

Flexure Concepts for 40K

Metered Flexure Mount of Hardware for Cryogenic Testing

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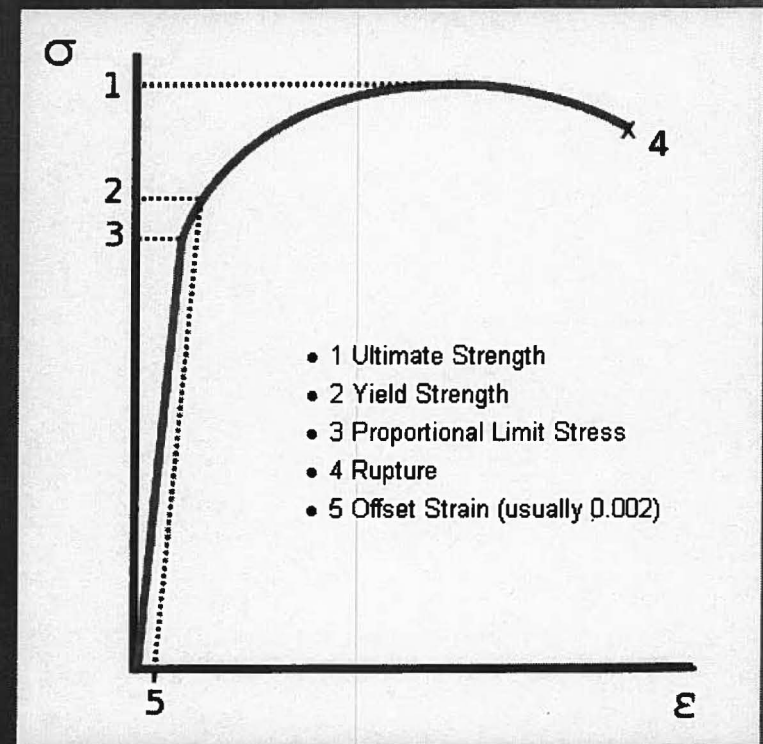
Design Challenge

- How do you kinematically mount an ultra-low CTE optical assembly for sub-40K metrology?
 - Factors of Safety of 3 on Yield / 5 on Ultimate
 - Typical Mounting materials are aluminum or stainless steel
 - Optical Assembly CTE: Aluminum CTE = 8
 - Optical Assembly CTE : SS CTE = 6

Yield vs Ultimate Strength

www.wikipedia.org

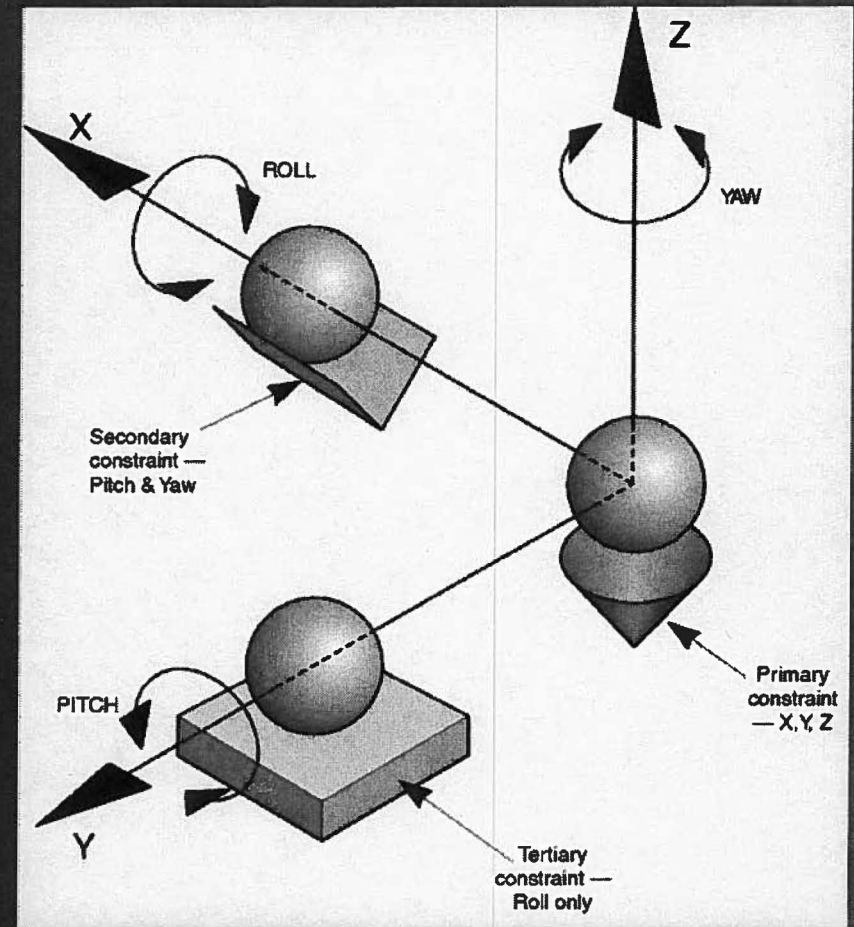
- **Yield Strength**: the stress at which a material begins to deform plastically
- **Ultimate Strength**: the maximum stress that a material can withstand while being stretched/pulled before plastic deformation



Kinematic Mount Review

www.newport.com

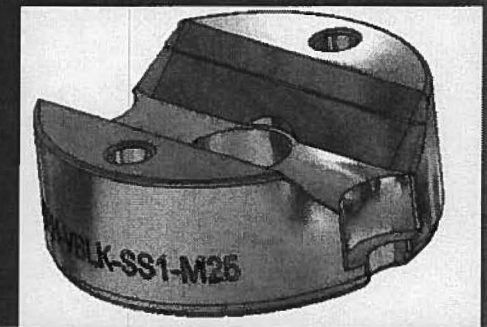
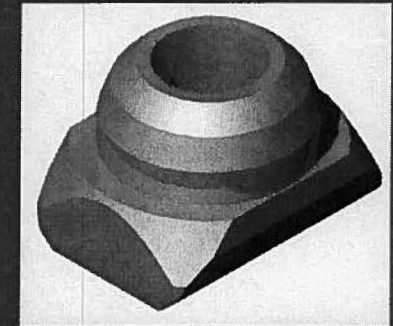
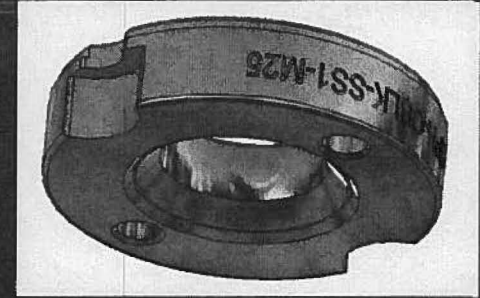
- Constrain 6 degrees of freedom (6-DOF) ... no more, no less
- Mounting system cannot impart a moment on the payload
- Only rigid body motions are observed in payload
- Disadvantages
 - Point Contact
 - Invariant Point is Ball in Cone



2-2-2 Kinematic Mount

www.gr-engineering.com

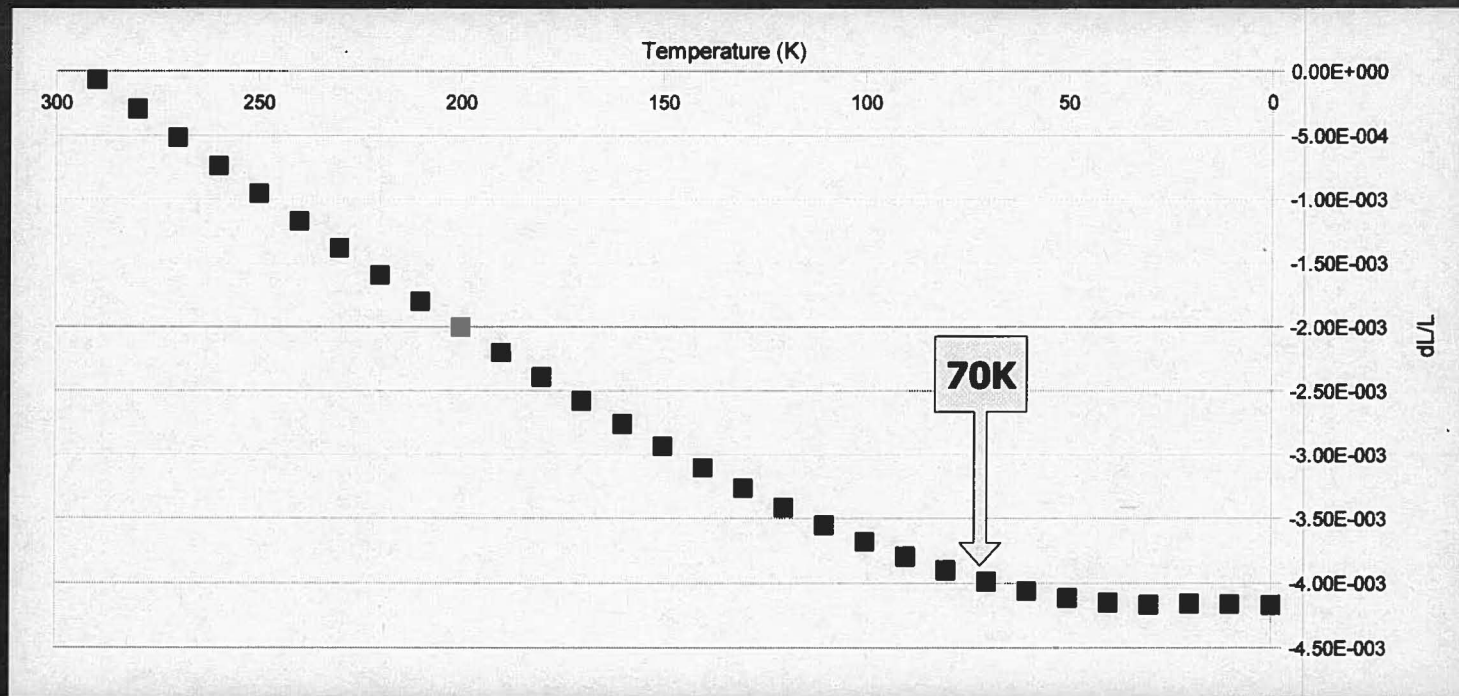
- Ball in a Cone (3-DOF)
- Cylinder in a Groove (2-DOF)
- Advantages ...
 - Same assembly at all three locations (modularity)
 - Line Contact distributes stress for increased load capacity
 - Invariant Point is chosen by designer



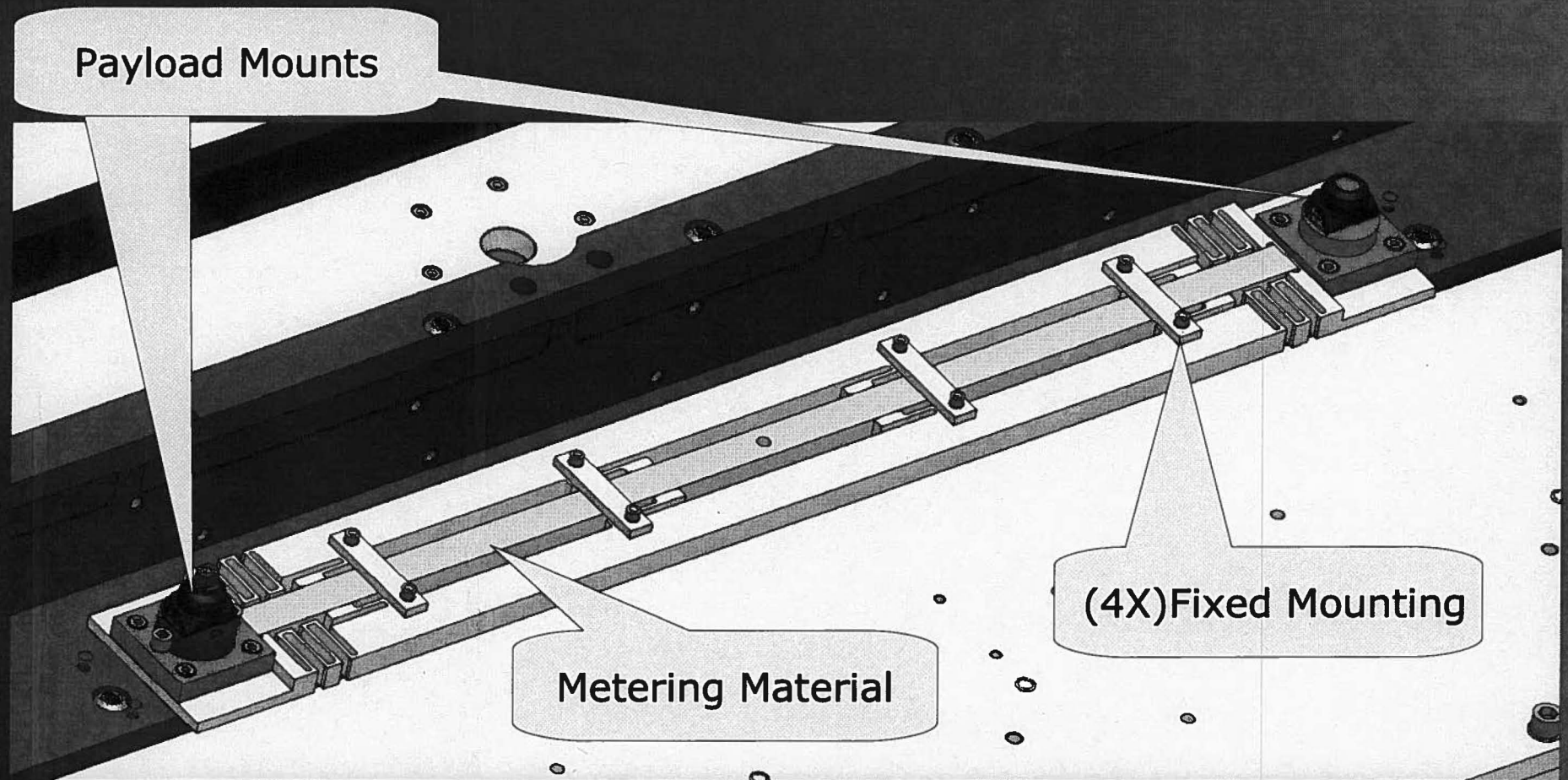
Sub-40K Target / 70K Properties

Material Property Reference: MIL-HDBK-5H, 1 Dec 1998 p3-364 and F.R. Schwartzberg, S.H. Osgood, R.G. Herzog, M. Knight, Cryogenic Materials Data Handbook (revised), v1, sections A, B, C, AFML-TDR-64-280, AD713619 (1970)

At 70K, deformation is at 95%



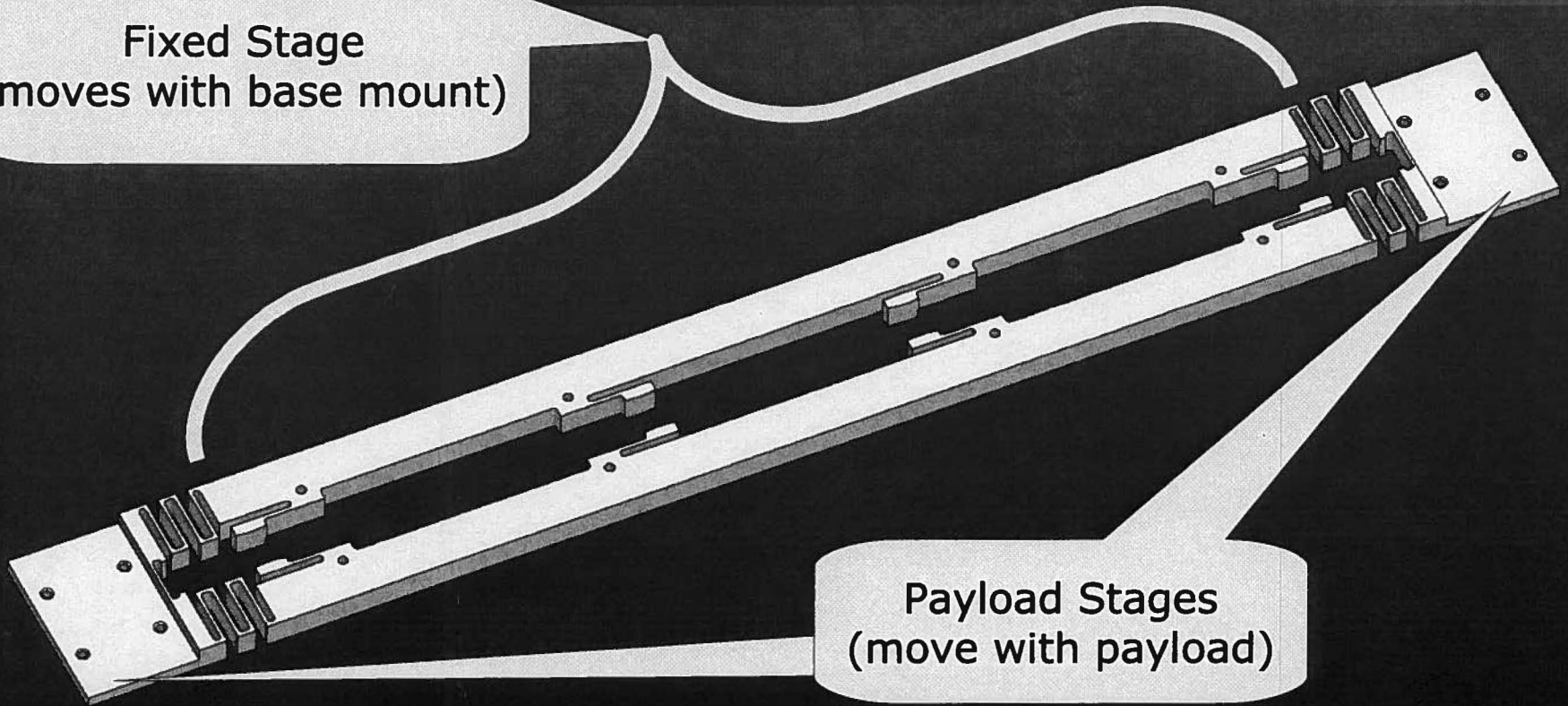
Metered Flexure Mount



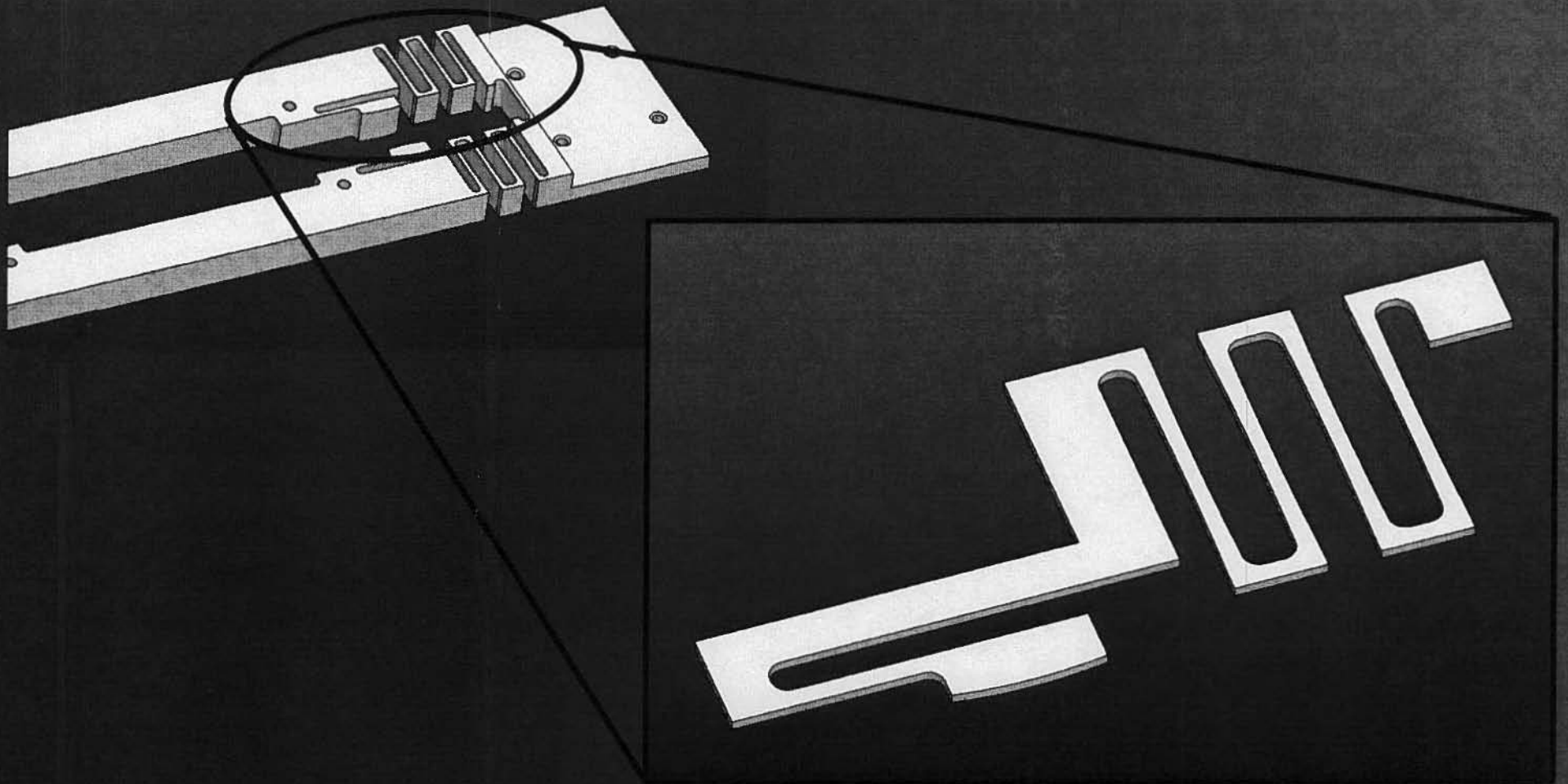
Metered Flexure Mount

Fixed Stage
(moves with base mount)

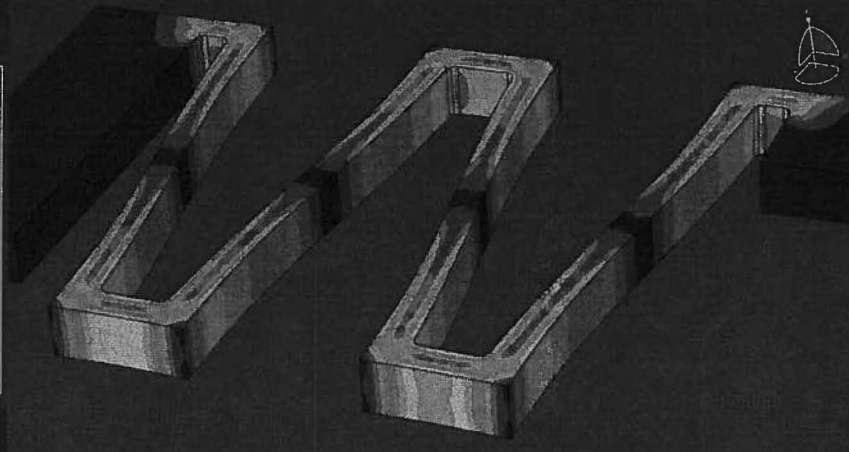
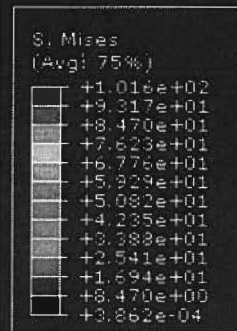
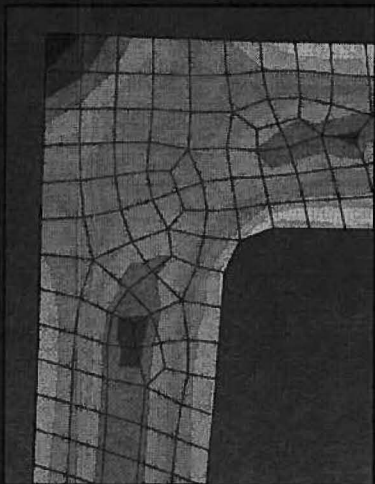
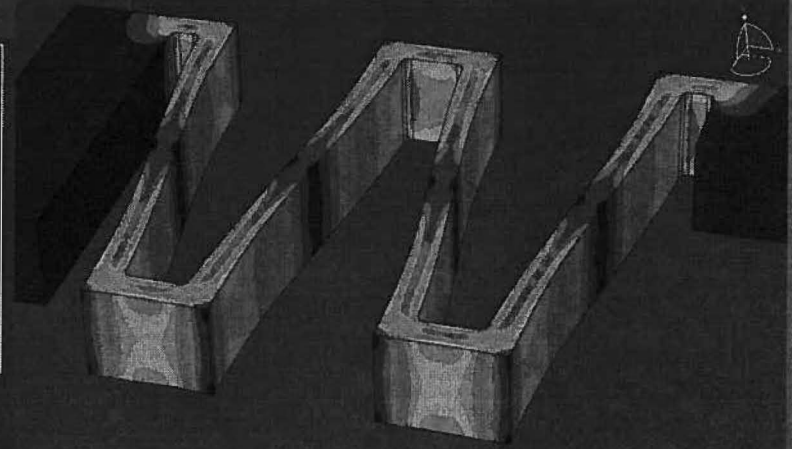
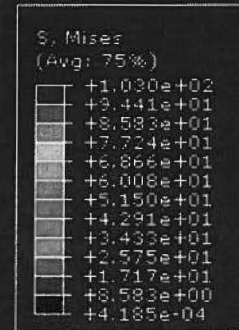
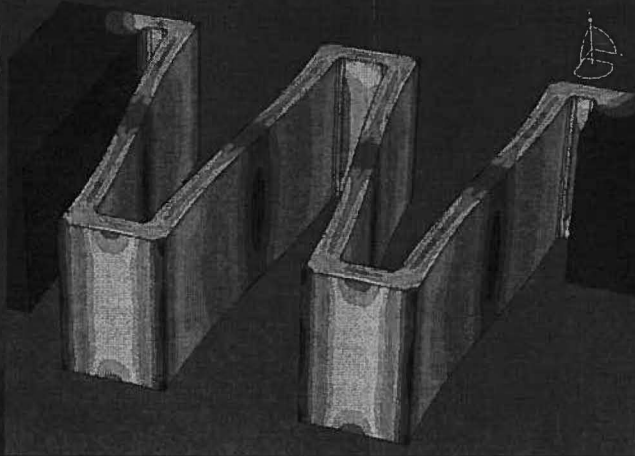
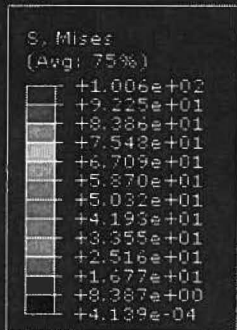
Payload Stages
(move with payload)



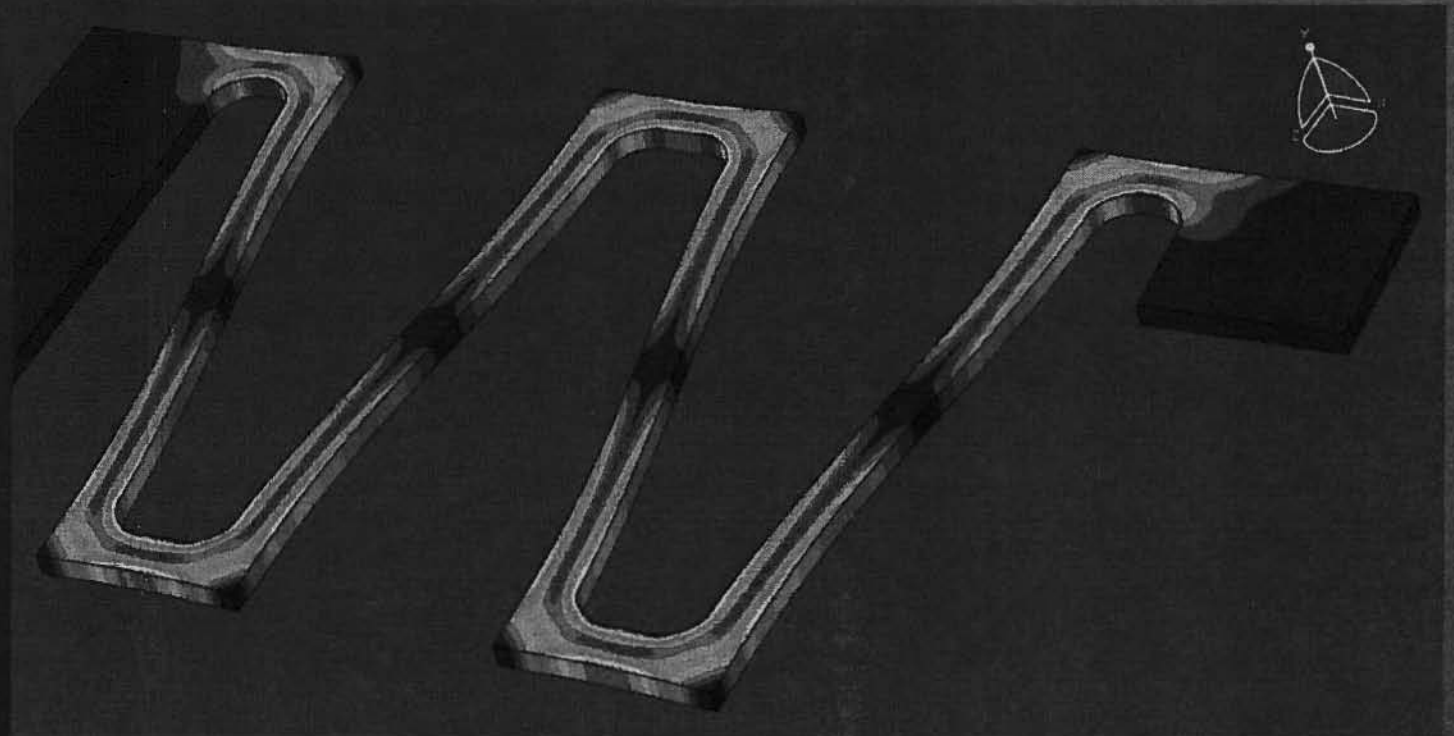
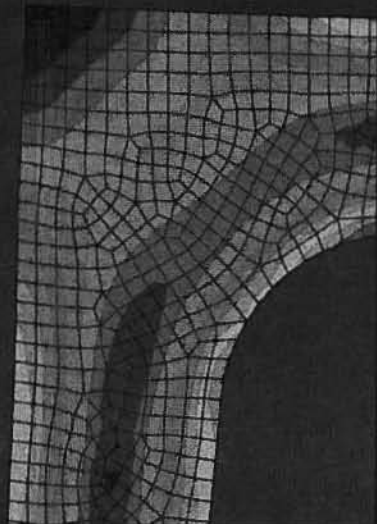
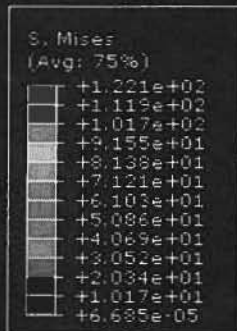
Symmetry Helps with Analysis



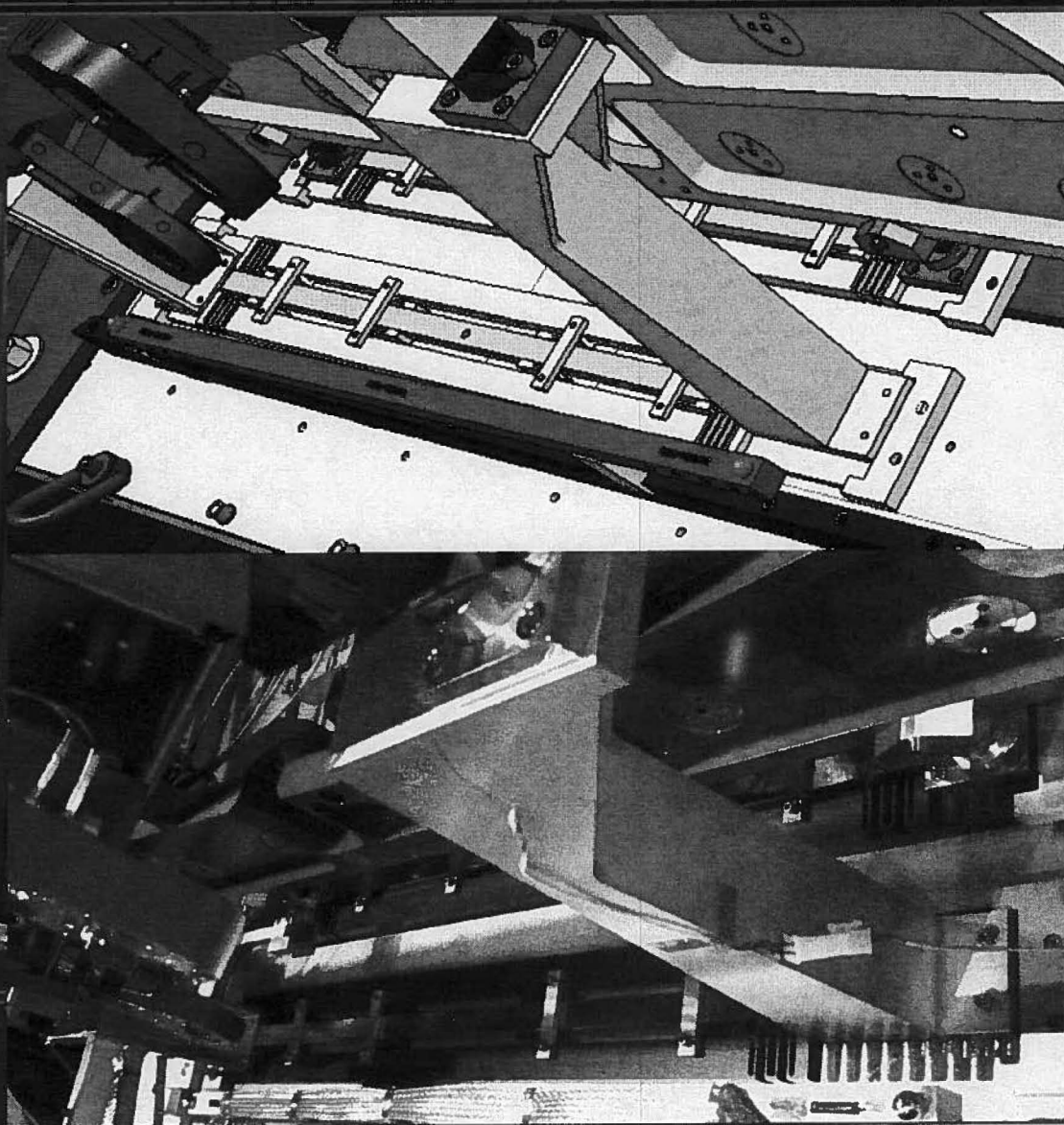
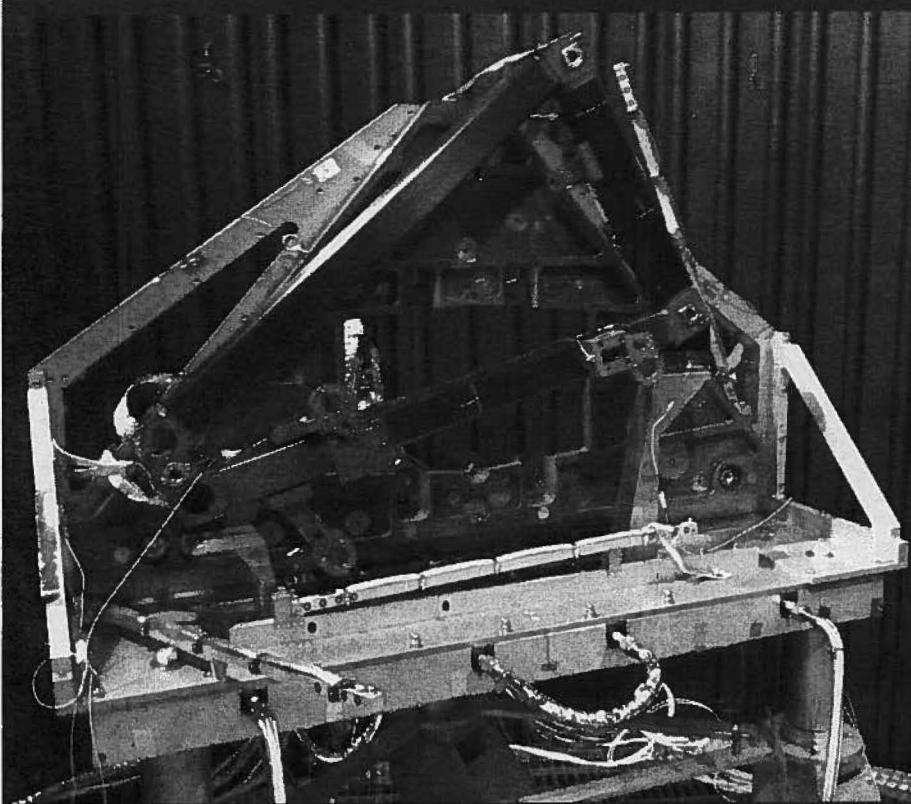
Is this a 2D Problem?



Final Analsys Run



Did It Work?



What's Next?

- Metered Flexure Mount in 6-DOF System

