

# Light weight silicon mirrors for space instrumentation

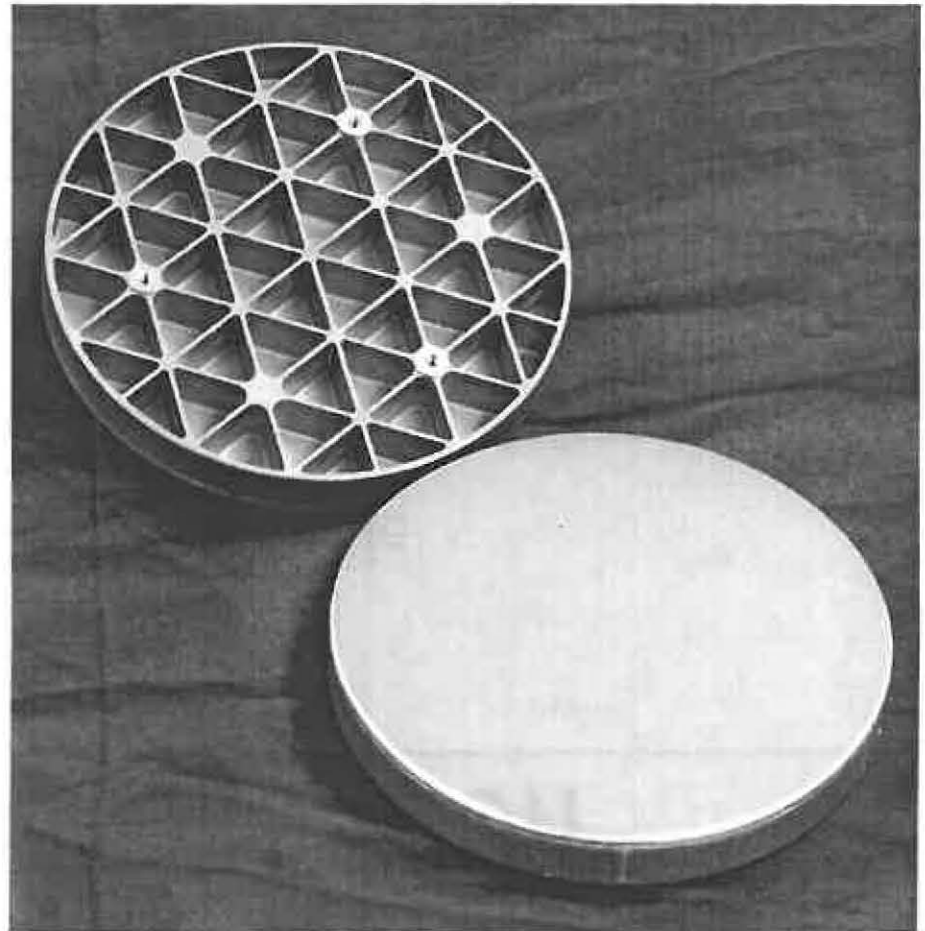
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Each mirror is a monolithic structure from a single crystal of silicon

The mirrors are light weighted *after* the optical surface is ground and polished

Mirrors made during the initial phase of this work were typically  $1/50 \lambda$  or better (RMS at 633 nm)



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## Steps in Initial Process:

- 1: Form a blank from a single crystal silicon boule
- 2: Heat treat the blank at 1250 C to heal crystalline damage caused by the sawing and grinding used to form the blank
- 3: Form the optical surface by conventional grinding & polishing
- 4: Bond a protector disk to the optical surface using stacking wax
- 5: Light weight the mirror using ultrasonic machining to form an isogrid pattern
- 6: Remove the protector and heat treat again to heal crystalline damage caused by the light weighting process

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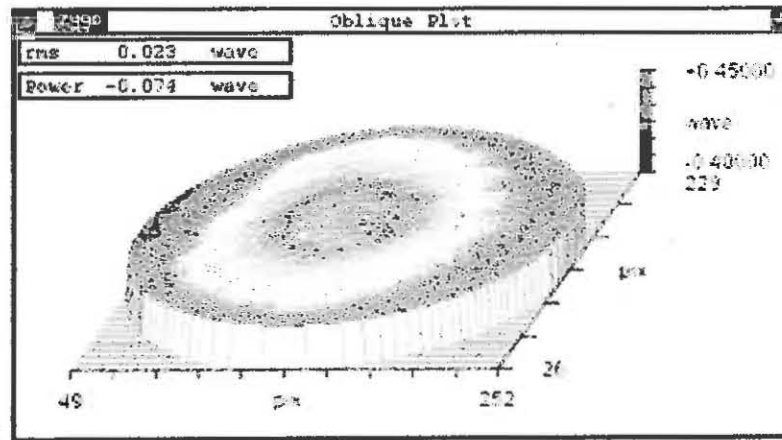


Figure before lightweighting

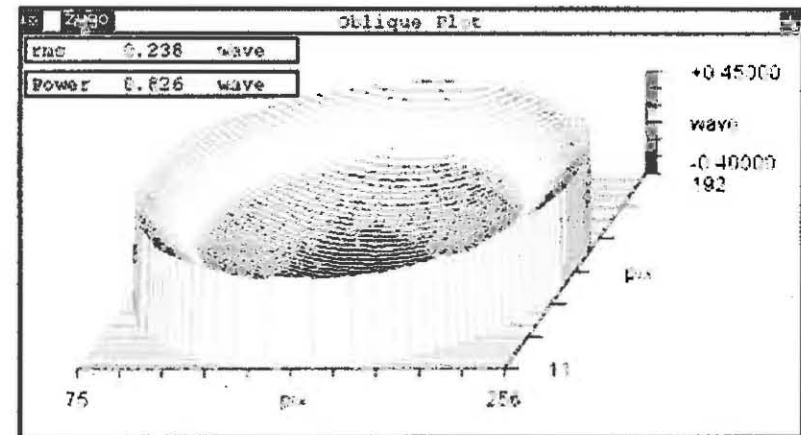
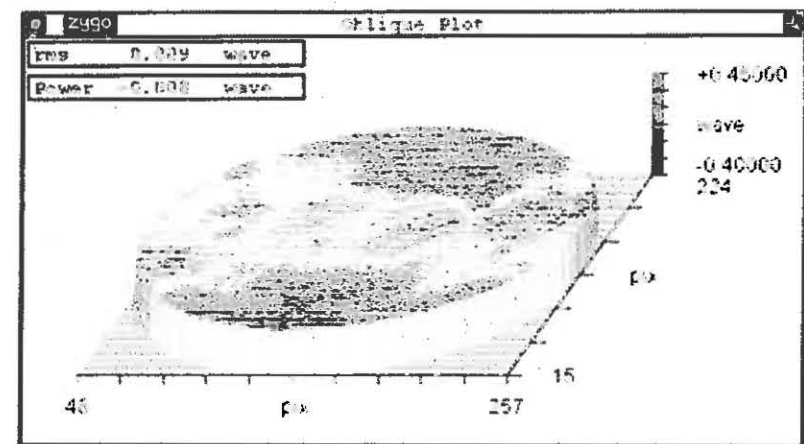


Figure after lightweighting,  
before heat treating

Figure after heat treating



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## CIRS-Lite Cassegrain Primary



Rear View (model)



Front View (photo)

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## TIRS Scene Mirror / Backside View



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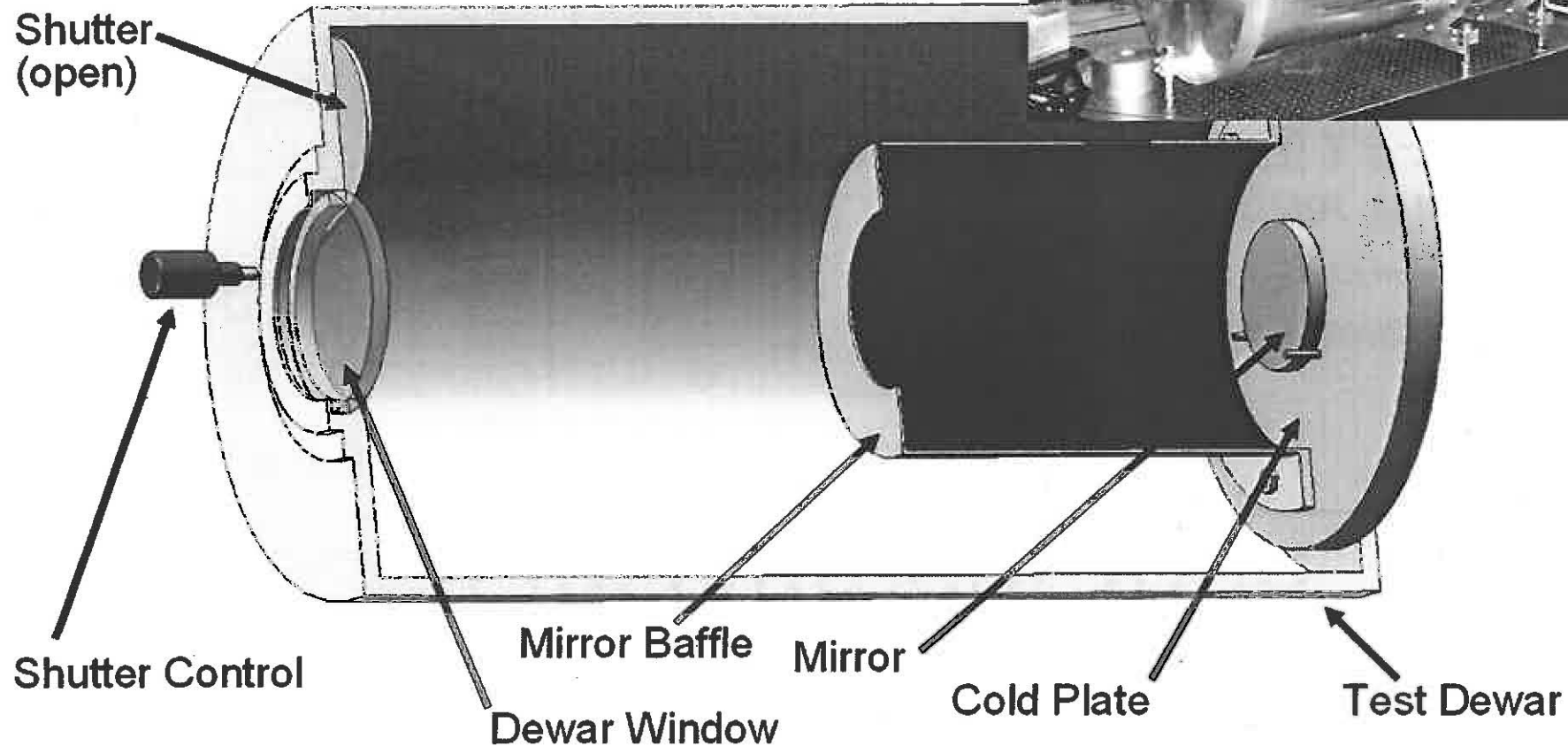
TIRS Scene Mirror / Front View



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## Cryogenic Test Facility

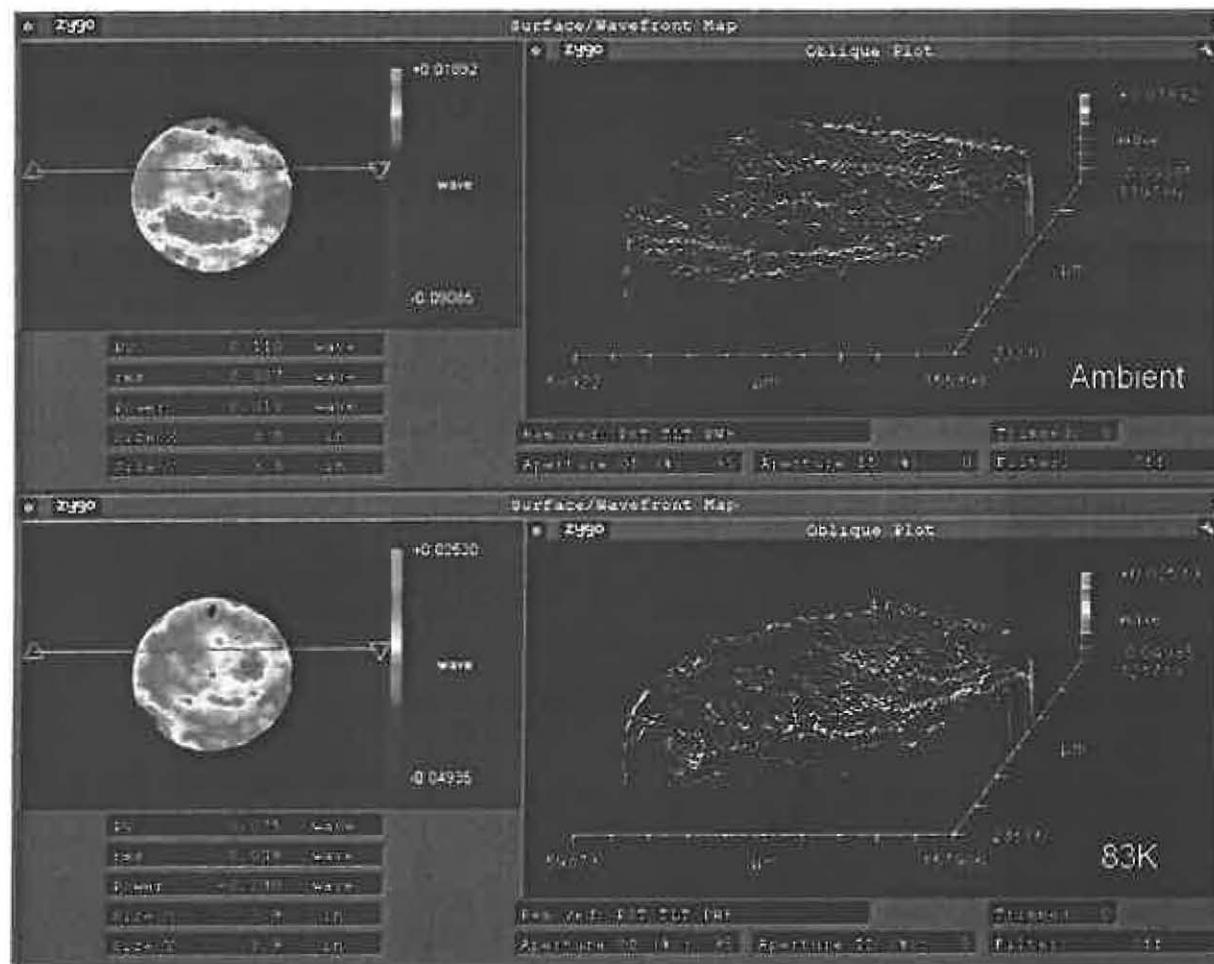




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Measured Change RT vs 83K w/o Power =  $0.001\lambda$



Actual Power Change  
After Compensating  
for Dewar Window  
=  $0.056 \lambda$  P-V,  
=  $\lambda/30$  RMS.



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## Flat Mirror with Side Mounting Ferrules

