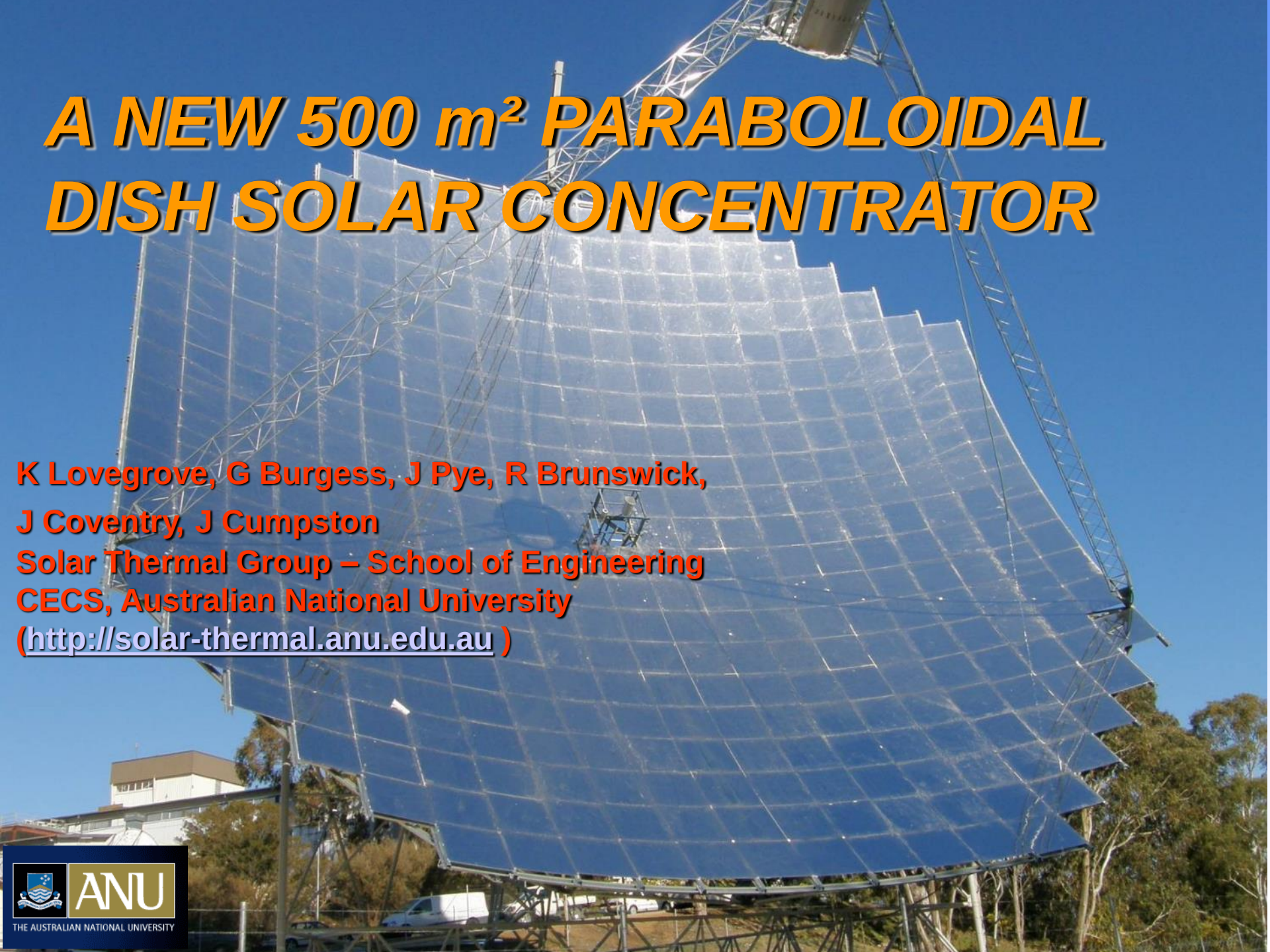
A NEW 500 m² PARABOLOIDAL DISH SOLAR CONCENTRATOR



K Lovegrove, G Burgess, J Pye, R Brunswick,
J Coventry, J Cumpston
Solar Thermal Group – School of Engineering
CECS, Australian National University
(http://solar-thermal.anu.edu.au)

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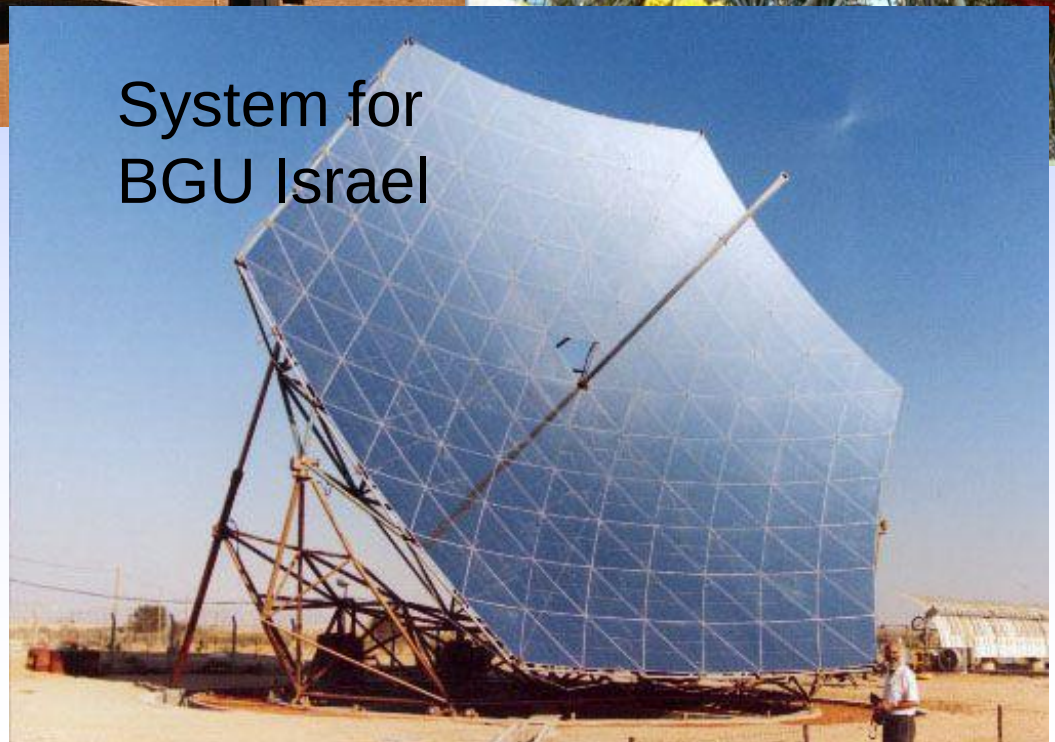
Solar Thermal at ANU

Old and new

Our history

White Cliffs – 14 x 20m^2 dishes

SG3 400m^2 Big Dish



System for BGU Israel

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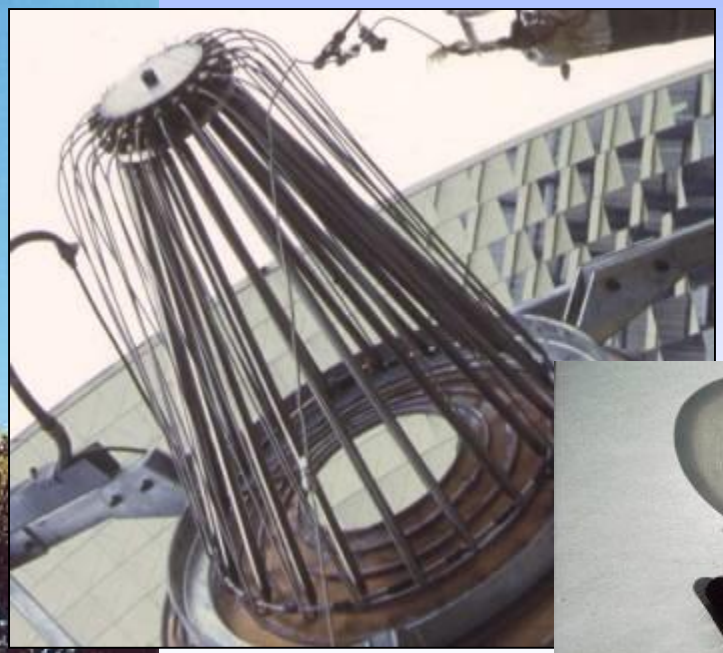
Why Dishes?

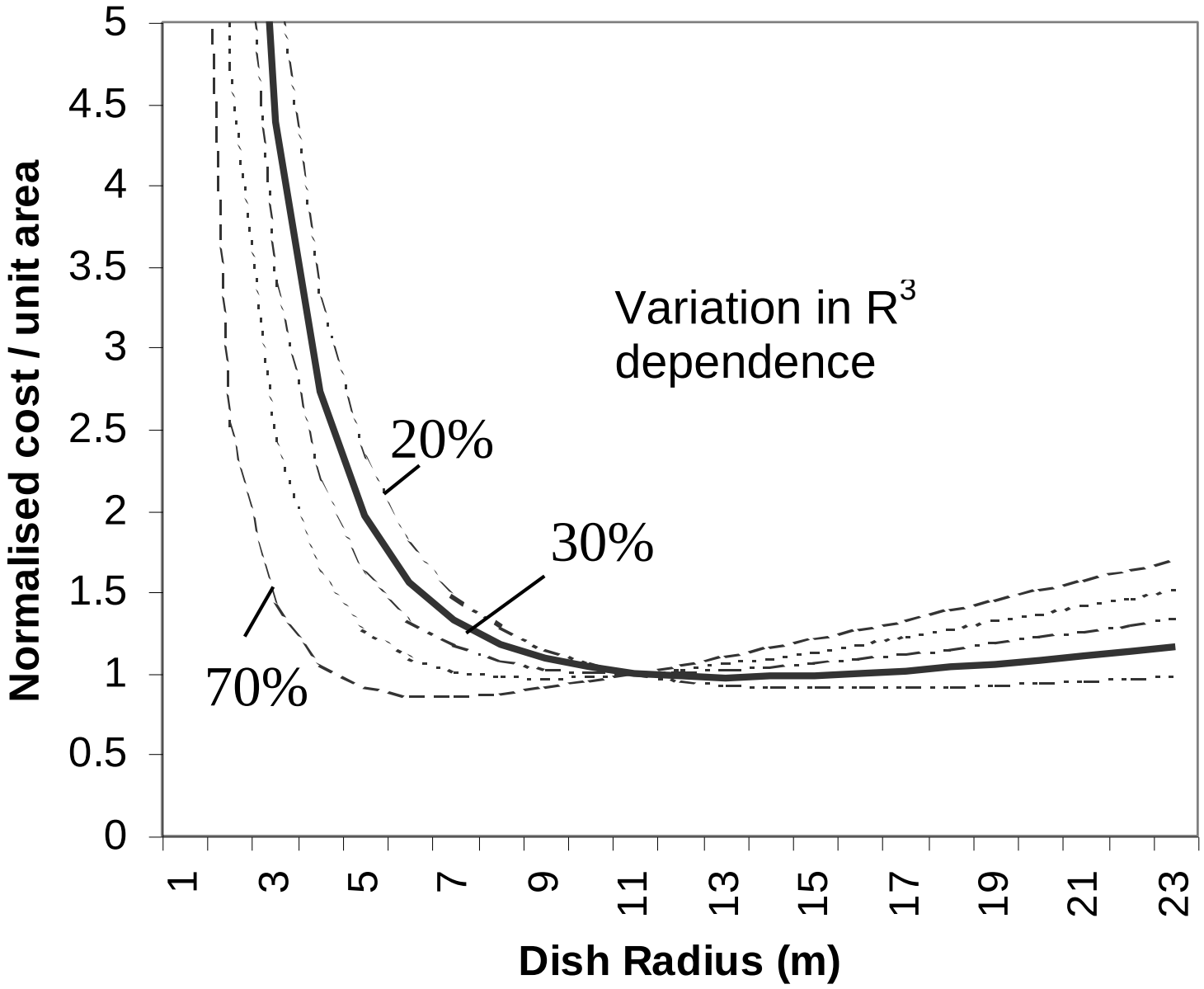
	Trough	Tower	
System	SEGs VI	SolarTres	Dish 10
	Serg&Lund	Serg&Lund	ANU
Size	30MWe	13.6MWe	10MWe
Solar Field Optical Efficiency	0.533	0.56	0.85
Receiver thermal efficiency	0.729	0.783	0.9
Transient effects			0.92
Piping loss efficiency	0.961	0.995	0.961
Storage Efficiency	1	0.983	1
Turbine power cycle efficiency	0.35	0.405	0.35
Electric loss efficiency	0.827	0.864	0.86
Power plant availability	0.98	0.92	0.94
Annual Solar to Electric Eff	**10.59%**	**13.81%**	**19.14%**

Why Dishes II?

- 1500+ suns = high temperatures = solar driven chemical reactions



Why Big Dishes?



The Gen II Big Dish

(the slightly bigger dish)

- A large aperture, Altitude Azimuth tracking dish
- Completely re-engineered for mass production
- Identical spherical mirror panels
- Formed on an accurate jig
- Space-frame based on circular pipe with simple welded joins

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Details

- Aperture 494m2
- Focal length 13.4m
- Average diameter 25m
- Average rim angle 50.1^{o}
- Mirror reflectivity 93.5%
- Number of mirrors 380
- Mirror size 1165mm x 1165mm
- Total mass of dish 19.1t
- Total mass of base and supports 7.3t

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Rigorous integrated systems design approach

Mirrors

Receiver

Structure

Conversion

Foundations

Actuation

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All aspects re-visited - Geometry options included..

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Site works started Feb 08…


Jig will be re-used on future Wizard Power projects


Photogrametry used to
measure / adjust
support point positions

On site containerised section rolling machine

Coils of sheet steel in….

Structural sections out

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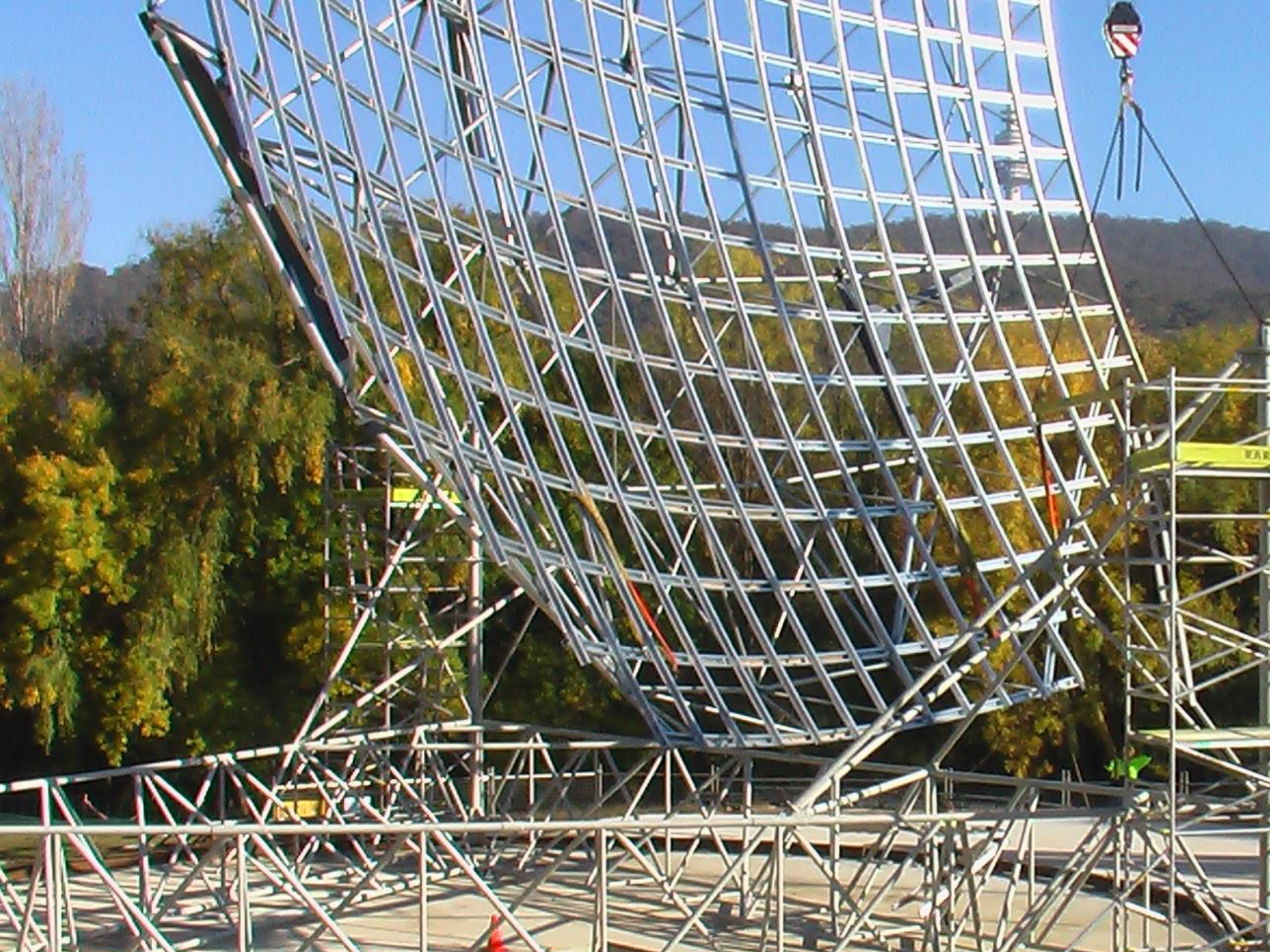
31 March
2009

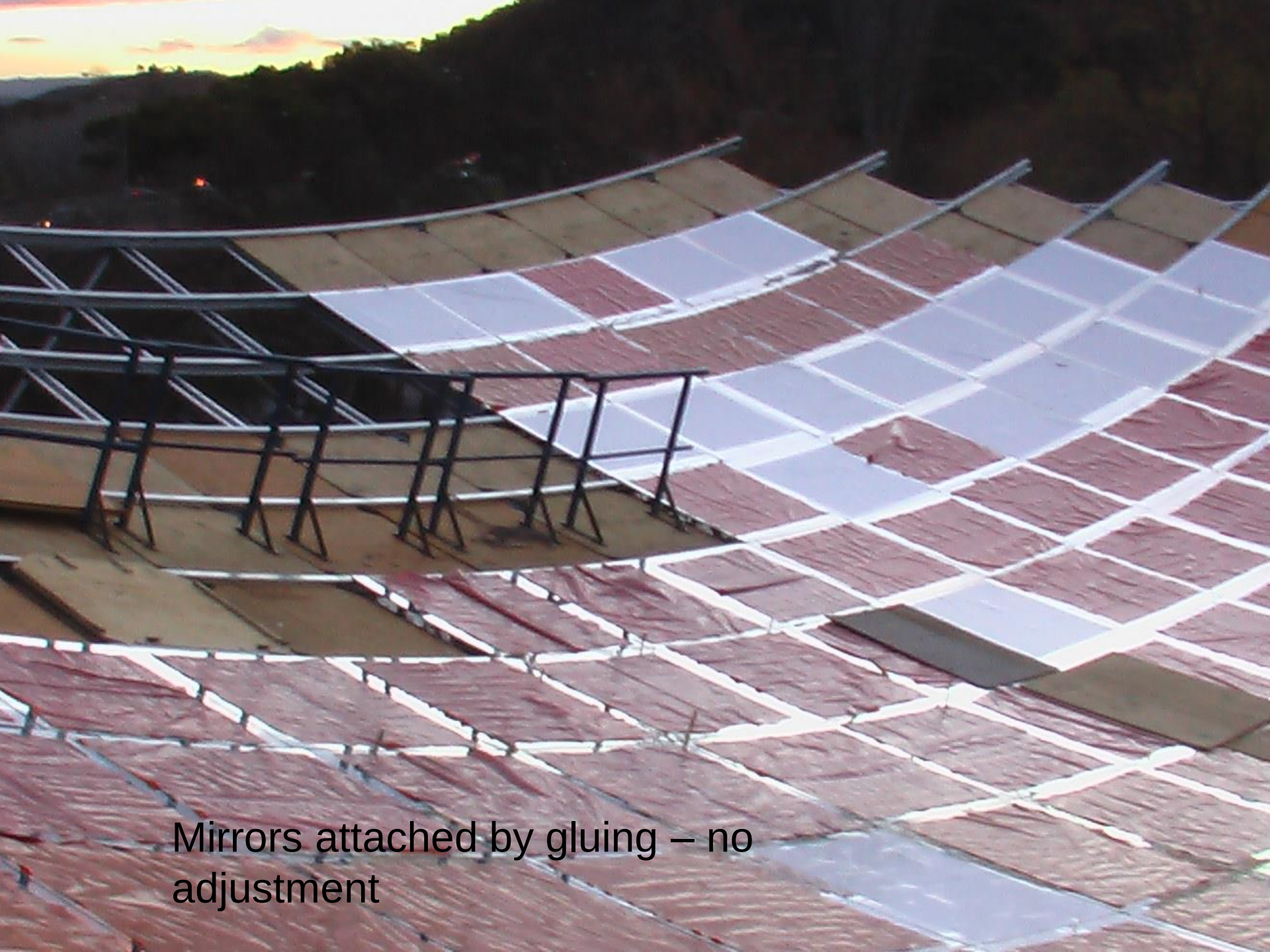

HUMBLES
HUMBLES
HUMBLES


02 6299 6100



380 identical mirrors


R·A·K

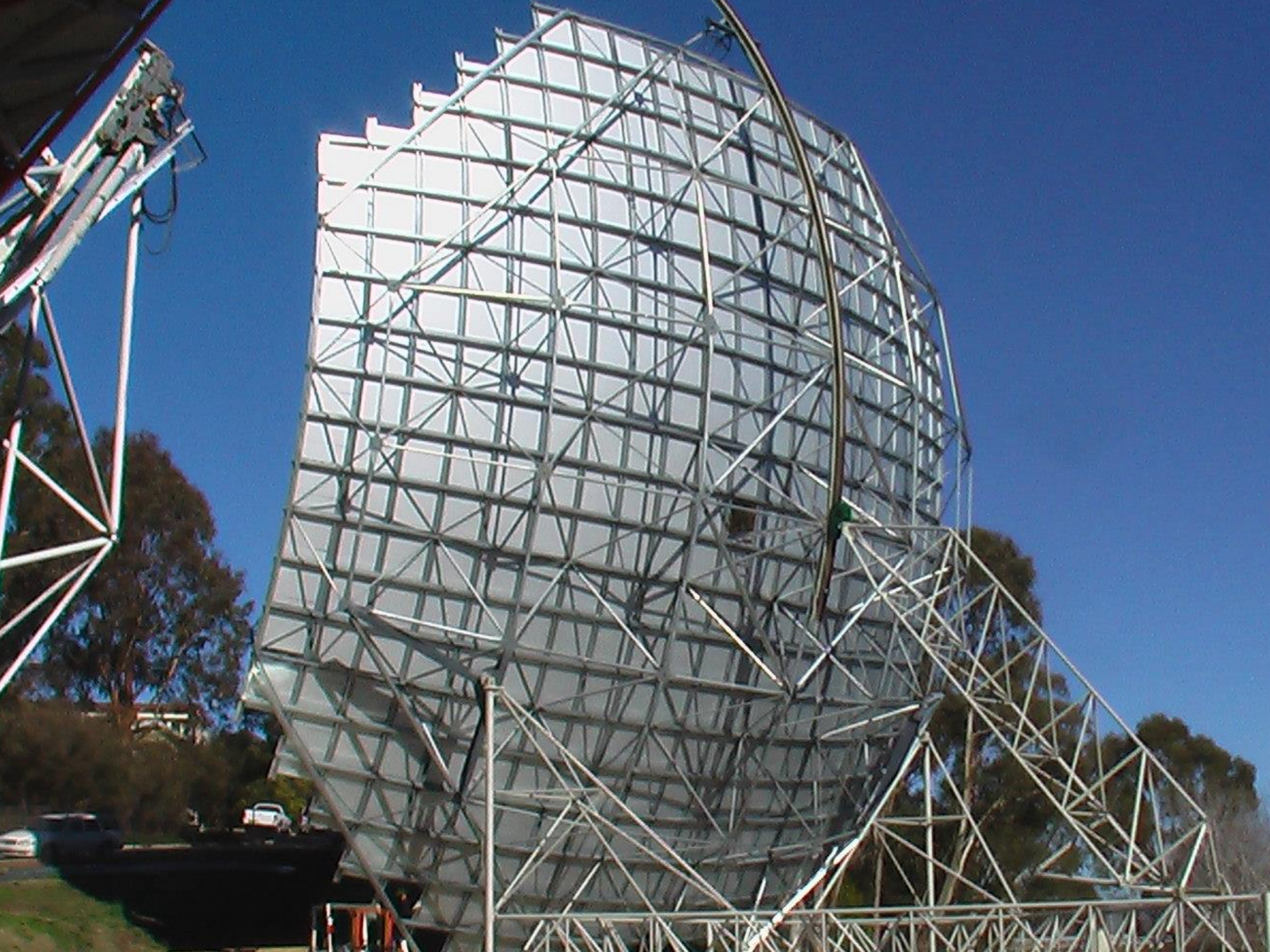


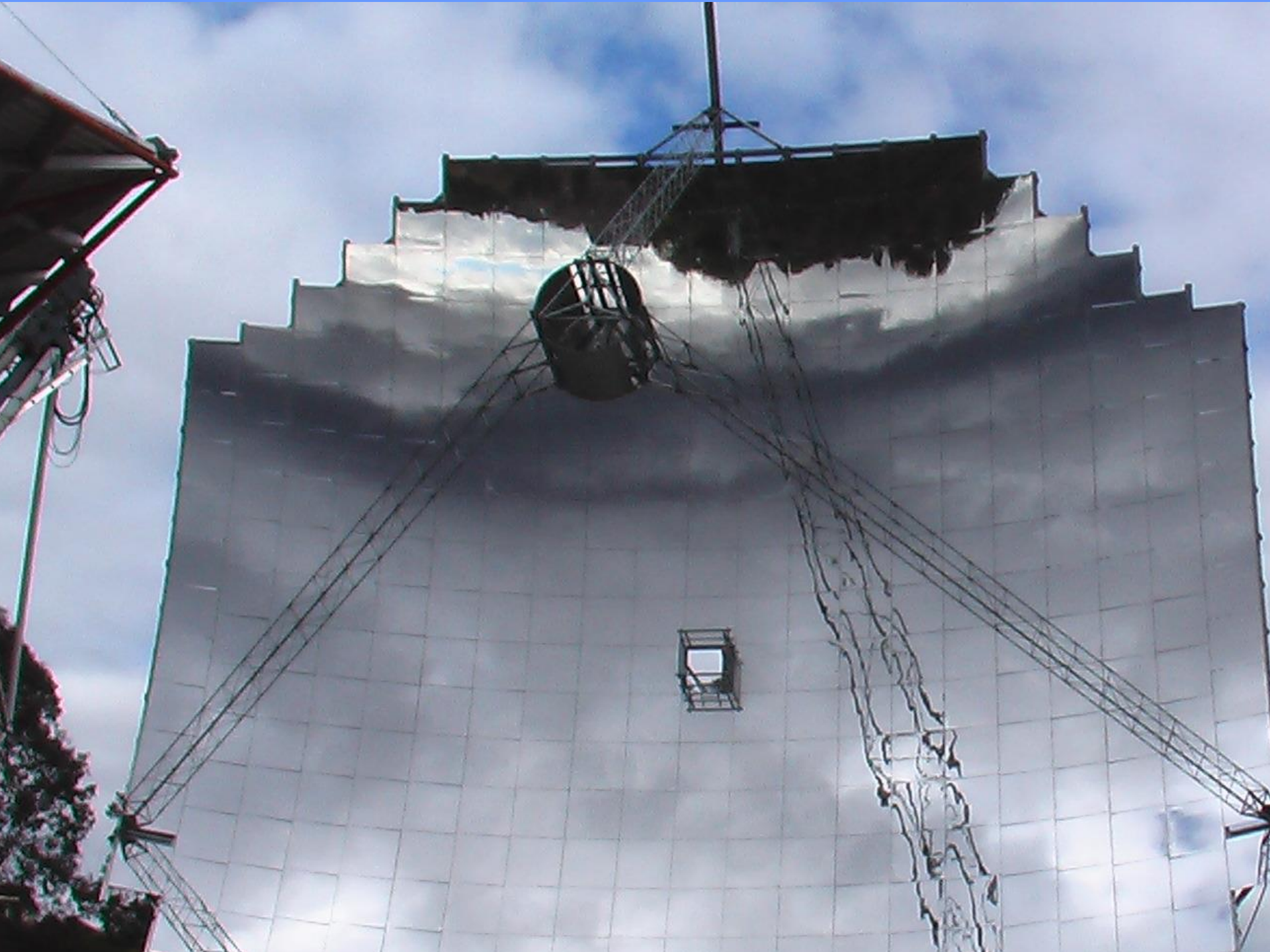
Mirrors attached by gluing – no adjustment

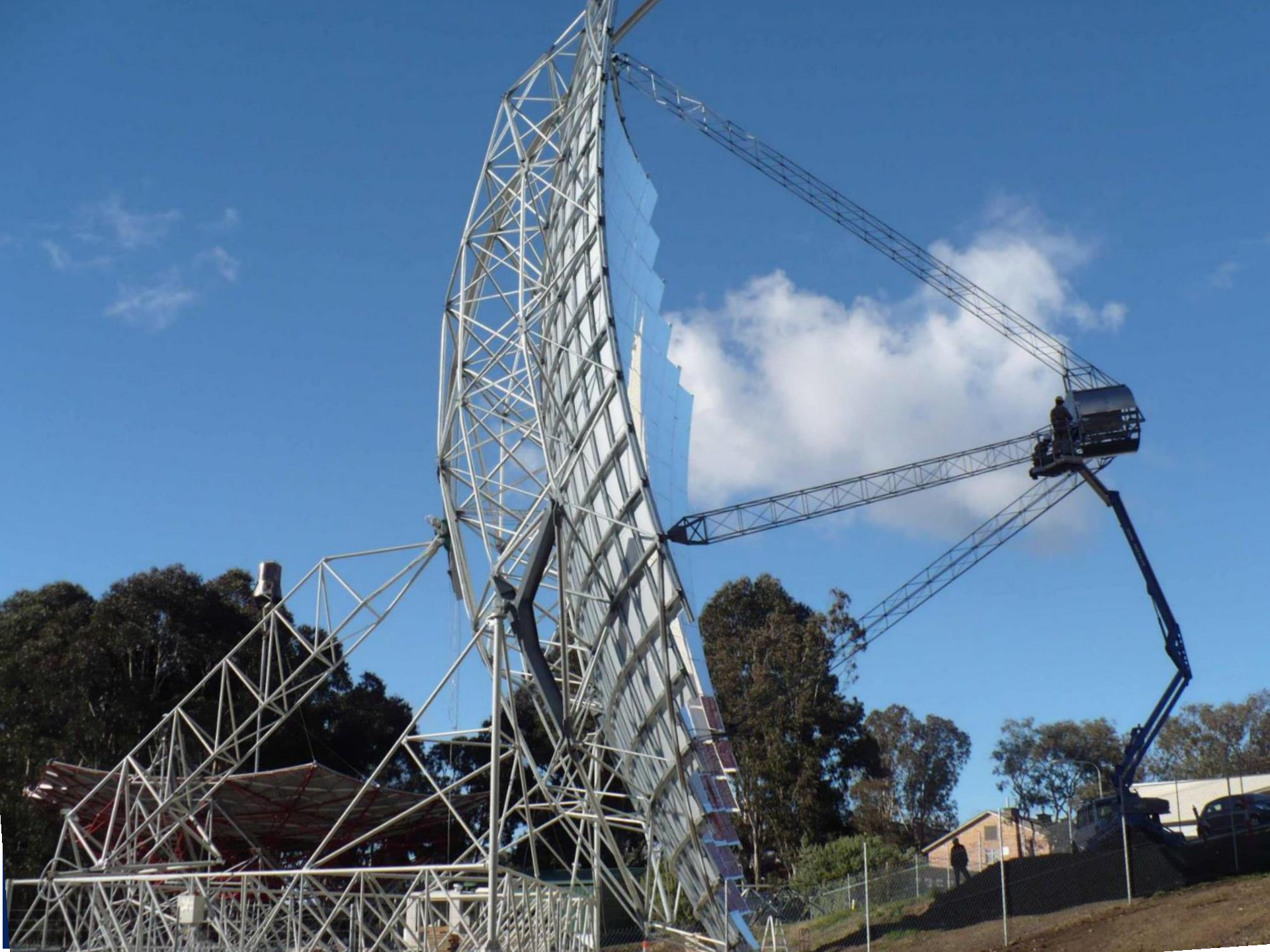

First sun 29 June 2009


Only 80m^2 of mirrors
were deployed

Whoops …..








Images of passing clouds are encouraging…

First operation with all mirrors

Whoops 2…..


Whoops 3…..


90 100 110 120 130 140 150 160 170 180 190
STAINLESS STEEL


Lets try
astronomy

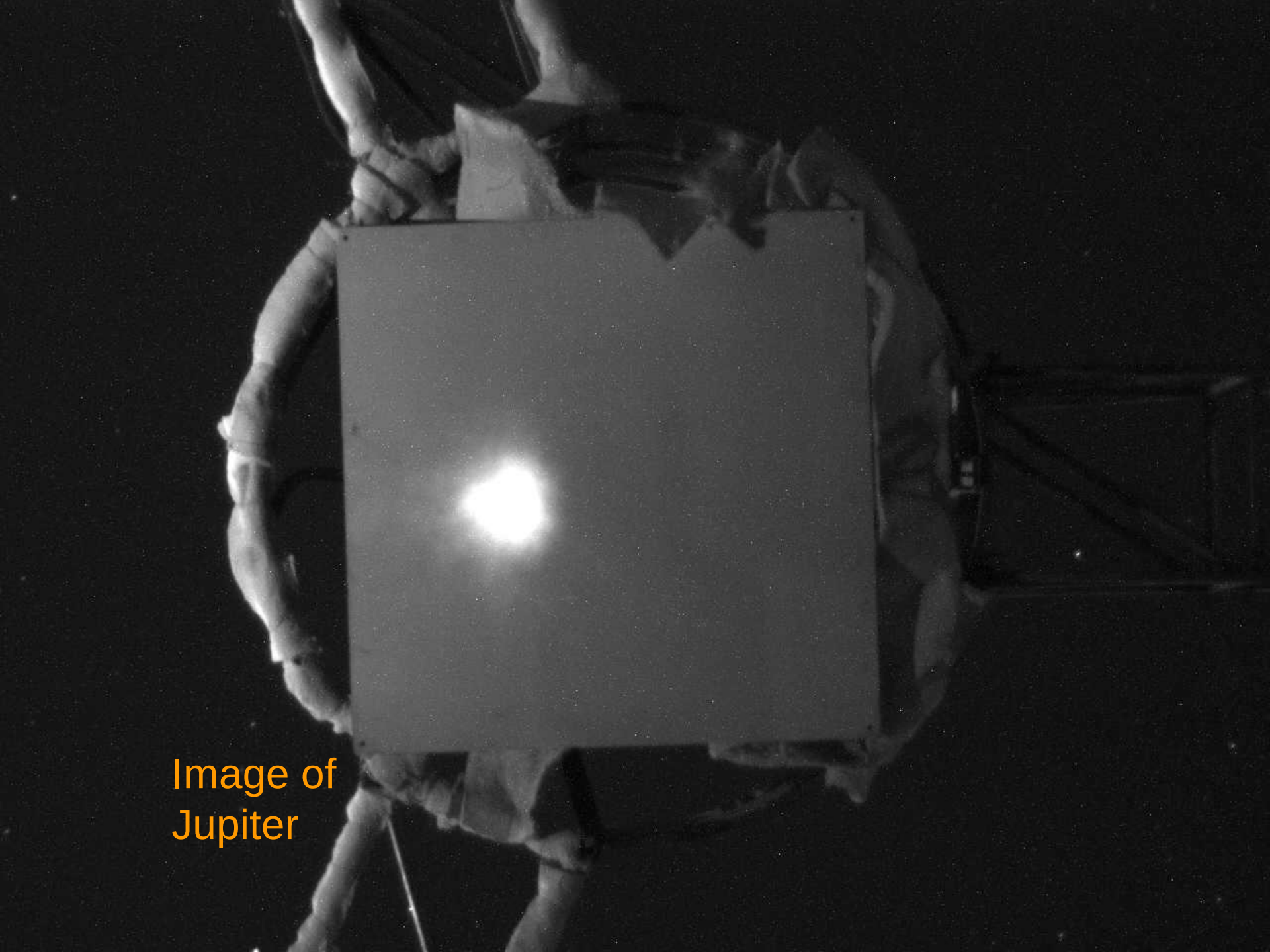
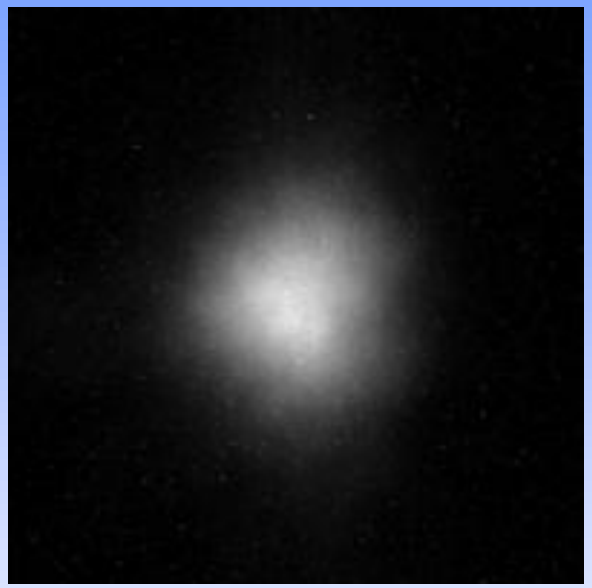
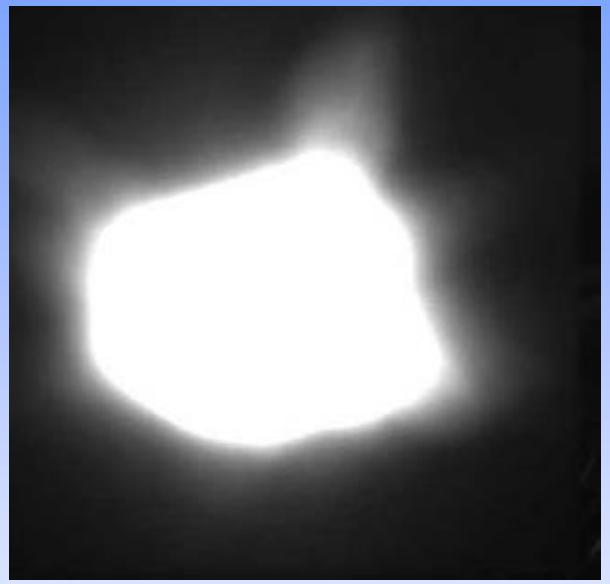


Image of
Jupiter



Jupiter

Full Moon



Full Moon
over exposed

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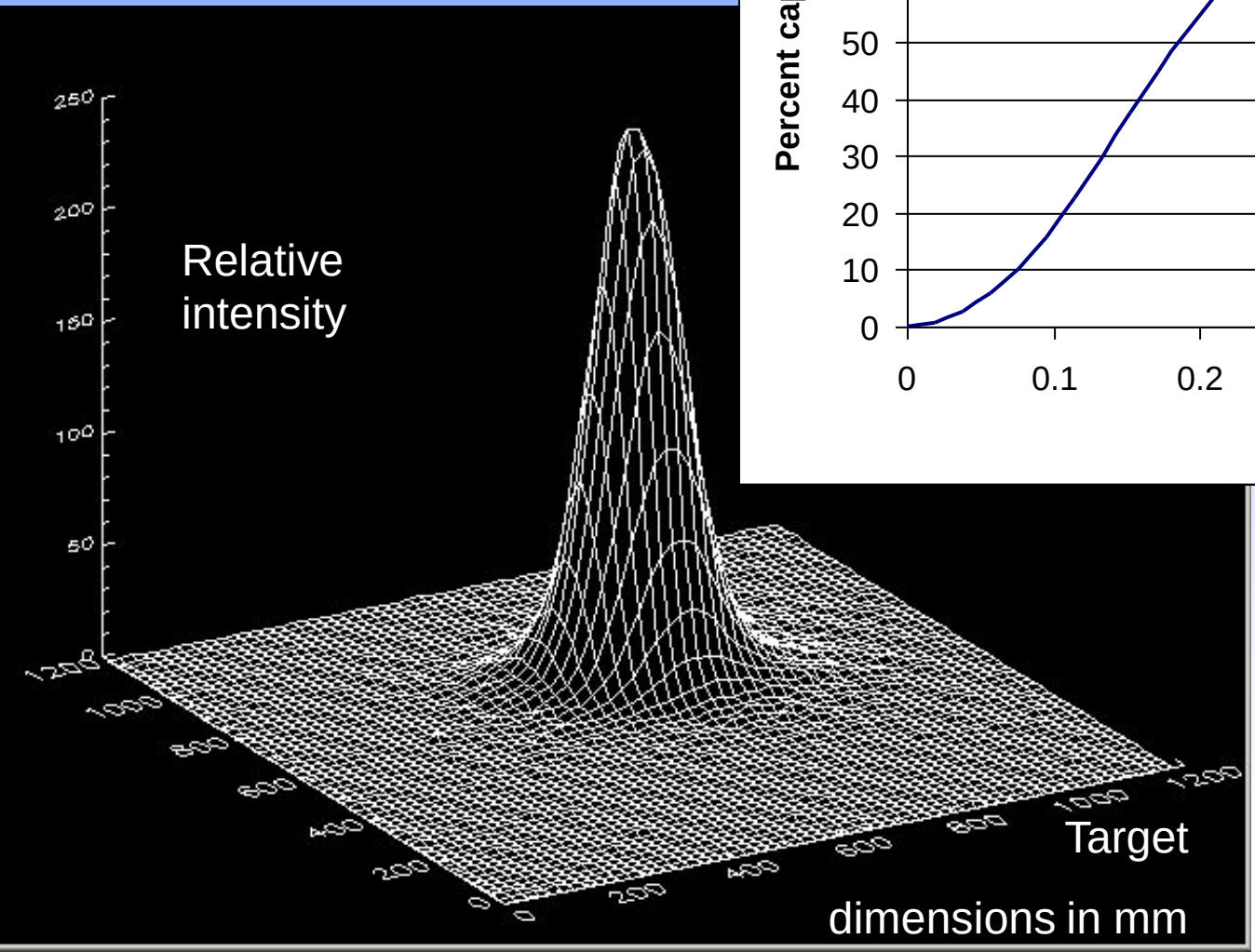
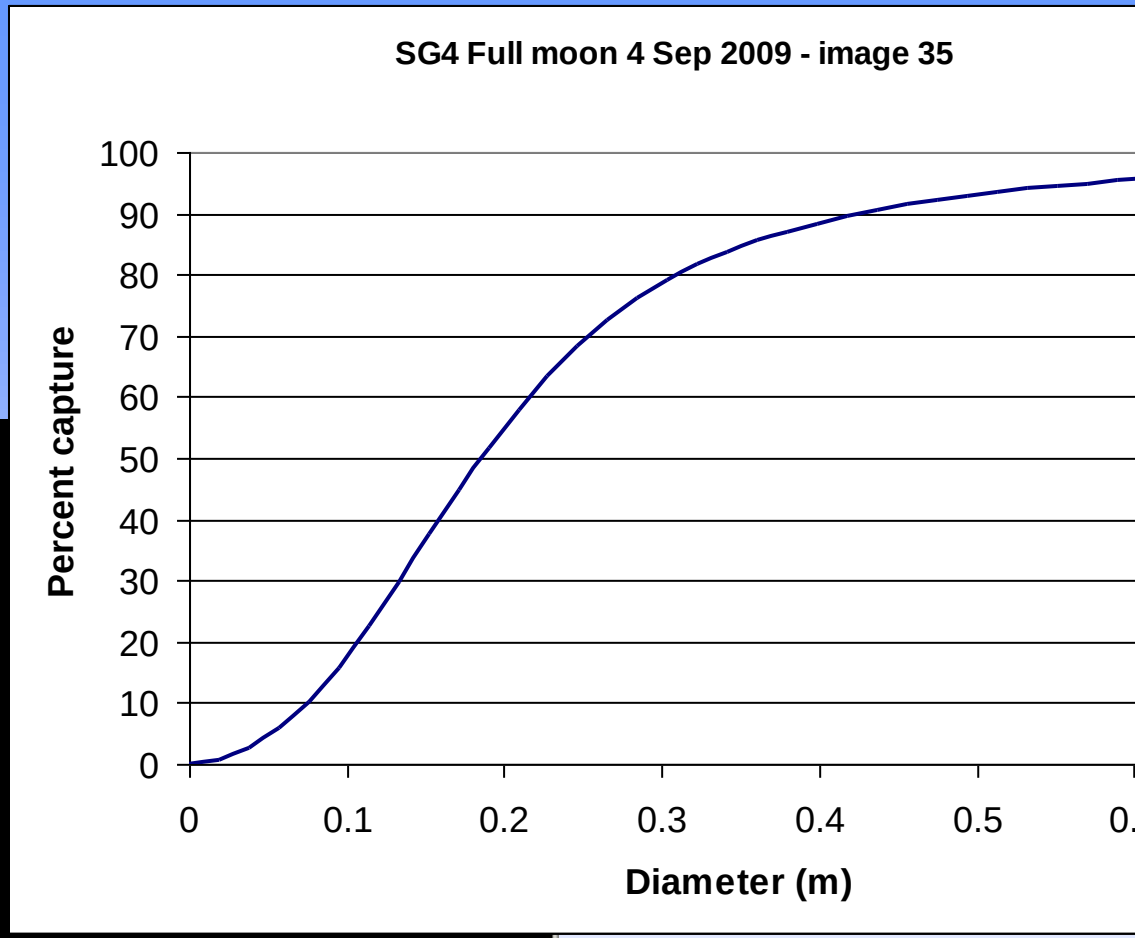
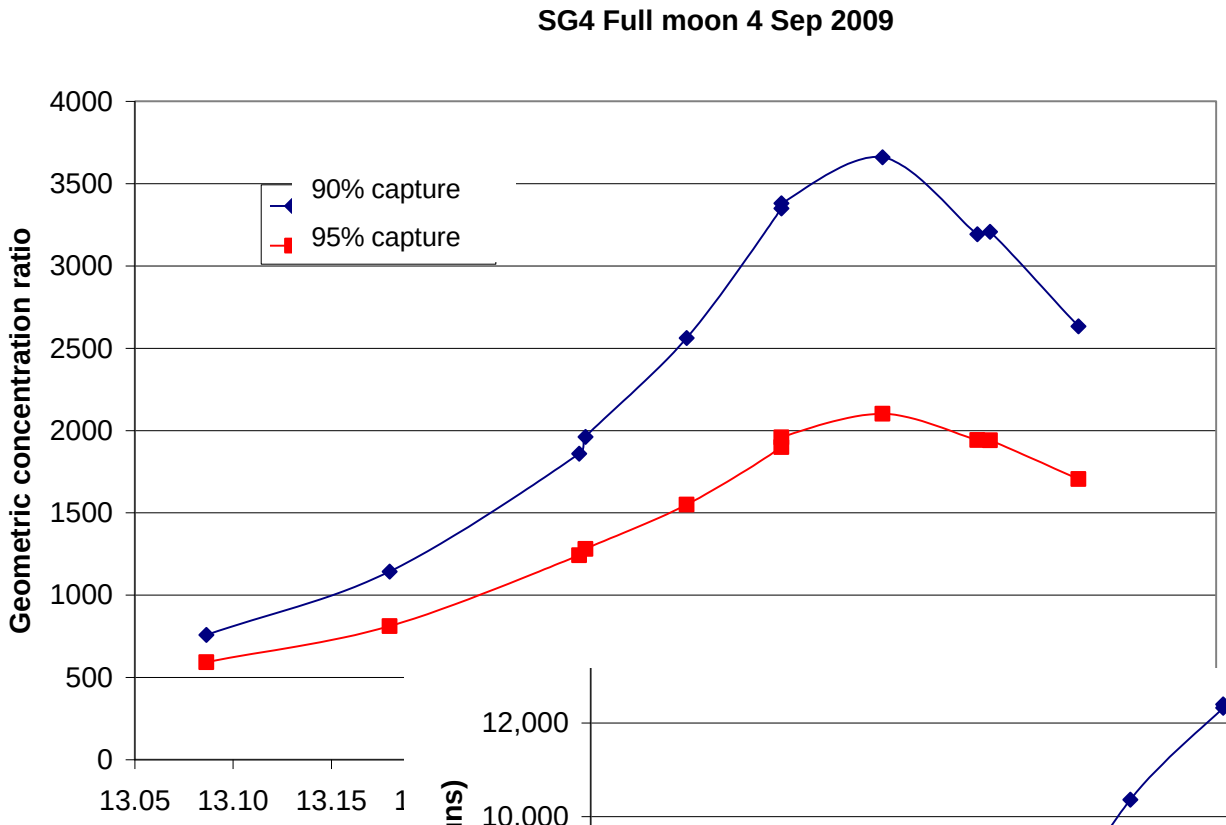
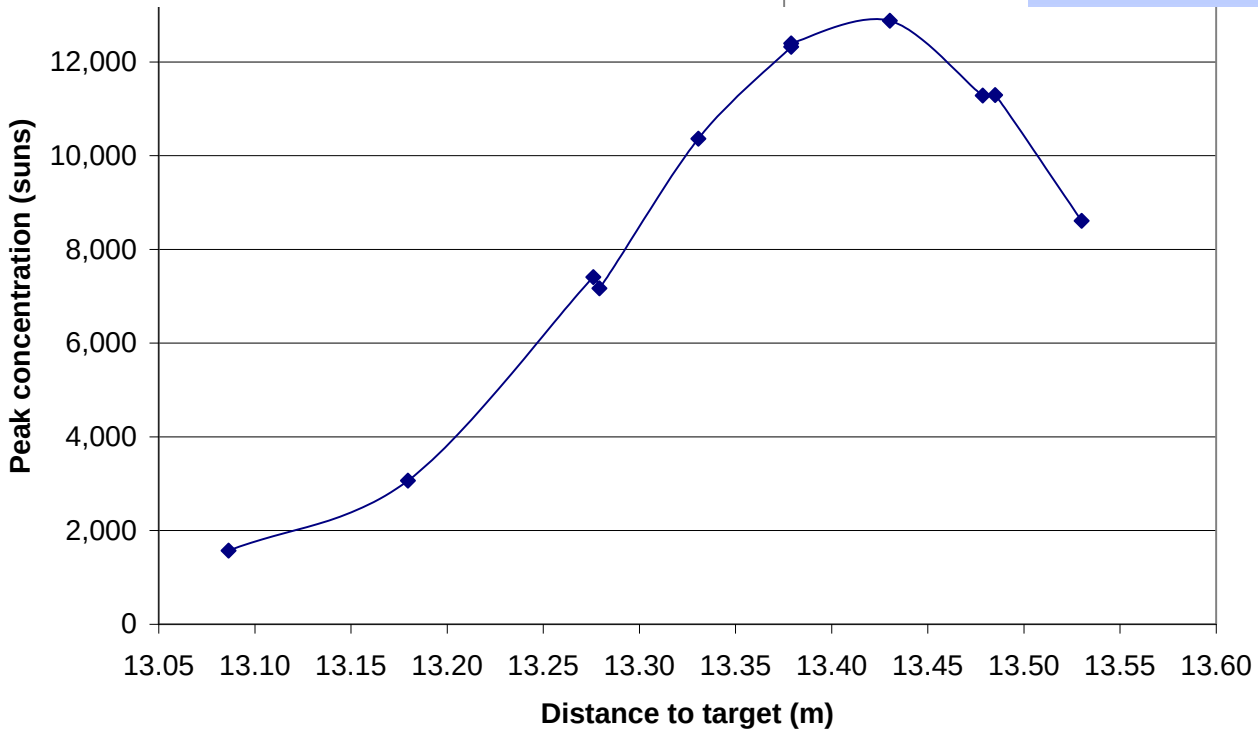
How good is it really?









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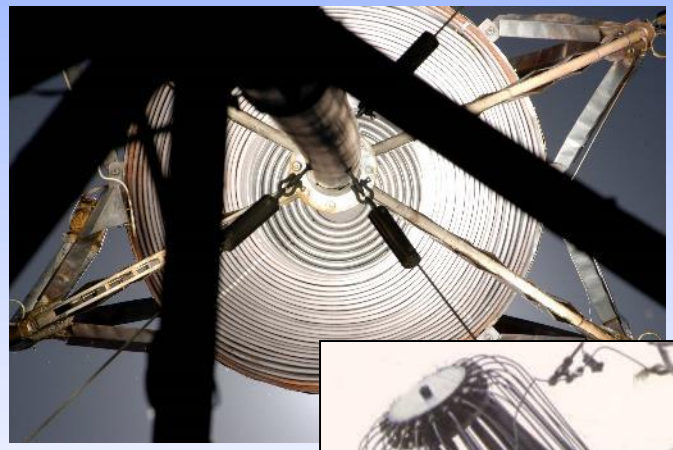
Dish = Dish Stirling ?

No!!!,

Dish =

- Dish Steam
- Dish Chemical
- Dish Brayton
- Dish PV
- and Dish Stirling ☺



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Conclusions

- System design for manufacture of a Gen II Big Dish successfully completed
- The design is ready for large scale commercial role out
- Identical non adjustable mirrors still allow excellent optical performance
- The design is suitable for a driving a range of conversion processes including those needing high levels of concentration

The new dish was designed and built 95% in house - Many thanks to

ANU:

- Justin Bishop
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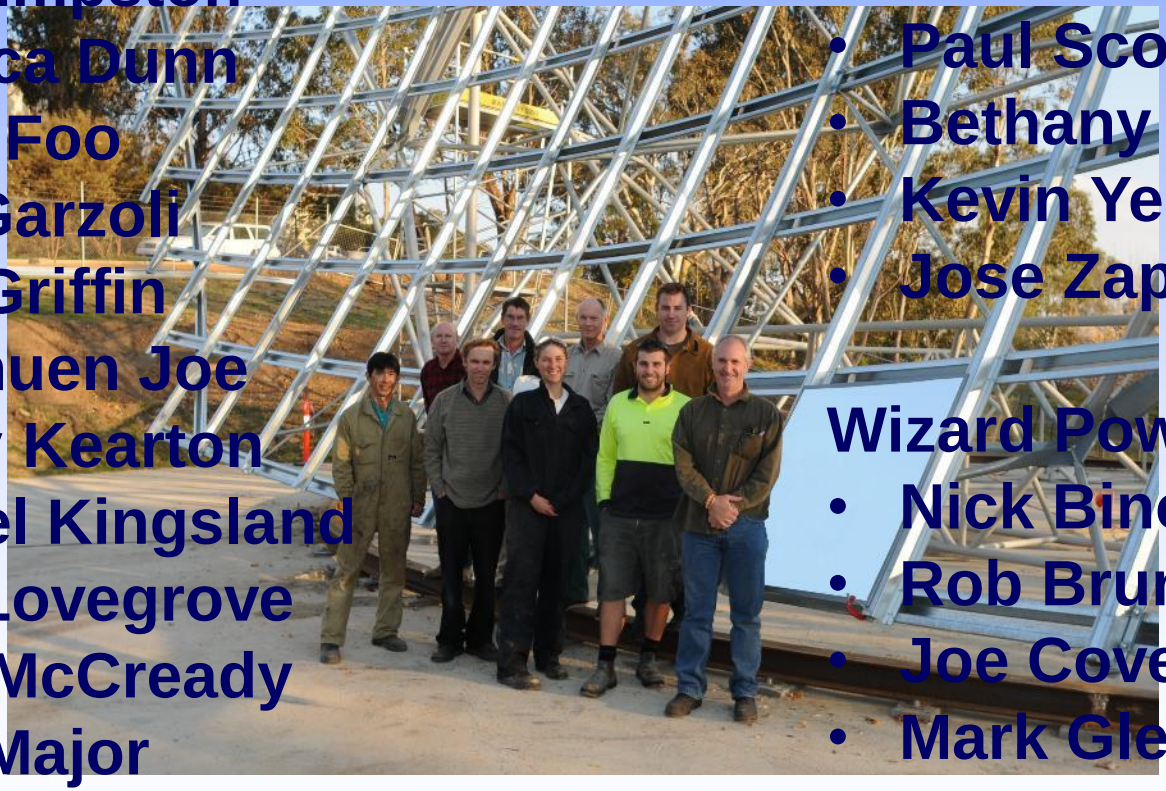
- Ashley Kearton
- Michael Kingsland
- Keith Lovegrove
- David McCready
- Geoff Major



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- Mark Gledhill

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