirror, suspension system and deployment mechanisms (if segmented) must be treated as a unit for a design point.

Current Launch Vehicles





What is an Acceptable Design Point?

- Operational performance [It has to work]
- Launch Survival [It has to get into orbit]
- Manufacturing Considerations [it has to be made]
- Cost and Risk Estimates [It has to be affordable and reasonable risk of success]

Operational Performance

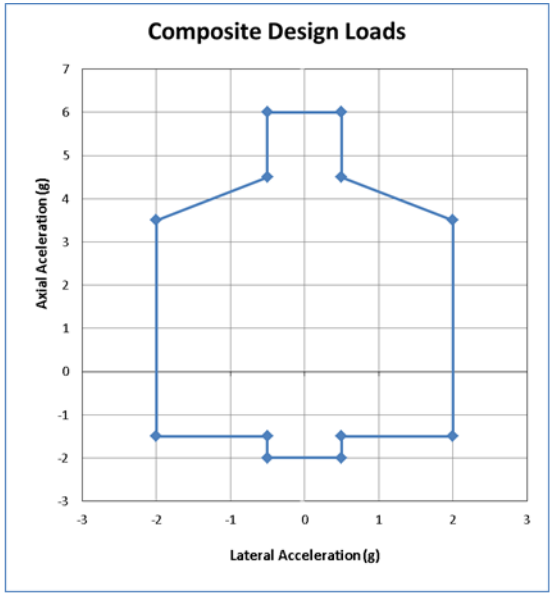
- Optical Stability
- Thermal Stability
- Jitter rejection
- Optical performance, diffraction, quality etc.
  - Monolith versus segmented primary
  - Off axis versus On axis

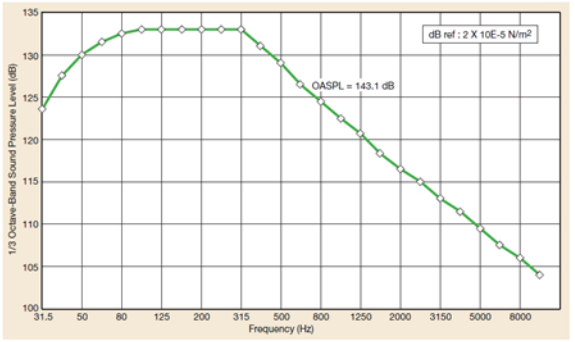
Launch Environment

- Steady State Acceleration
- Vibro-Acoustic
- Sinusoidal
- Random Vibration

- Support System(s)

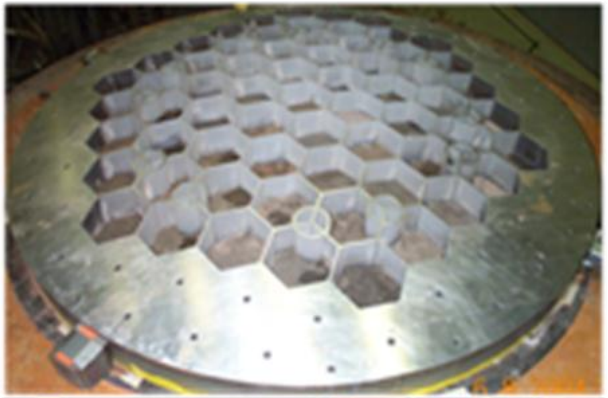
- Shroud Geometry
- Payload to L2 Orbit

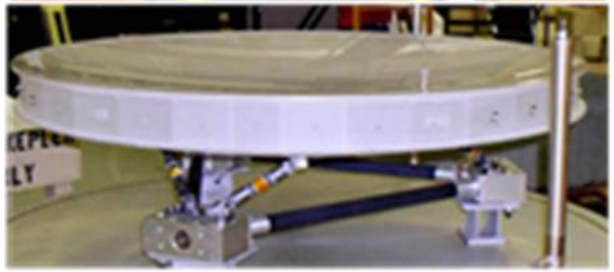




Manufacturing Considerations

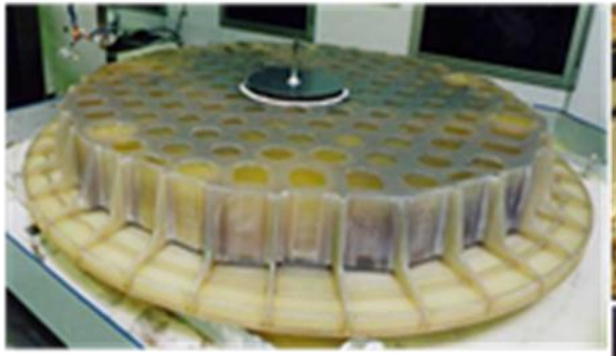
FRIT BONDED ULE





*LOW TEMPERATURE FUSION IS AN ALTERNATIVE ASSEMBLY, REQUIRES SLUMPING

POCKET MILLED ZERODUR



Can the blank be made?

Can the blank be transported where needed?

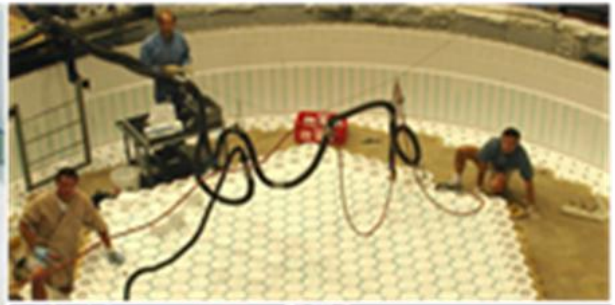
Can the mirror be processed (flipped etc.)?

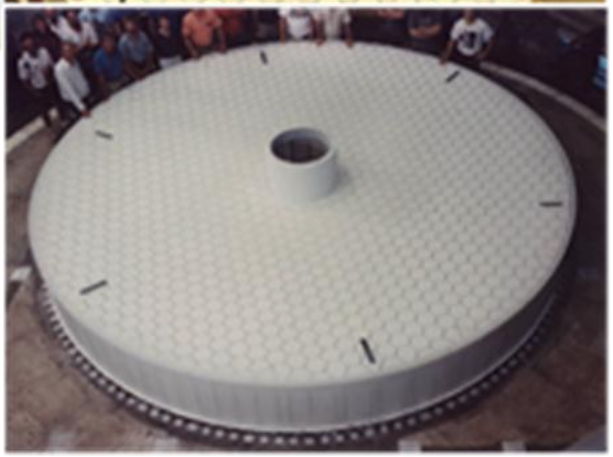
Can the mirror be tested (gravity offset)?

Can the mirror be coated?

Can the mirror be transported where needed?

CAST BOROSILICATE

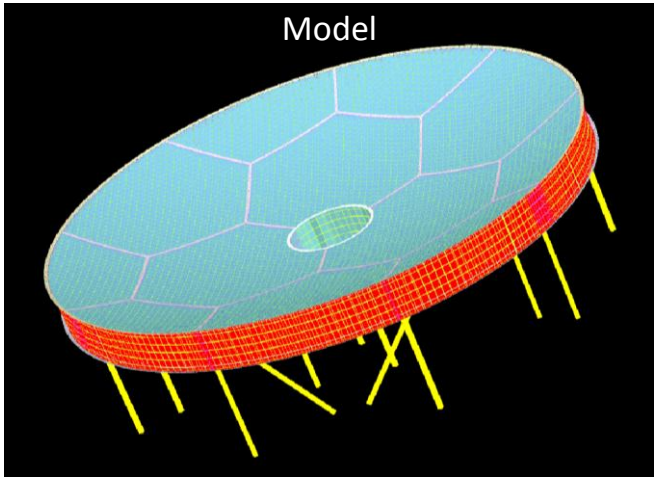


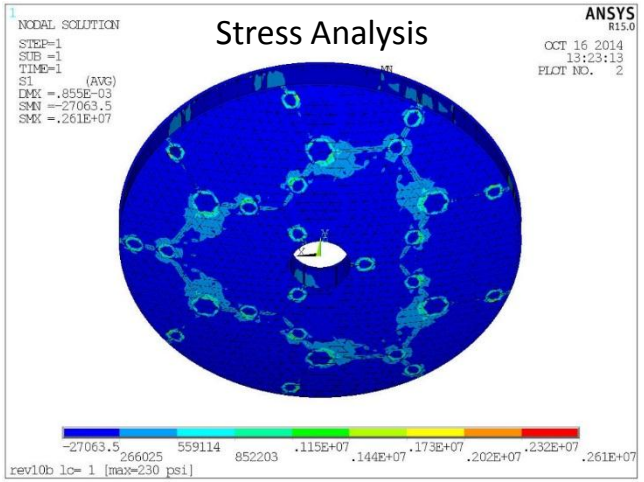


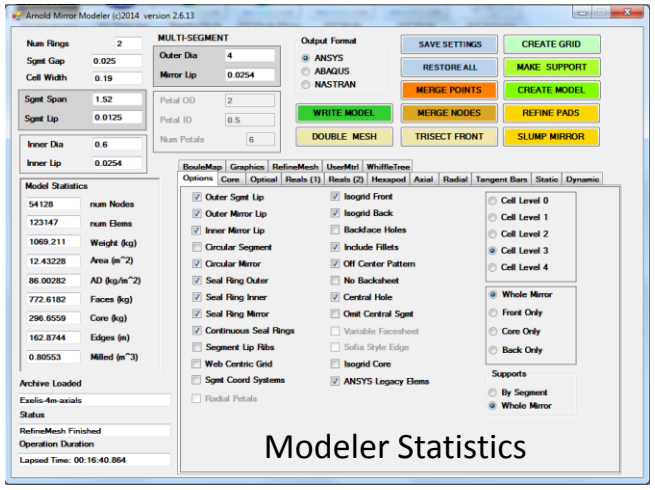
Support Systems

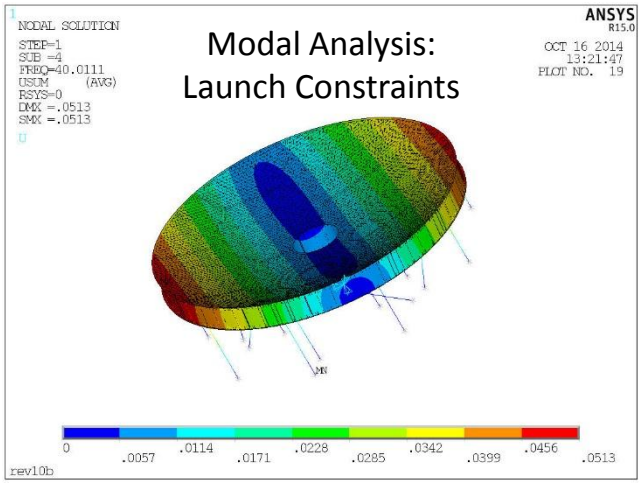
- Operational requirements
  - Kinematic
  - Jitter rejection
  - Thermal and figure control
- Launch requirements
  - survive
- Auxiliary Launch system
  - Beyond certain diameter versus mirror mass
  - Key characteristics
    - Detach after launch
    - Share load evenly with operational system

Typical Deep-Core LTF ULE

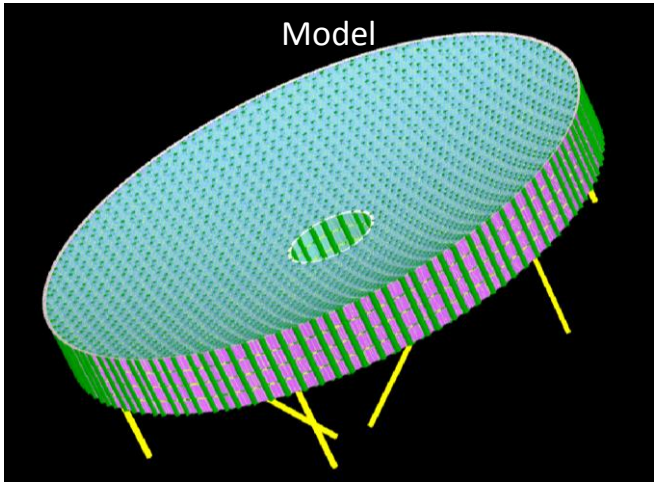


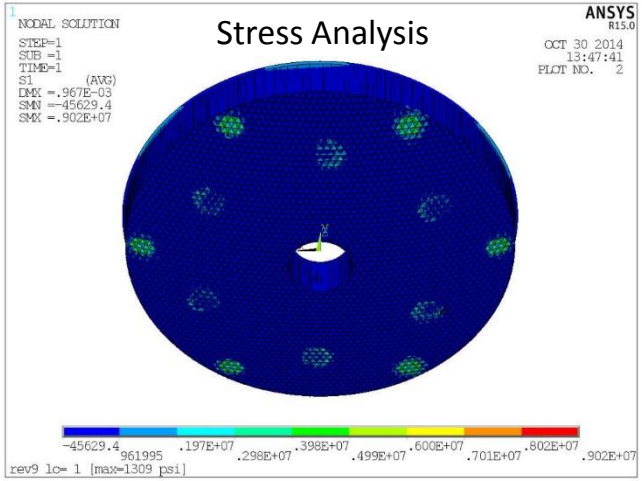


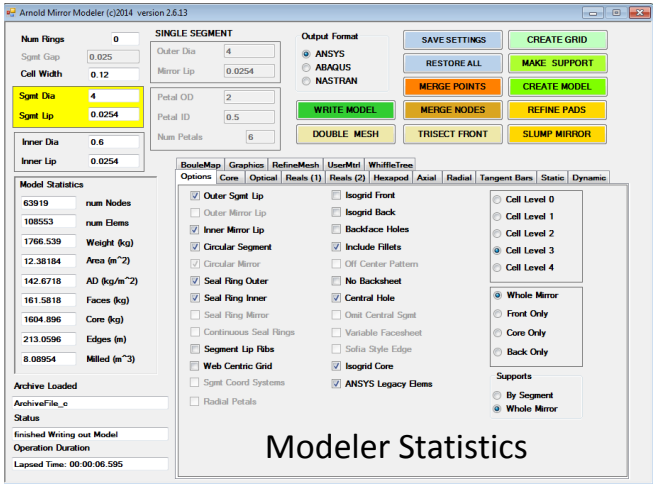


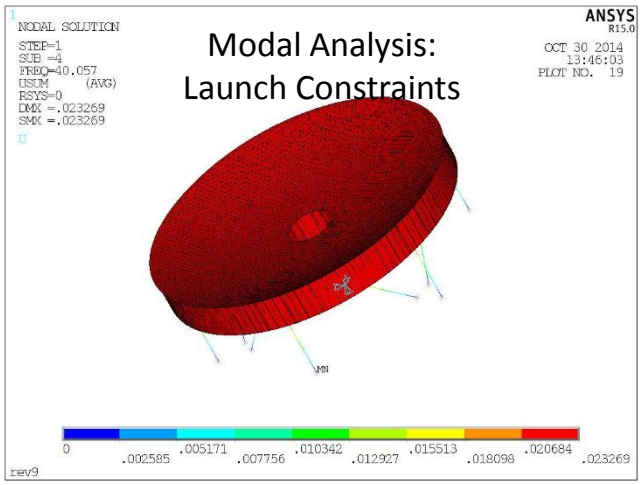


Typical Open-Back Zerodur "Milled"

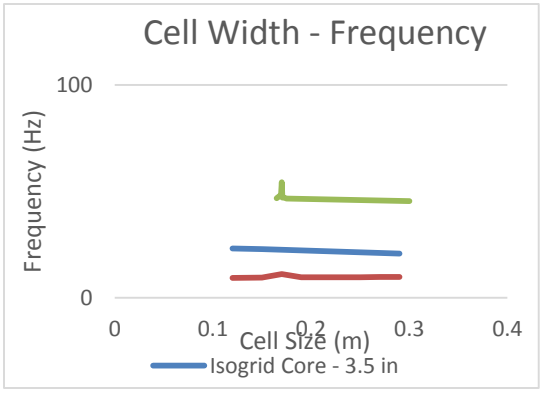


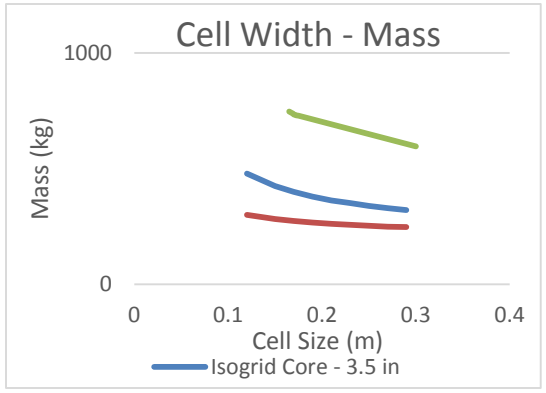


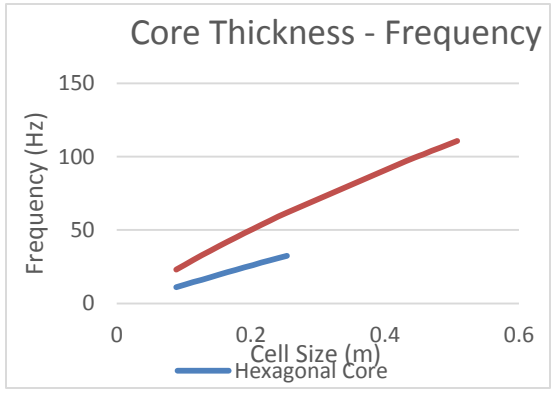


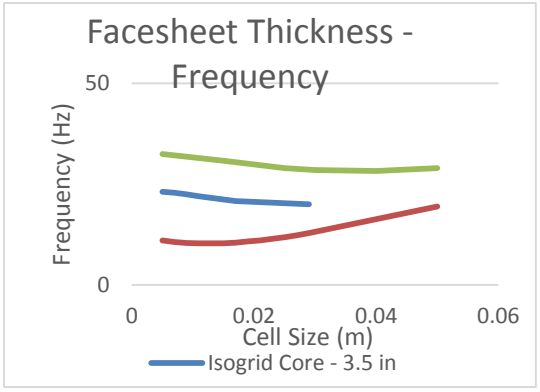


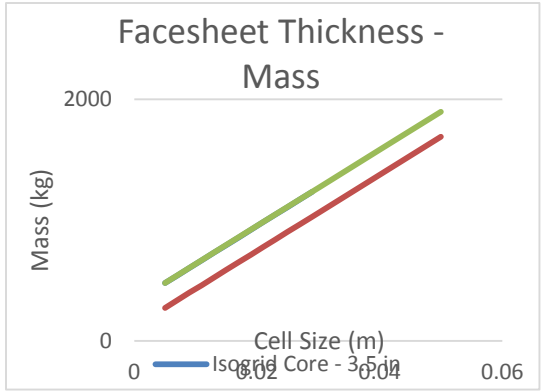
Typical Trade Studies Within a Design point

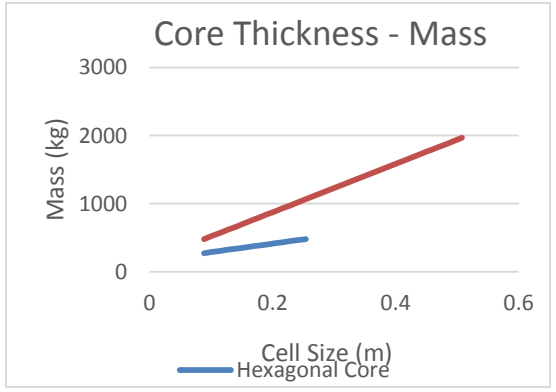






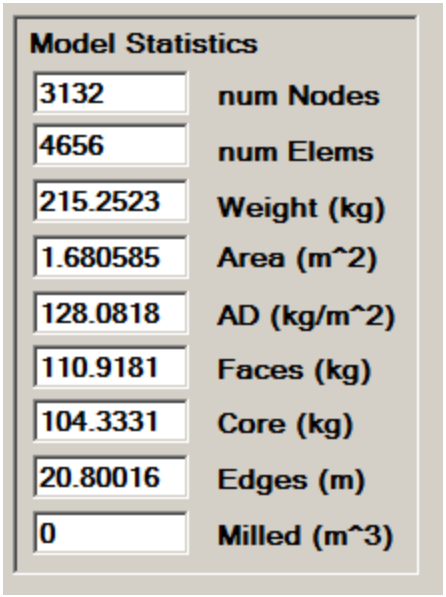






Cost and Risk Estimation

- **Costs**
  - Initial fabrication costs
  - Transportation and handling costs
  - Optical processing costs
  - Testing costs
  - Coating costs
  - Integration into satellite costs
  - Launch costs



- **Risks**
  - At each stage what happens if damaged

Tools Being Developed

- Integrated Optical Analysis System
  - Standardized inputs
- Thermal Analysis System
  - Shares models with structural analyses tools
- Structural Analysis Tools
  - Arnold Mirror Modeler supports commercial FEA packages and both monolith and segmented mirror and support systems.
- Cost and Risk Assessment Tools

Path Forward

- Continue integration of various design tools
- Mature likely manufacturing methods
- Explore new materials or refine existing methods for 4 meter class mirrors and beyond
- Explore segmented versus monolith rationale

Summary & Conclusions

- The goal is the design of a realistic next generation successor to the James Webb Space Telescope.
- Applying systematic approach
- Byproducts of effort useful to all aspects of telescope design … terrestrial or space.