Commercial Laser Communication Terminal Optic Mount Design

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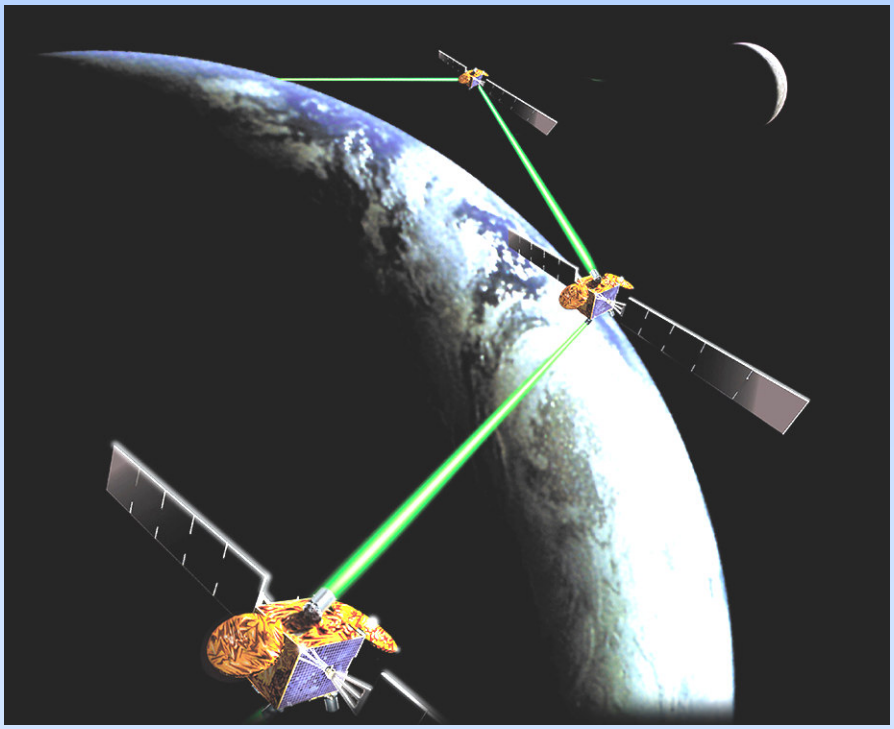
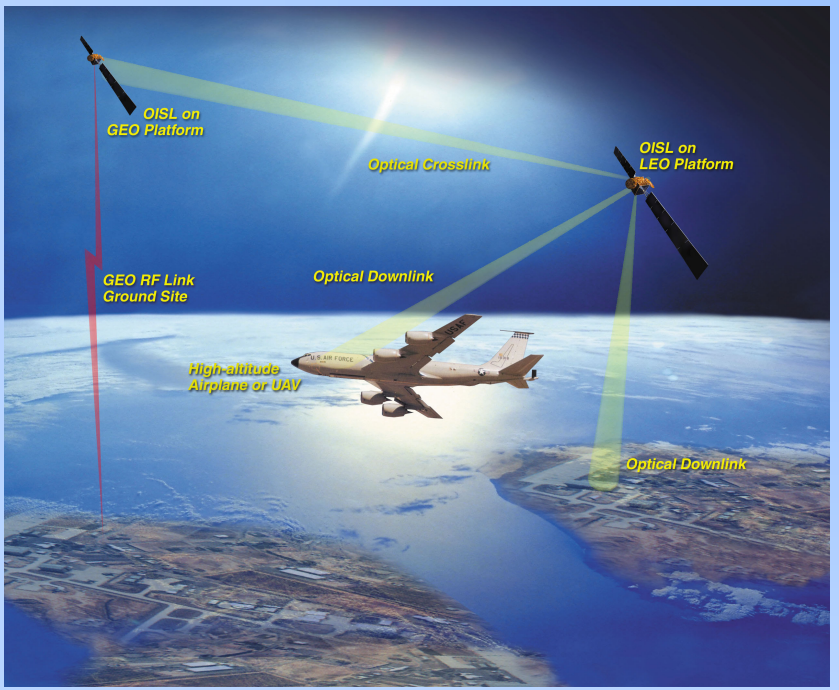
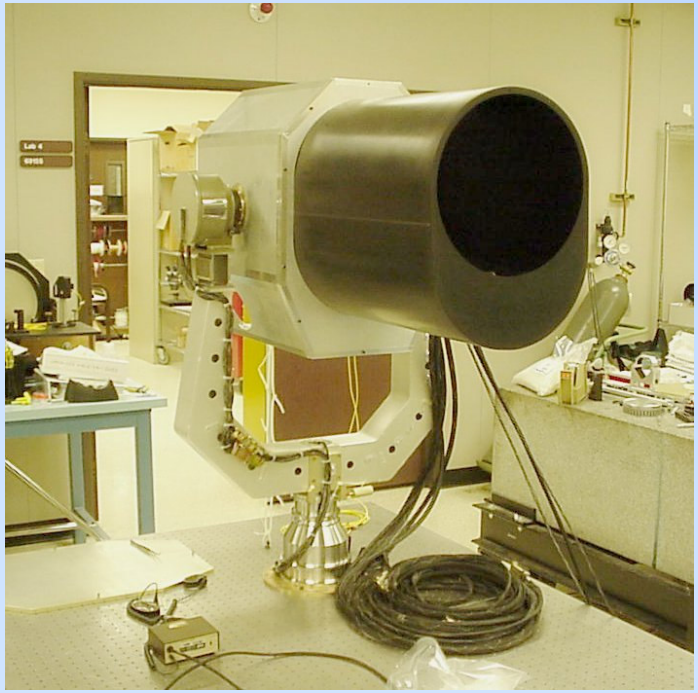


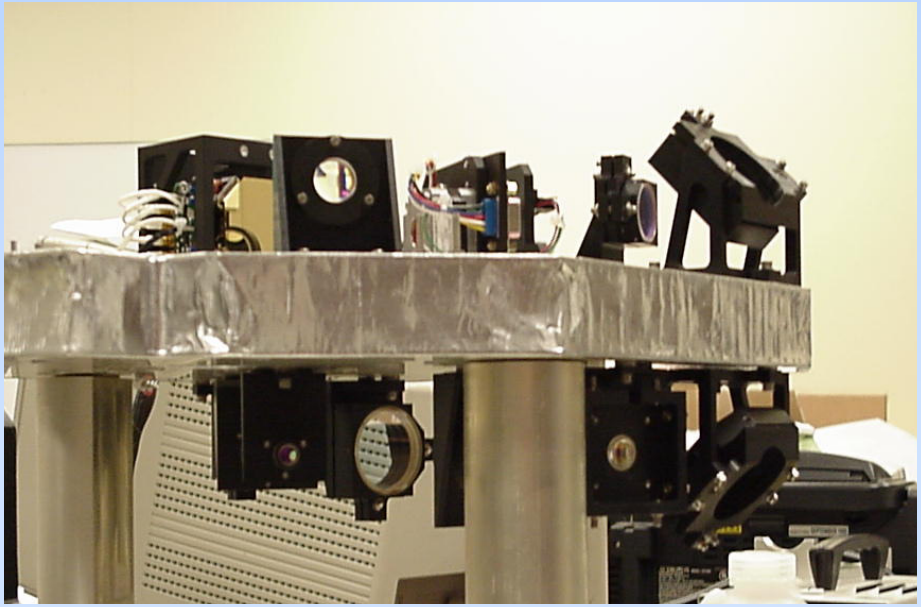
LaserCom

- Spacecraft, Satellites, Aircraft, and Ground Capabilities
- High Data Rates
- More Secure Transmissions



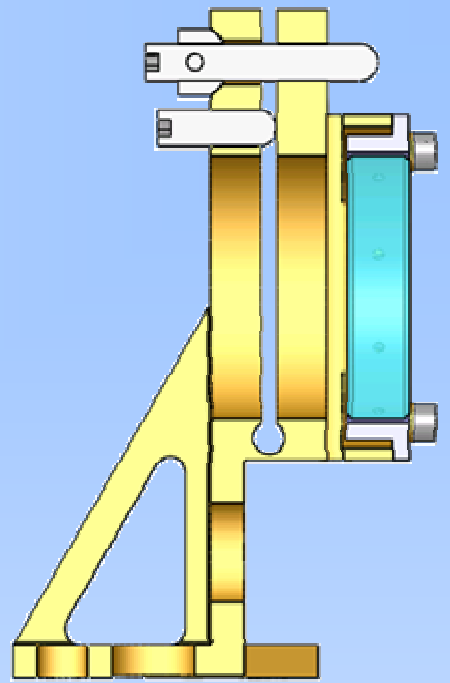
CLCT Demo

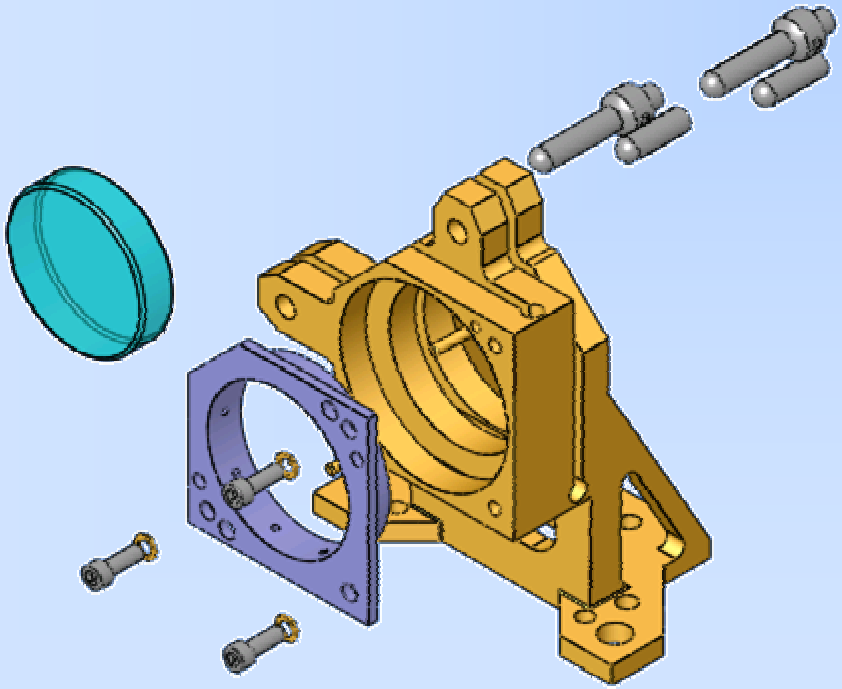


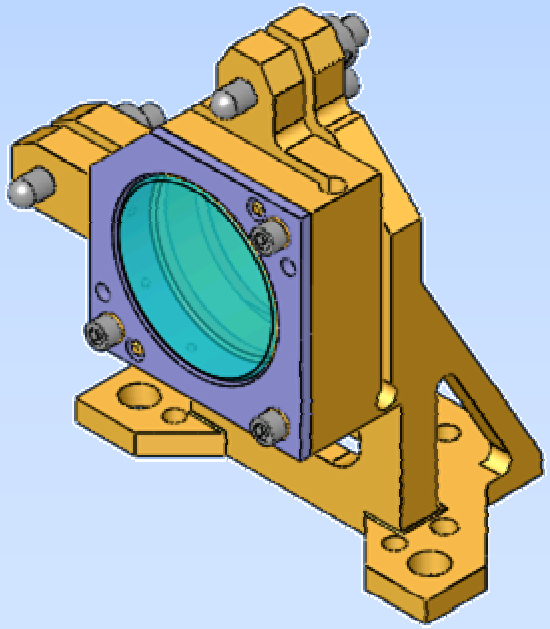


Mount Assembly

- Tip-Tilt Mount
- Titanium Mount and Bezel
- Applicable to Reflecting and Refracting Optics
- Adjustable to Different Optic Shapes and Sizes
- Assembly Weight Approx. 0.18 lb (80 g)

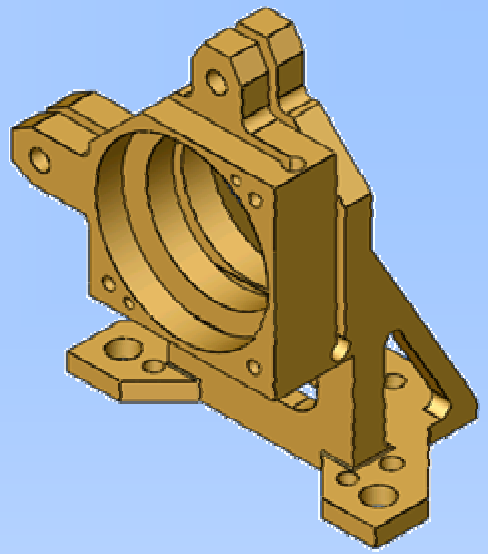






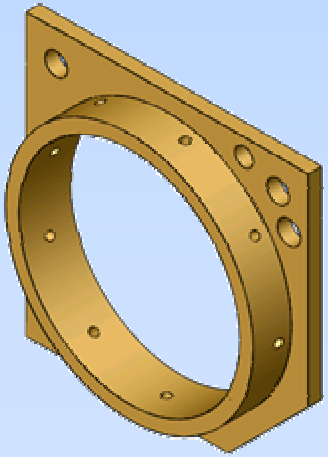
Mount Design

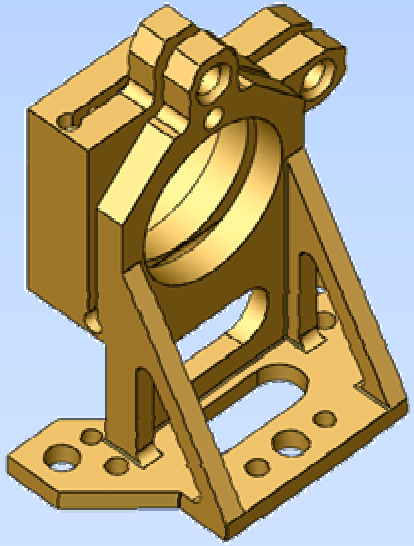
- Basic Dimensions: 2.5” x 2.3” x 1.9”
- Solid Titanium Piece
- ±1° Flexure Movement on Two Axis
- Modeled After CLCT Demo Mount



Bezel Design

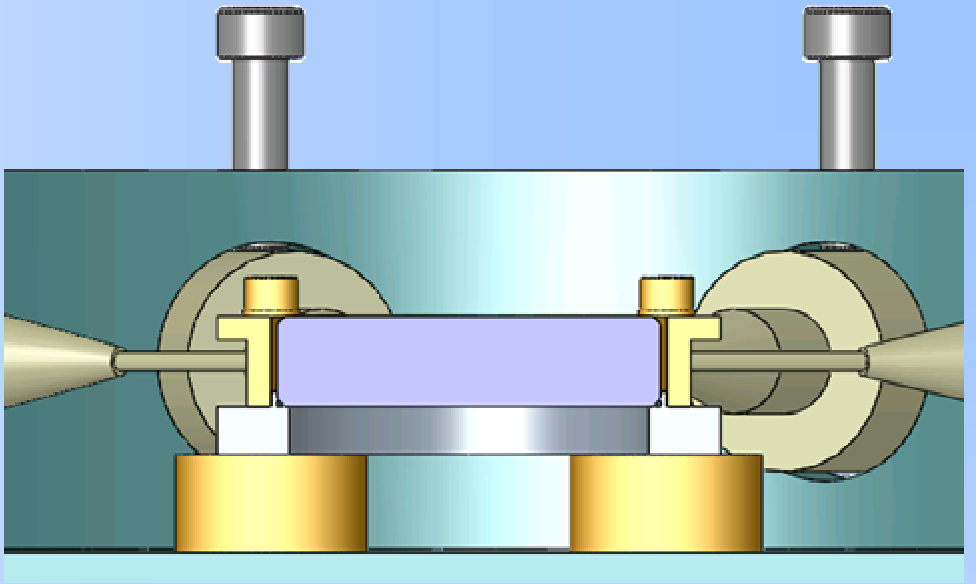
- Basic Dimensions: 1.3” x 1.3” x 0.2”
- 1/16” Thick
- Solid Titanium Piece
- Circumferential Bond
- Athermal Design

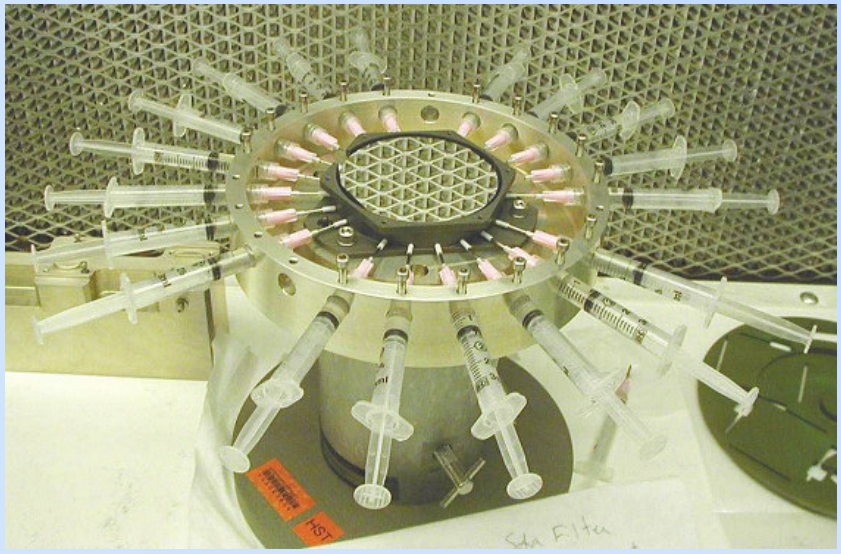


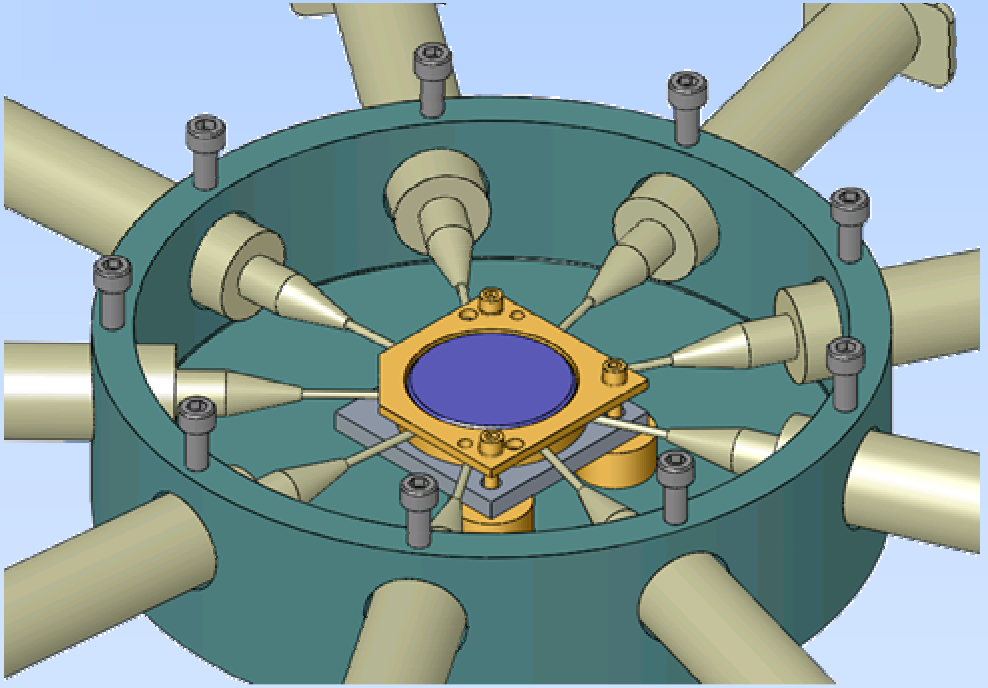


Bonding Set-Up

- Optic Bonded with PR 1564
- 0.4 mm Bond Thickness
  - Minimizes Thermally Induced Stress on Optic

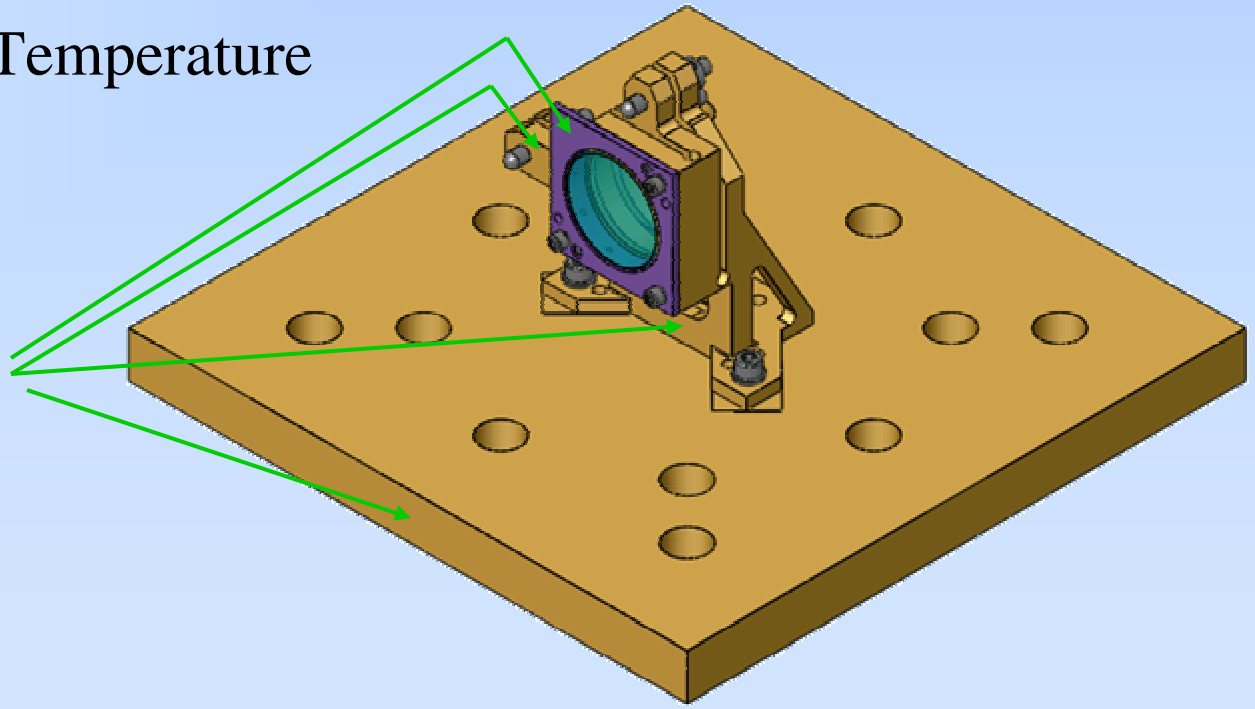






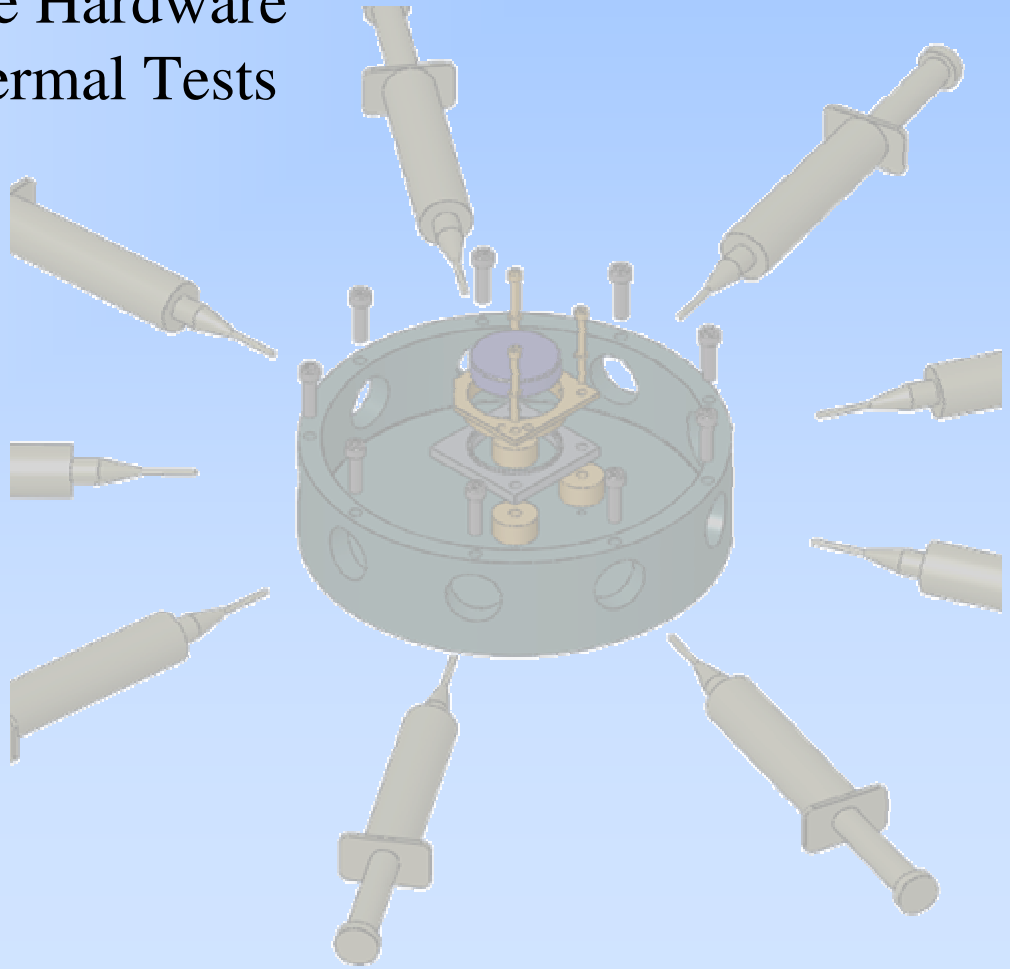
Test Set-Up

- Testing
  - Optic to Bezel Adhesion
  - Bezel to Mount Interface
  - Mount Flexure to Mount Base
  - Mount Base to Base Plate Interface
- Thermal Cycles
  - Survivability
  - Operational Temperature
- Vibration



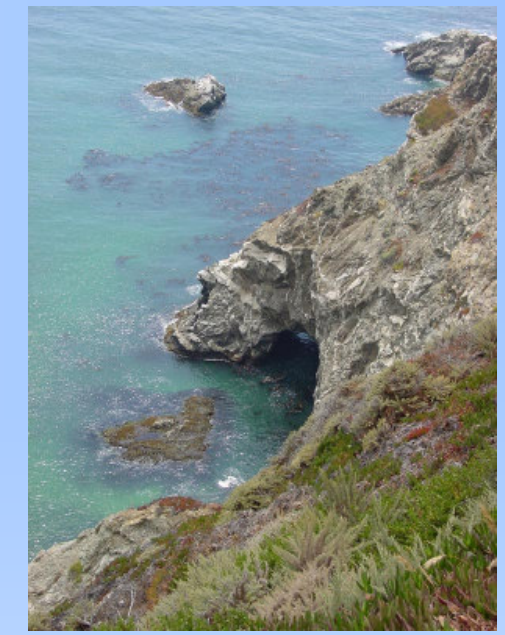
Future Work

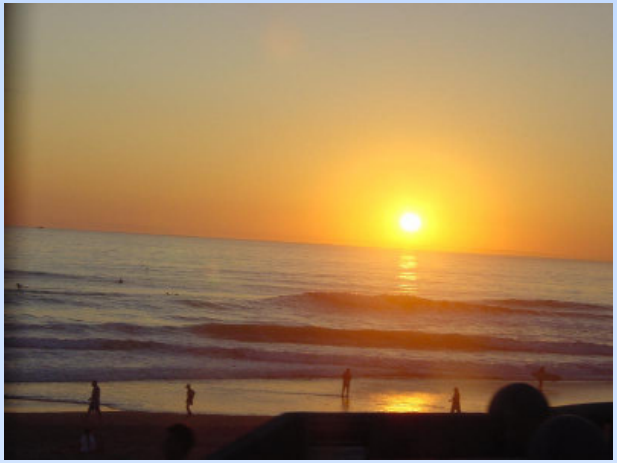
- Release Drawings
- Prepare Bonding and Test Procedures
- Manufacture and Assemble Hardware
- Perform Vibration and Thermal Tests



What I Learned

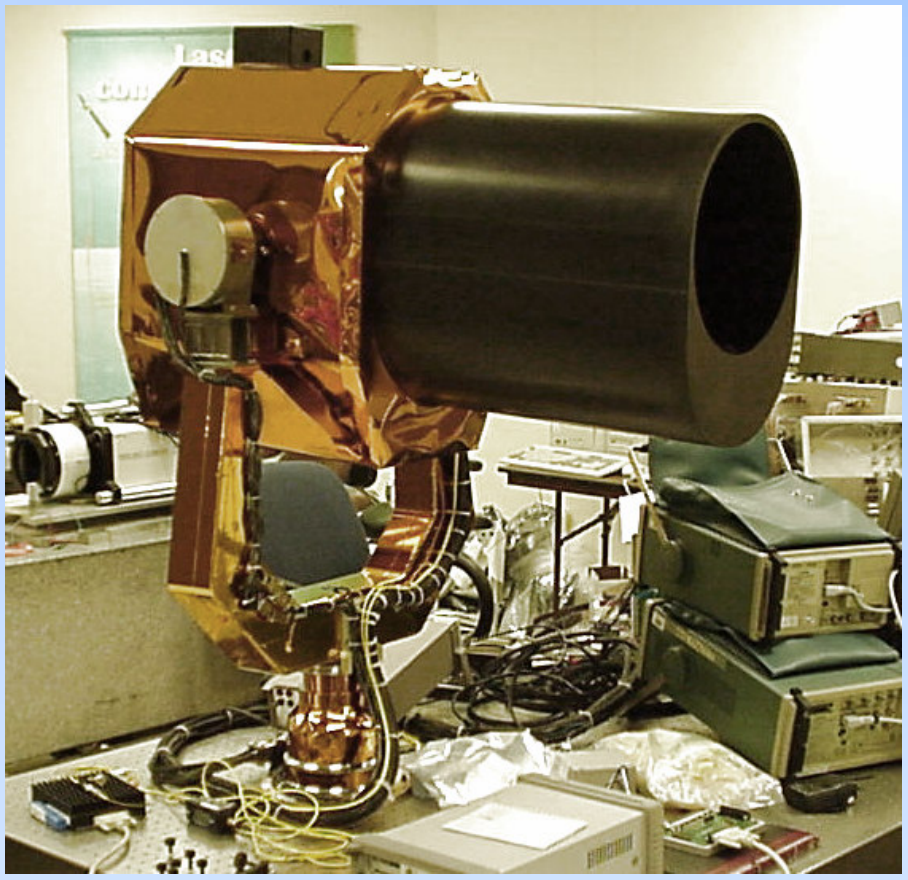
- SolidWorks
- Design Process
- Effort Put into Flight Hardware Design
- How to Make Drawings
  (GD&T)



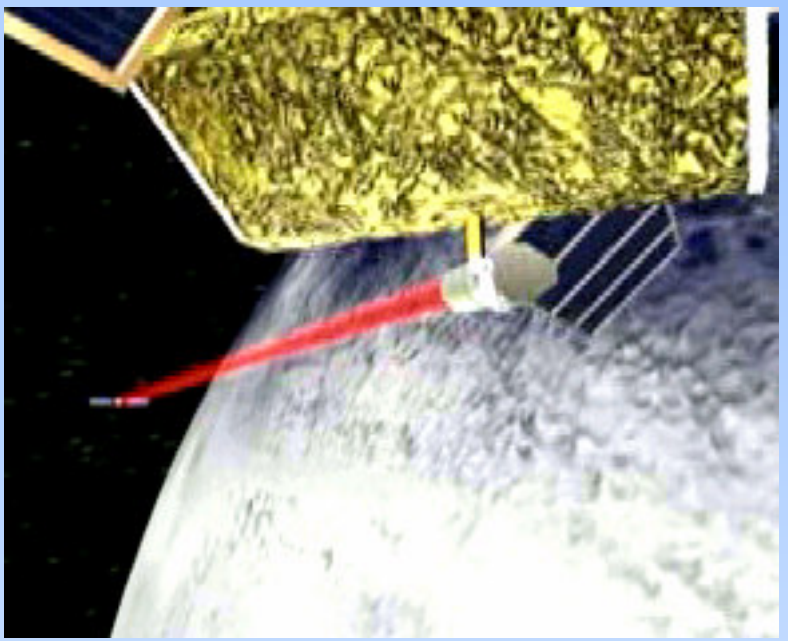


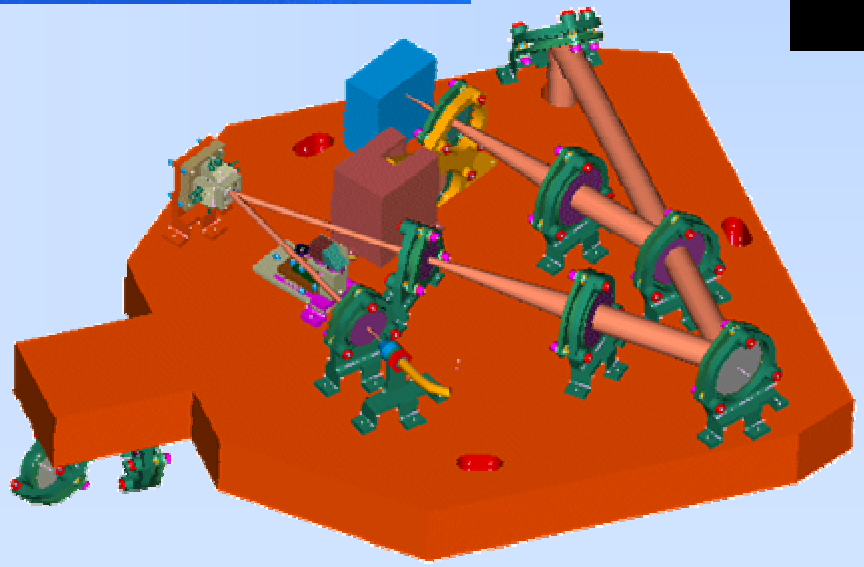
Thank You

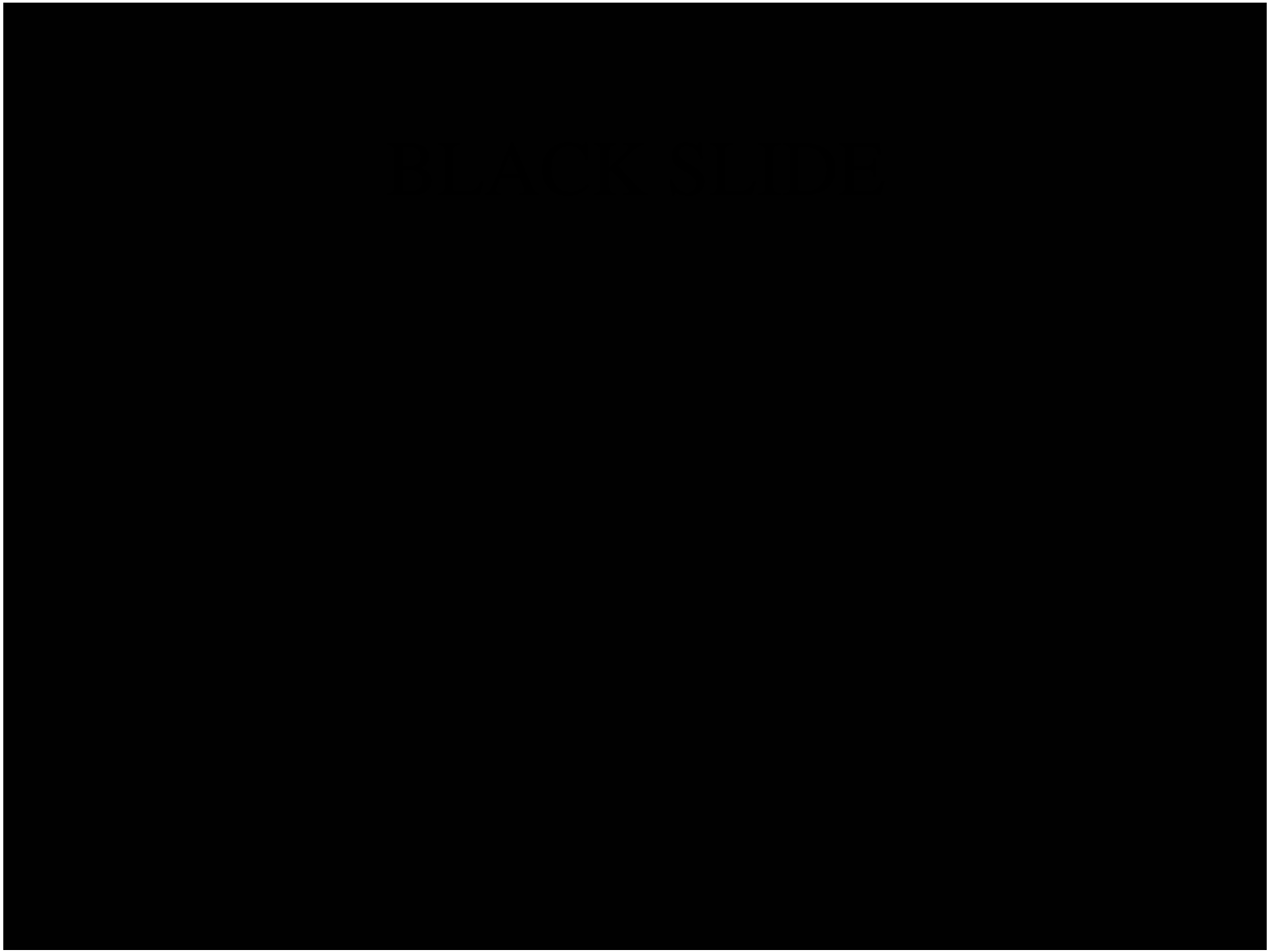
Mike Davis
Miro Ostaszewski
Scott Woolaway
Beth Kelsic
Suzanne Delchamps



Questions?

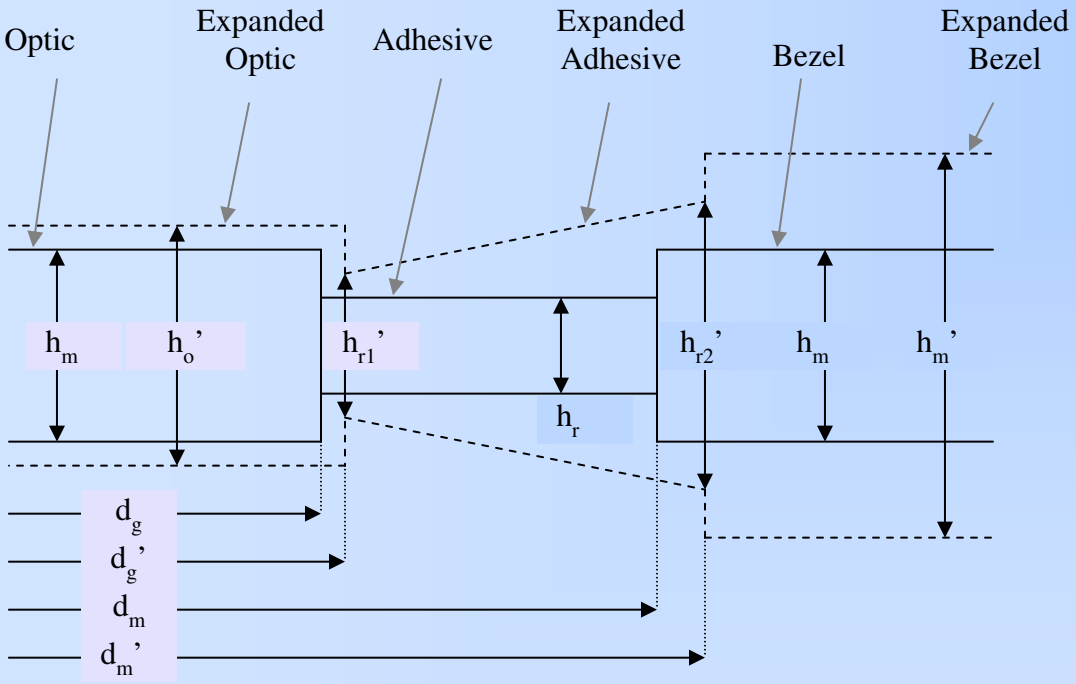






Thermally Induced Stress on Optic

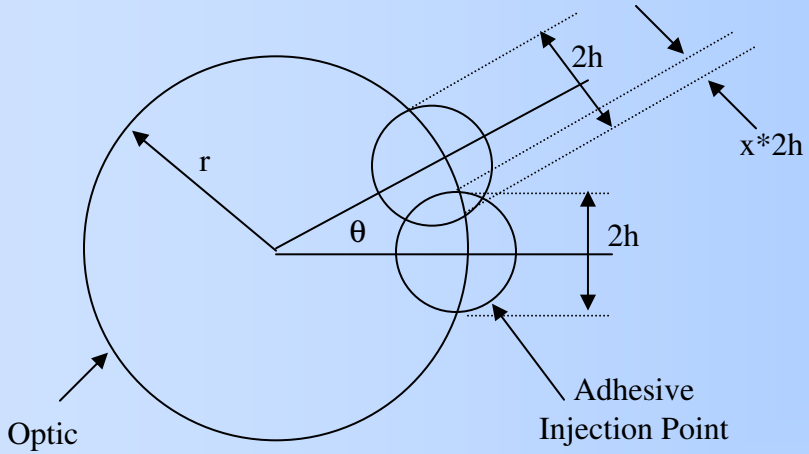
- Assume the adhesive only moves due to optic and bezel movement
- Calculate the shear stress on the optic based on the change in the angle of the glue wrt the optic
- Calculate the original and expanded volumes of the adhesive
- Compare the calculated volume with the volume the adhesive wishes to be based on its CTE

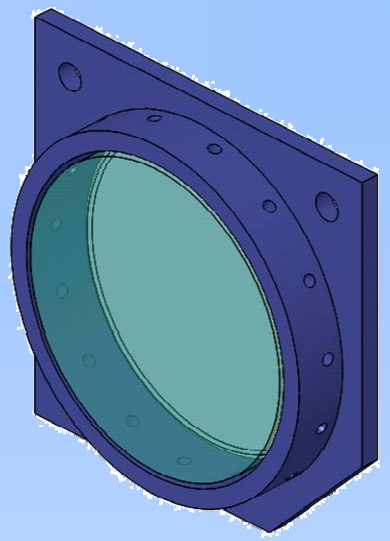


h_m : optic and bezel height
h_o' : expanded optic height
h_{r1}' : expanded adhesive height on optic side
h_r : adhesive height
h_{r2}' : expanded adhesive height on bezel side
h_m' : expanded bezel height
d_g : diameter of the optic
d_g' : expanded diameter of the optic
d_m : inside diameter of the bezel
(based on Daniel Vukobratovich's zero stress on lens equation)
d_m' : expanded diameter of the bezel

Note: $x' = x(1 + \alpha_x(\Delta T))$

Insertion Holes





n : the number of holes required
h : the height of the optic
r : the radius of the optic
θ : the angle between the injection holes
x : the fraction of 2h that overlaps for each injection point

$$n = \frac{\pi\, r}{h(1-x)}$$