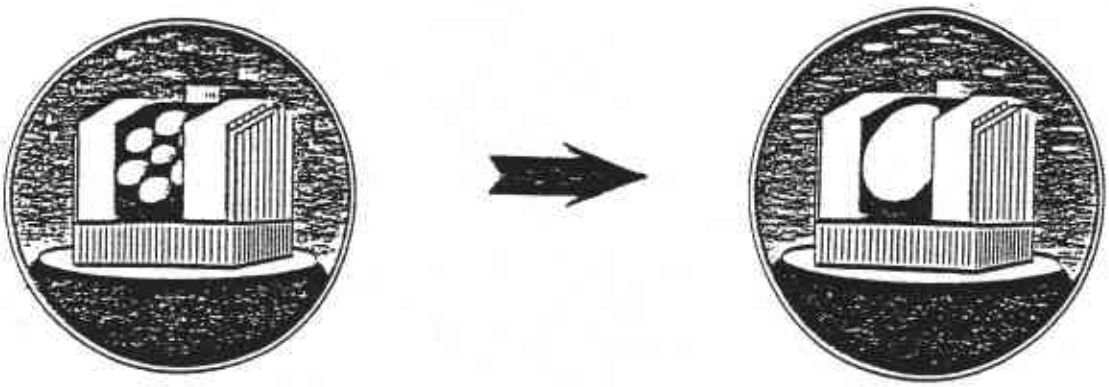
6.5 METER TELESCOPE



MMT Conversion Technical Memorandum #94-2

Two-Puck Loadspreader: Stress Due to Ball Decoupler Failure

Shawn Callahan

February 1994

Two-Puck Load Spreader: Stress Due to Ball Decoupler Failure

Shawn Callahan, MMTO
February 8, 1994

1.0 Abstract

This report examines the stress in the glass and in the load spreader flexure from forces applied to the mirror due to a ball decoupler failure.

The results of this analysis show that a ball decoupler failure will cause a maximum stress in the glass of 0.79 MPa (113 psi).

2.0 Introduction

The following analysis calculates the maximum force that can be applied by the actuator perpendicular to the load spreader at the ball decoupler before the load spreader flexure begins to yield. The stress in the glass at flexure failure is determined as well as the deflection of the flexure.

Giancarlo Parodi has calculated that the stress in the mirror reaches 0.7 MPa (100 psi) when 12,000 N-mm of torque is applied to a single puck. If we assume that force applied perpendicular to the load spreader is equally transmitted to both pucks, the maximum force that can be applied to the load spreader at the ball decoupler is 2 x 12,000 Nmm/300mm = 80 N (18 lbs).

A finite element model was created to determine the maximum stress in the flexure when an 80 N force is applied 300 mm above the back of the mirror. The ball decoupler is roughly 300 mm above the back of the mirror.

3.0 Model results

The finite element model in Figure 2 shows that an 80 N force causes a maximum stress in the flexure of 598 MPa. The yield strength of 4340 steel is 682 MPa. The current flexure will therefore begin to fail when (682/598) x 80 N = 91 N loads are applied perpendicular to the load spreader at the ball decoupler.

The corresponding stress in the glass at flexure failure is (91/80) x 0.7 MPa = 0.79 MPa (113 psi).

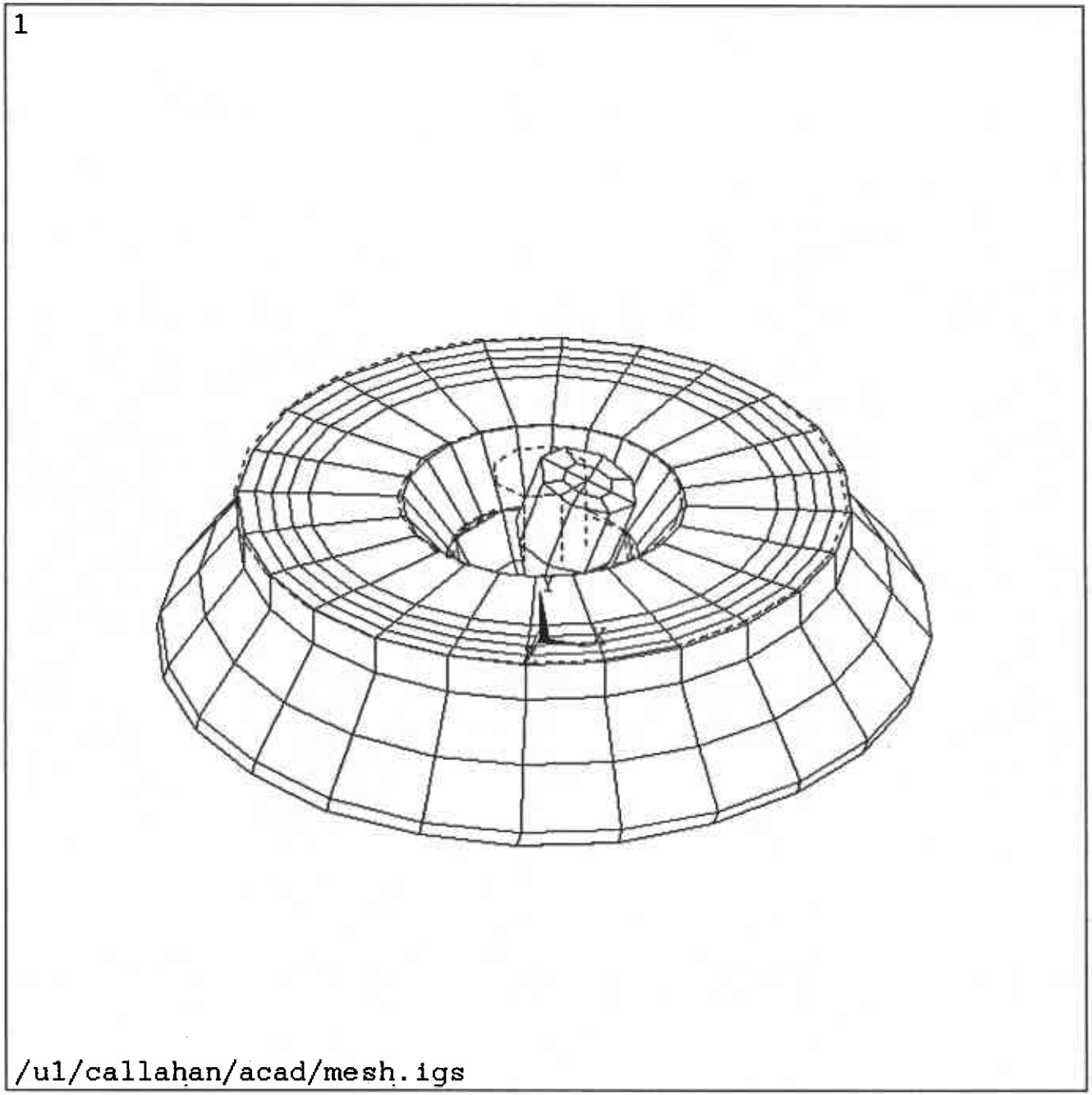
The model predicts that the angular deflection of the load spreader with 80 N side loads is 0.34 degrees or 1.8 mm at the ball decoupler.

4.0 Summary

The above results show that the current flexure of the two-puck load spreader will yield before excessive stress is applied to the mirror. The stiffness of the puck flexure is also sufficient to assure that the flexure will fail before deflection causes the ball decoupler to reach the hard limits of its travel.

5.0 List of Figures

Figure 1



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SEPC=71.426

DSCA=196.685
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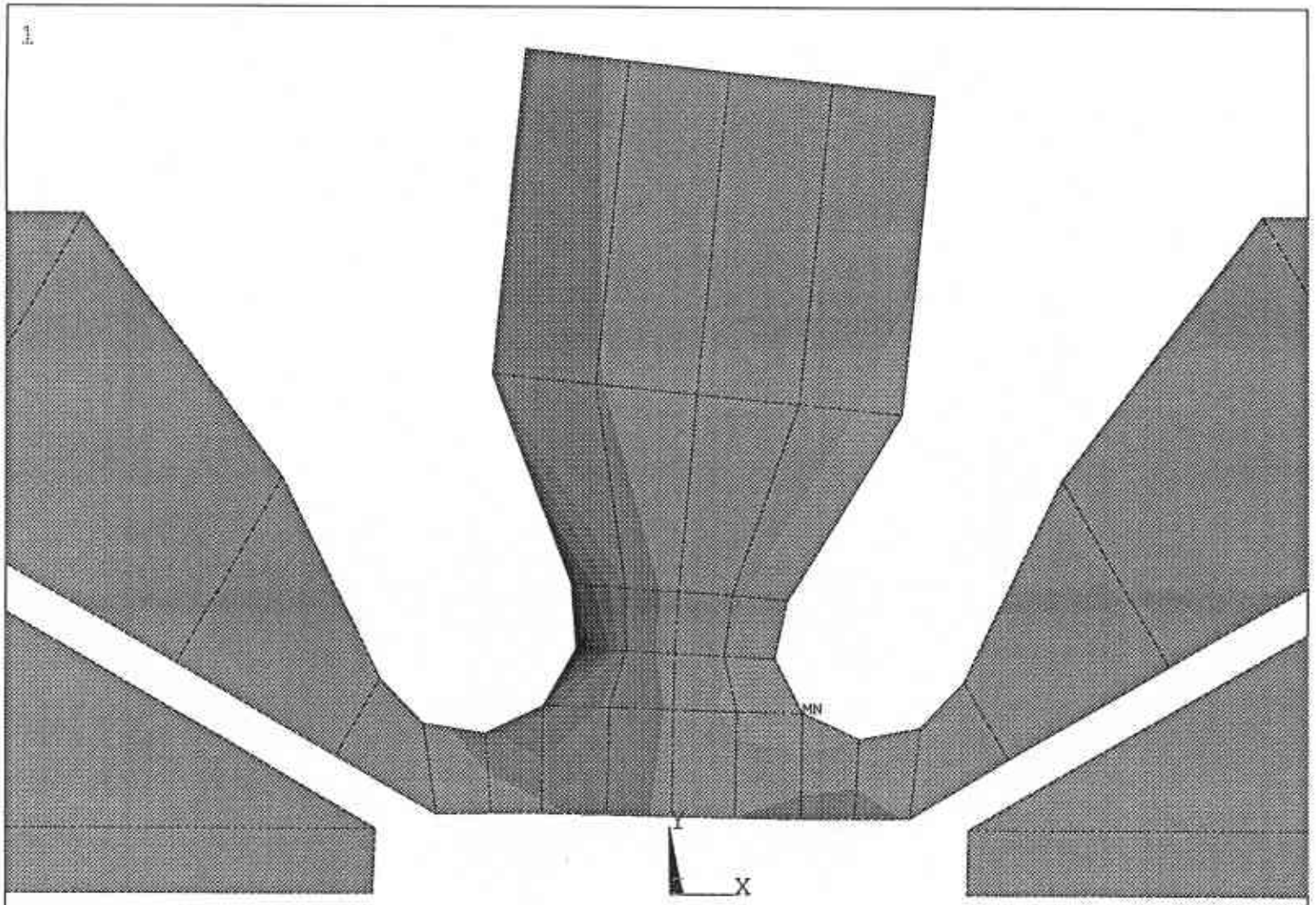
YF =13.931
CENTROID HIDDEN

Figure 2



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FEB 8 1994
11:11:49
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SMNB=-305.389
SMX =598.136
SMXB=861.448

-83.382
-7.658
68.066
143.791
219.515
295.239
370.963
446.687
522.412
598.136

/u1/callahan/acad/mesh.igs

Figure 3