

The Lovell Telescope

... through its surfaces

Simon Garrington, JBO/University of Manchester

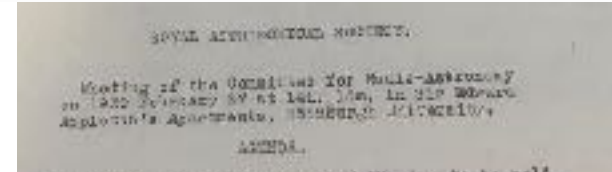
- Original design & redesign: 1950-1957
- Radical modification & new surface: 1971
- Replacement of surface: 2001
- Replacement of original surface: 2018
- Other consequences: foundations



Picture A. Holloway

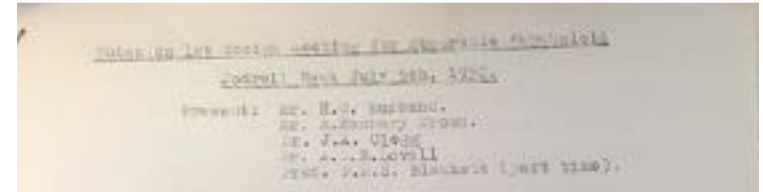
Original Mkl proposal and changes

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 - Interest from Air Ministry: 10cm radar
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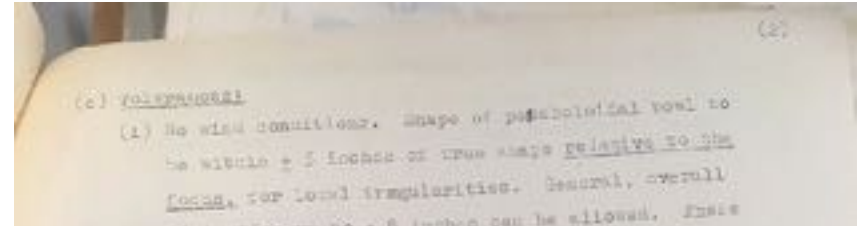
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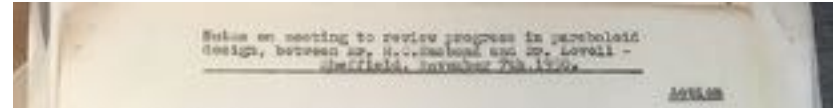
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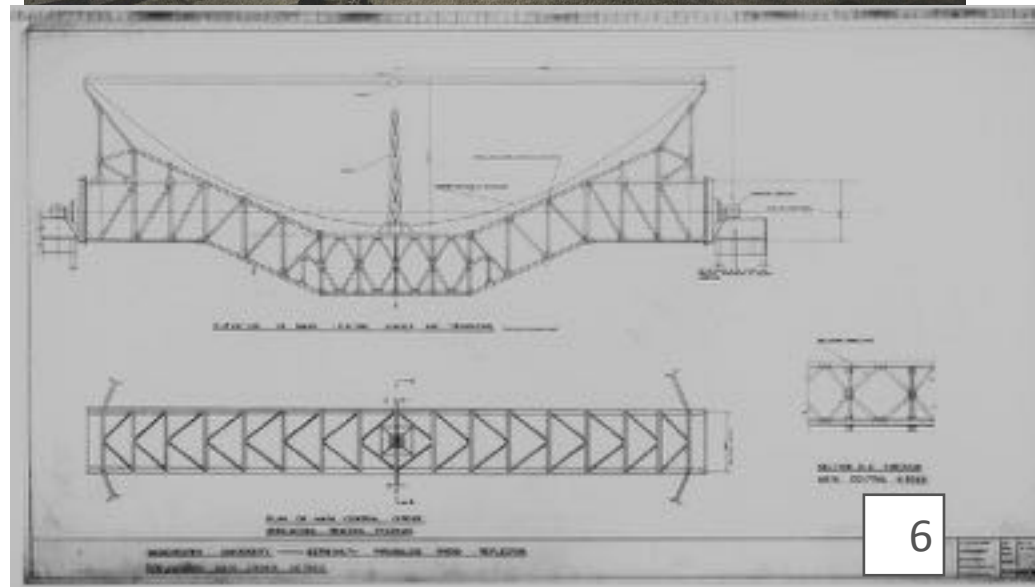
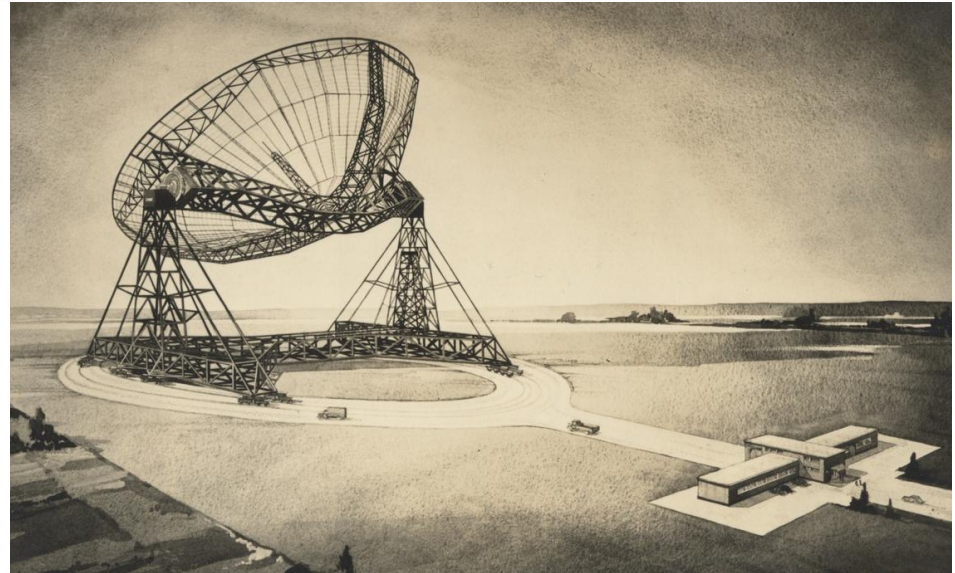
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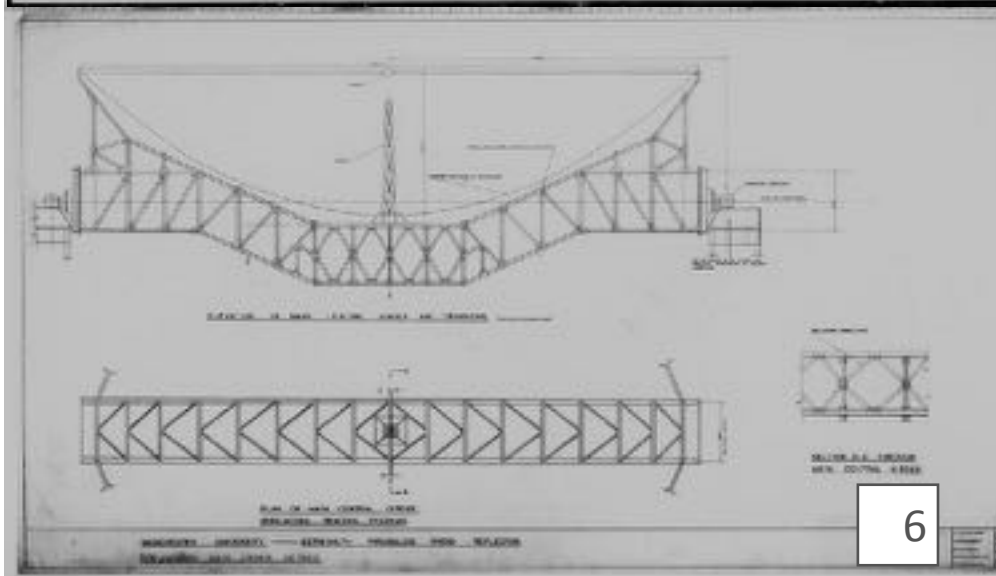
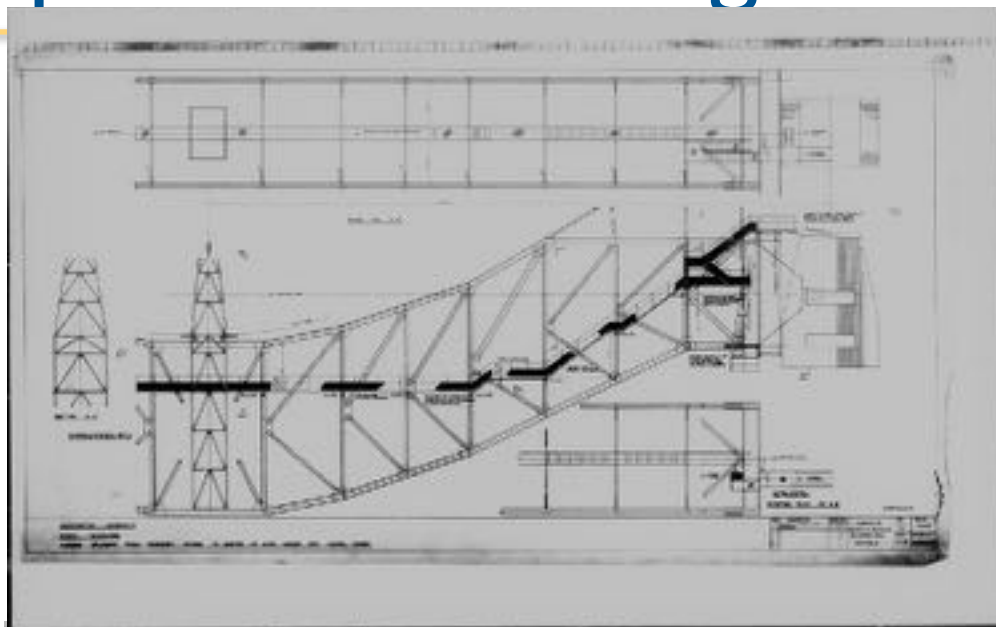
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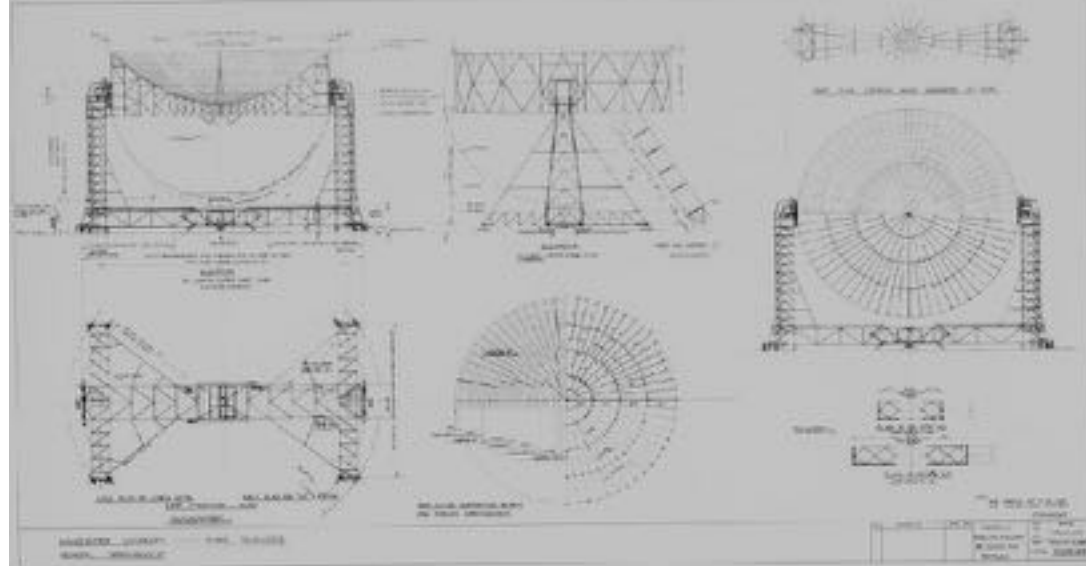
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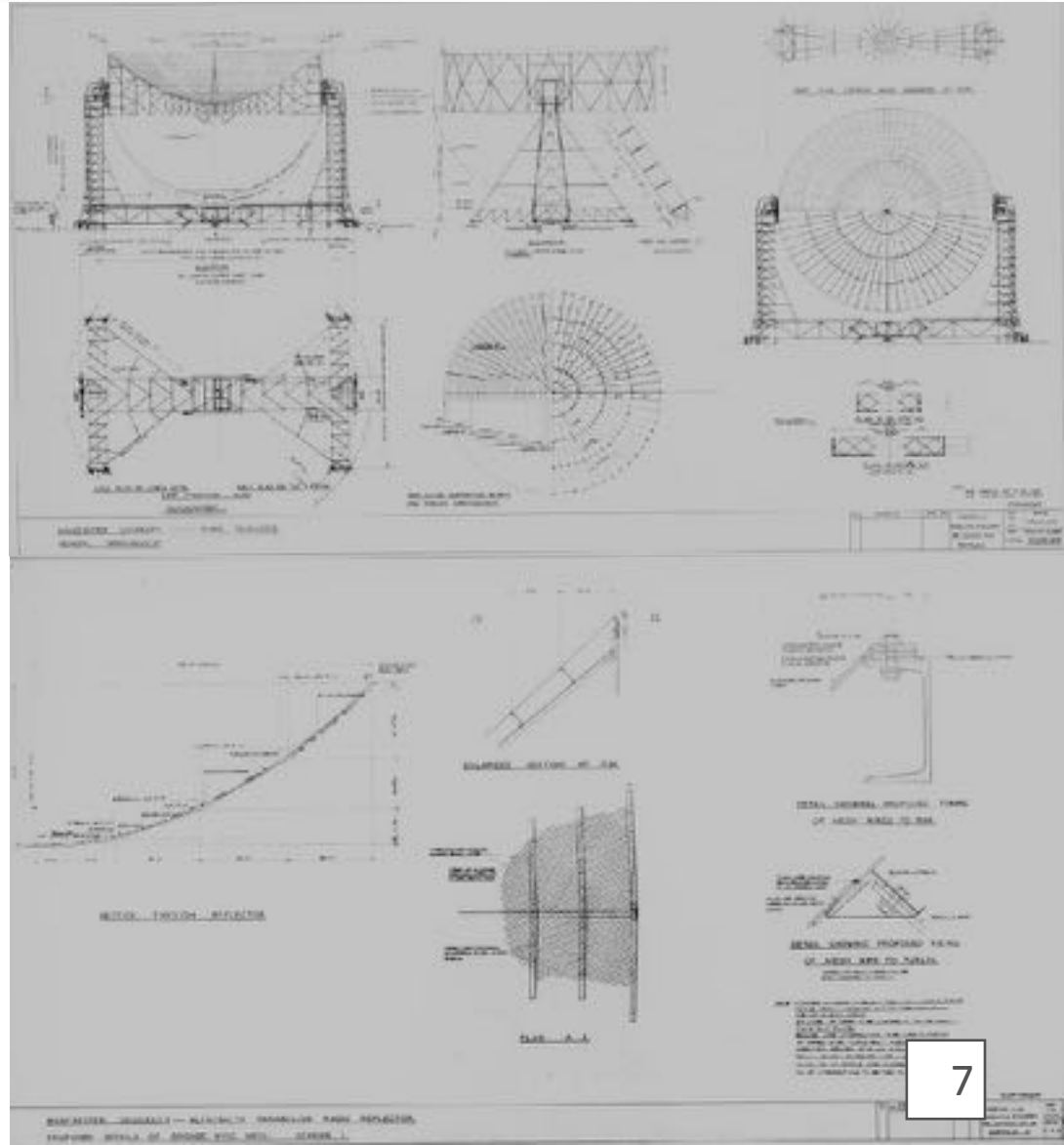
MKI - bowl & surface redesign

- New 'drum' support -
Aug/Sep 1954 [homology?]
- Major redesign ... in mid-construction
- Cost, weight increase ... Public Inquiry '57
- Husband suggests solid surface (continuous, fully welded)
 - conductivity
- Experiments Jun-Sep '55
 - 1-inch profile
- Main structure complete by this point...



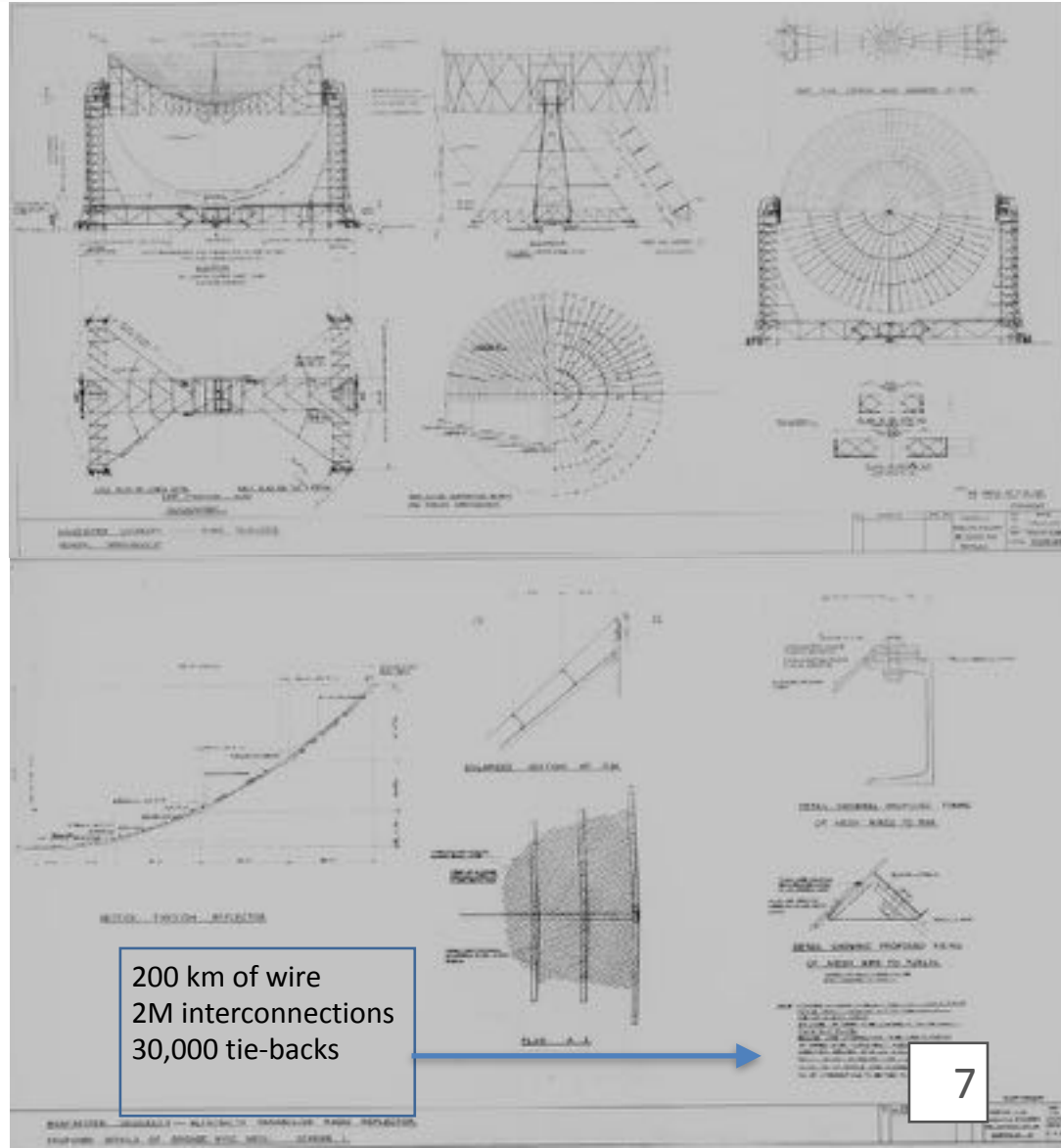
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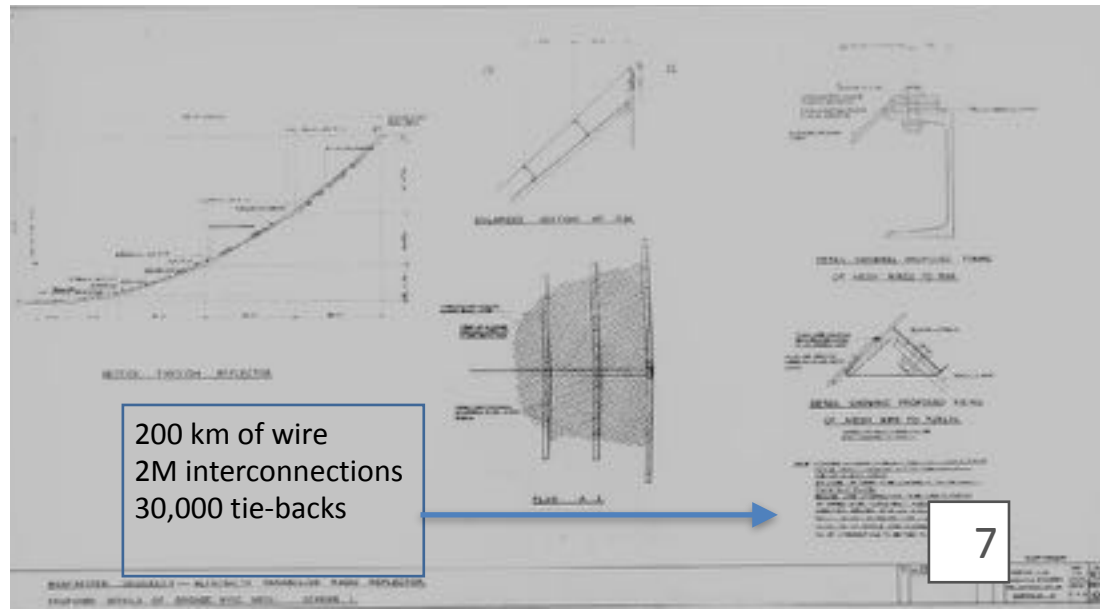
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200 km of wire
2M interconnections
30,000 tie-backs

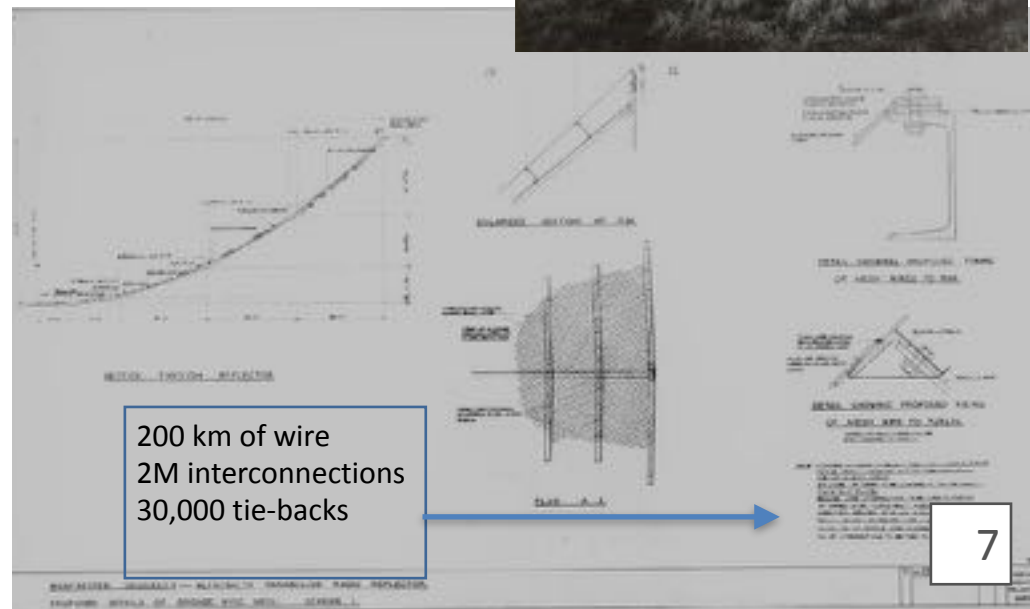
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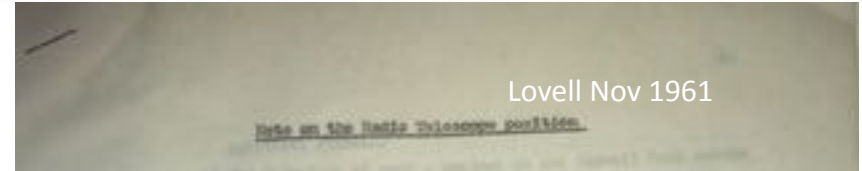
The Mkl, completed

- Surface installed 1956-7; 7000 plates; 13/welder/day
- Drives installed...
Sputnik launched 4 Oct 57, carrier rocket detected 11 Oct 57
- Efficiency of Mkl at 21cm ... 12%



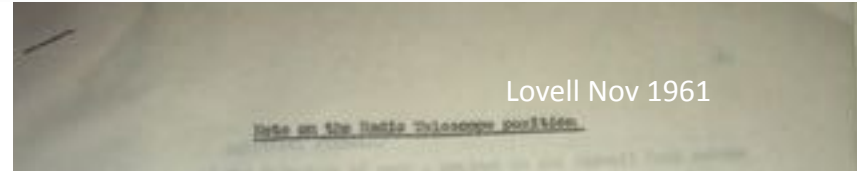
Conversion to MkIA

- ‘Improved MkI’
1961, alongside...



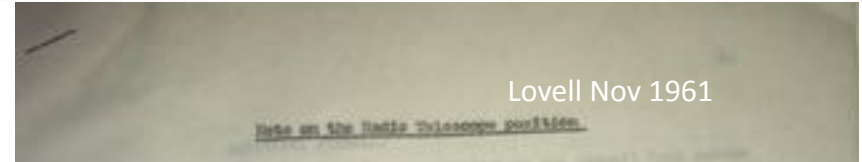
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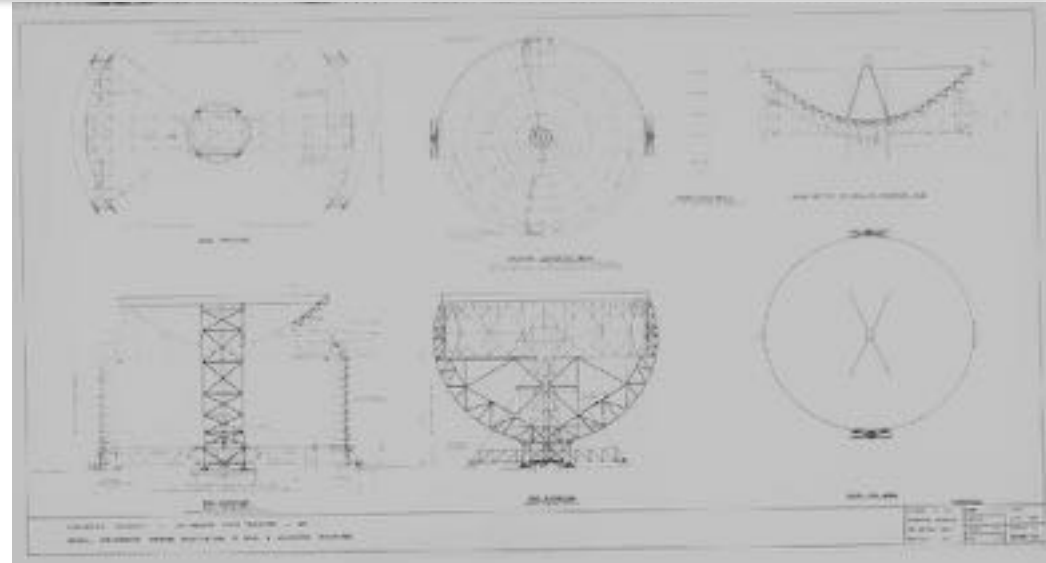
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MkIA - motivation

[Fleck ctee 1961-5;£4m
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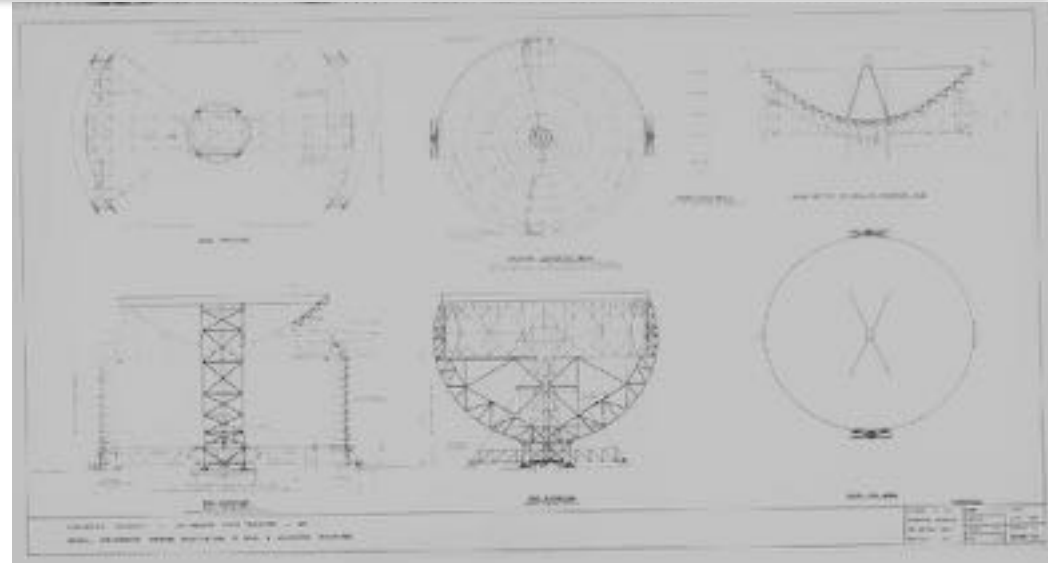
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 - central support
 - new surface
- Tactically - Lovell agreed to delay MkV in Dec '67
- Reality: foundations and structure failing
- c. 200t load relief on bearings/foundation



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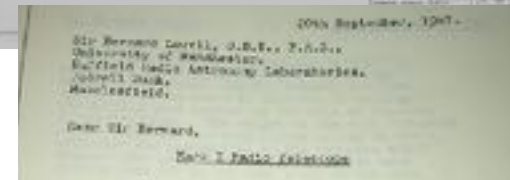
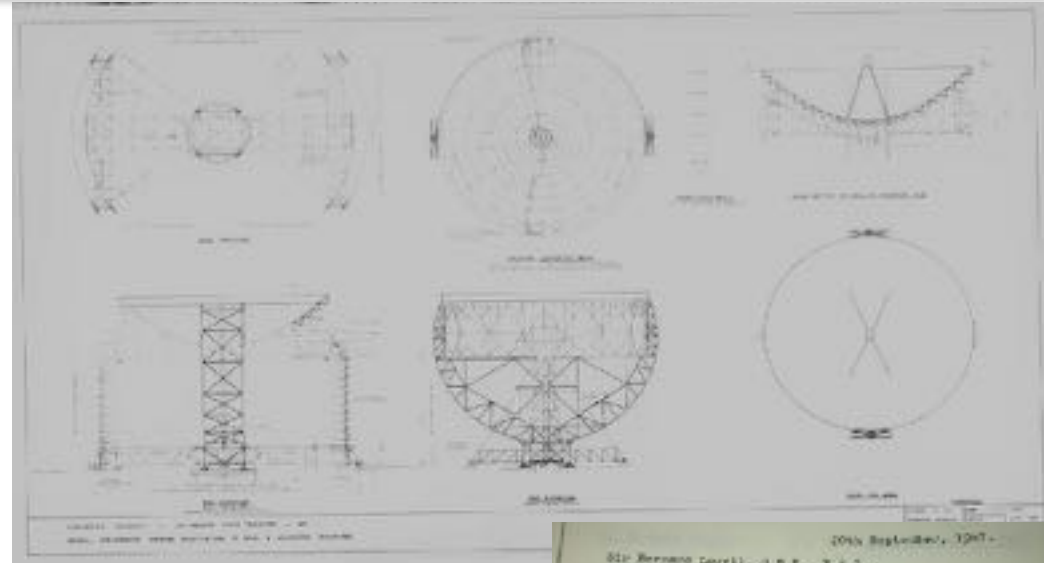
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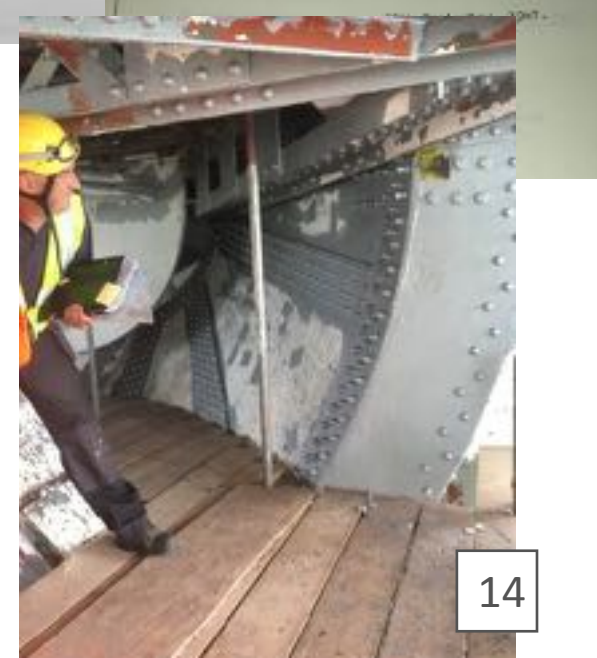
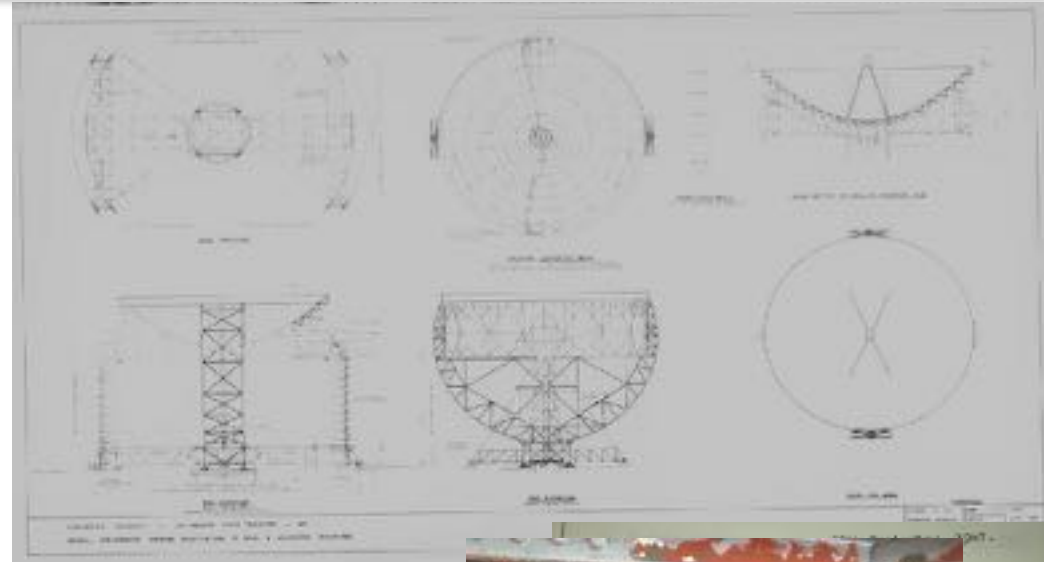
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MkIA

- 1968 report: 265'
- Changed during construction to 250'
- 1968-1972
- Cost £665k (c 0.5 Mkl)
- Husband's 'hardest job'
- New $f/D=0.3$ surface
 - 60% at 18cm
 - 14% at 6cm
- HI, OH, MERLIN, EVN, pulsars, quasars, gravitational lenses,+...
- Wheelgirder + central track: c. 960t (96 piles)



The MK-1 telescope

1971 - picture credit: R W Porco

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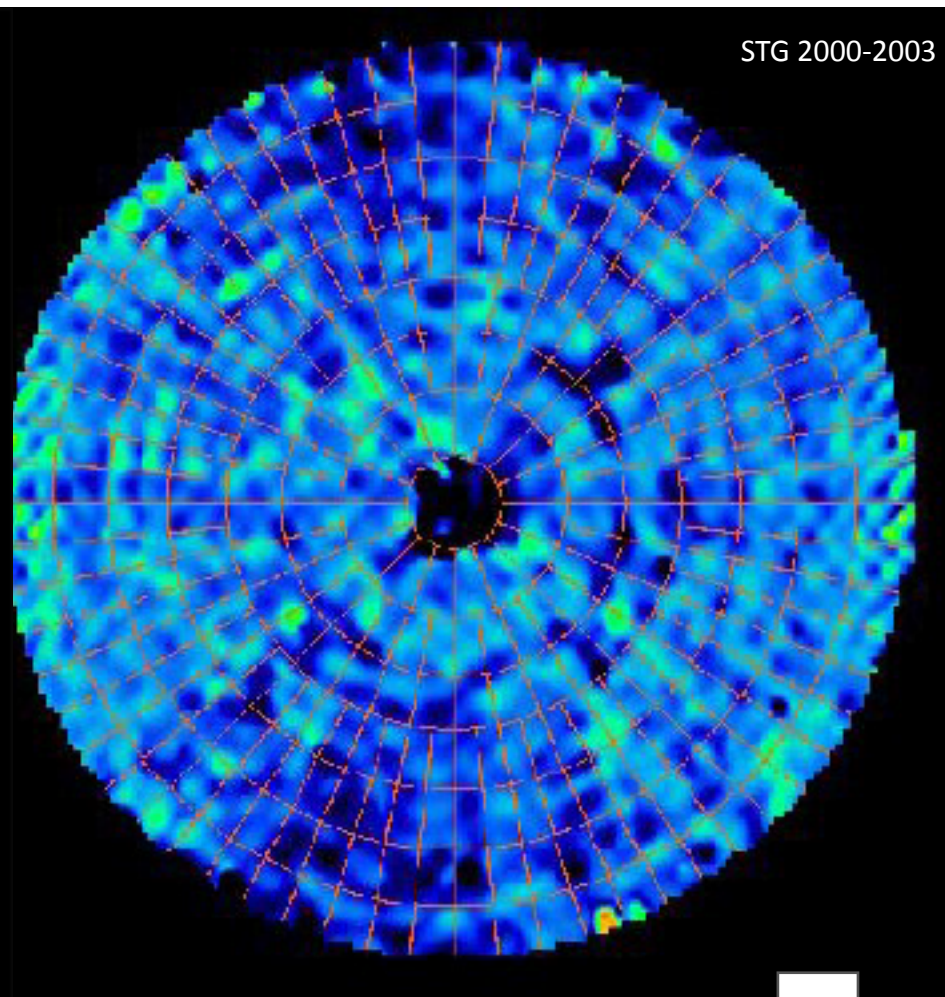
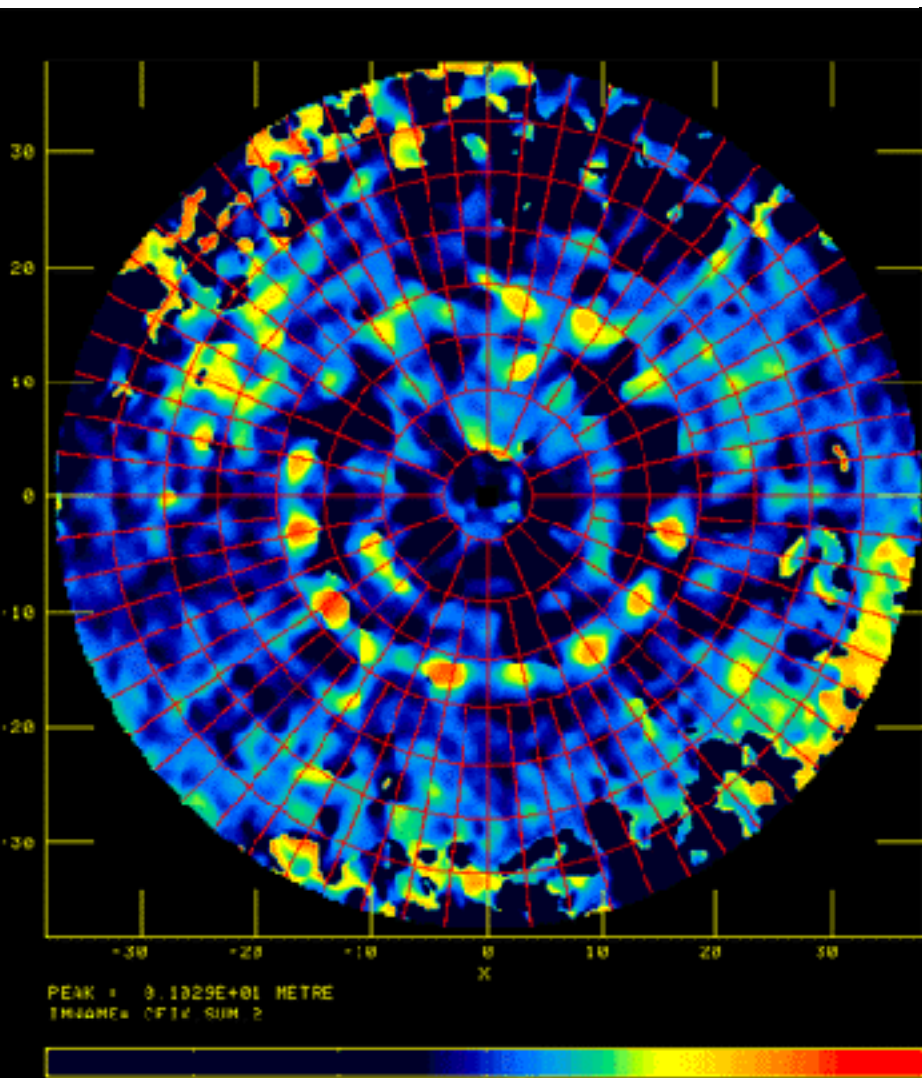
Surface replacement (2001-2)



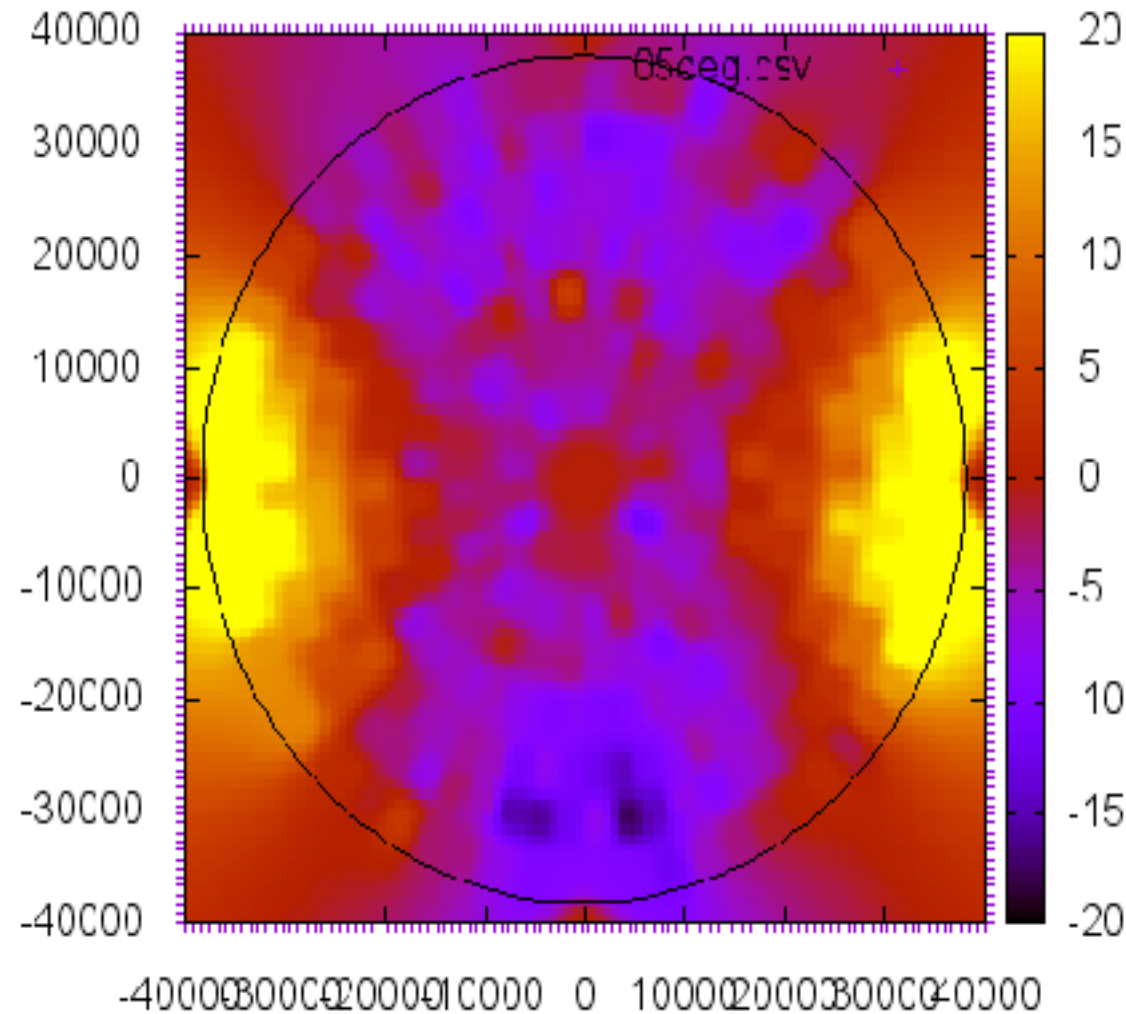
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Improvement in surface

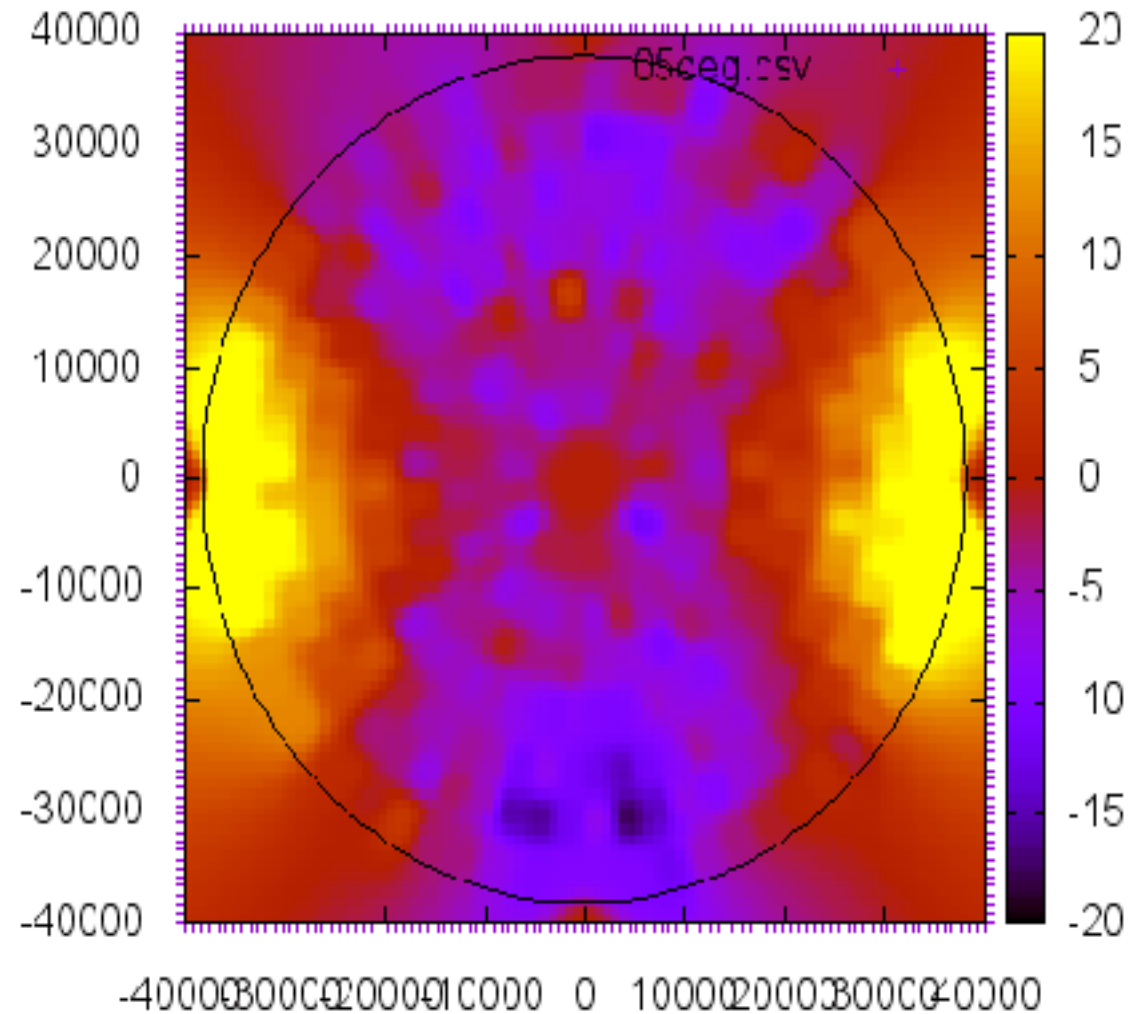


Surface deformation

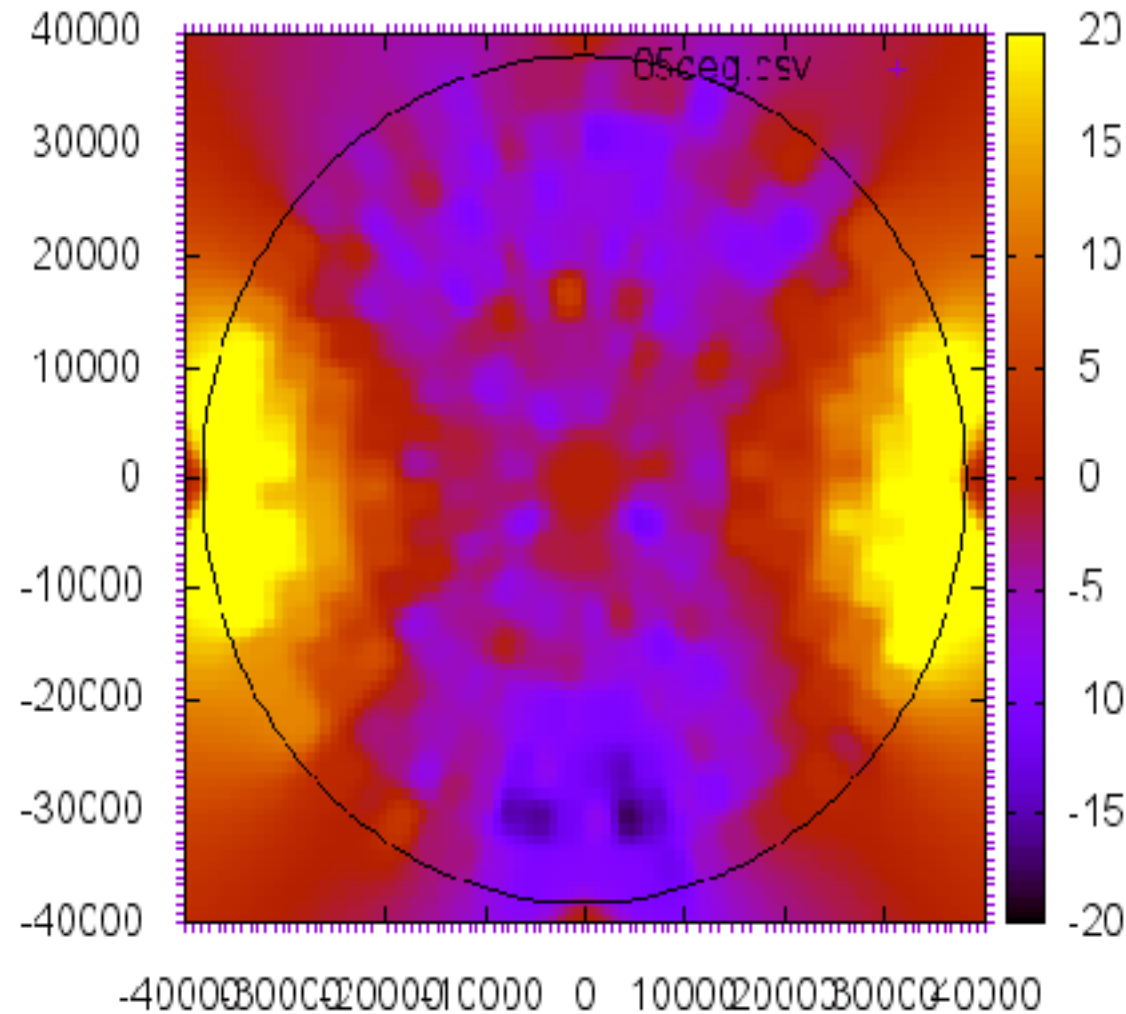


Total Station measurements by J A Battilana (analysis by STG)

Surface deformation



Surface deformation



Replacing the 1957 surface

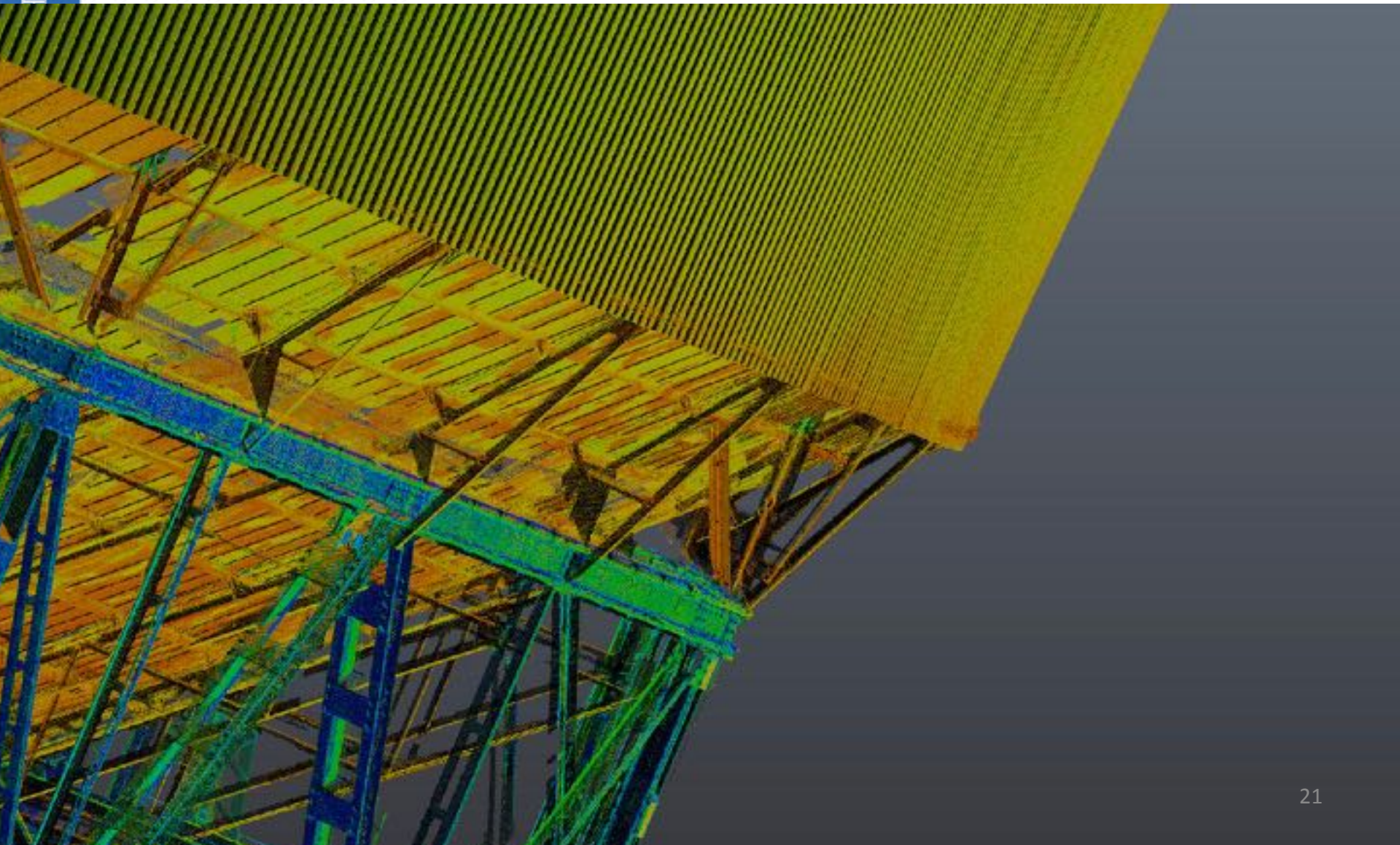
- Considered removal, repair, replacement
- Now replacing with fully galvanised and painted panels, bolted to new angle beams
- Profile not important but fit to original parabola



Mkl bowl framework

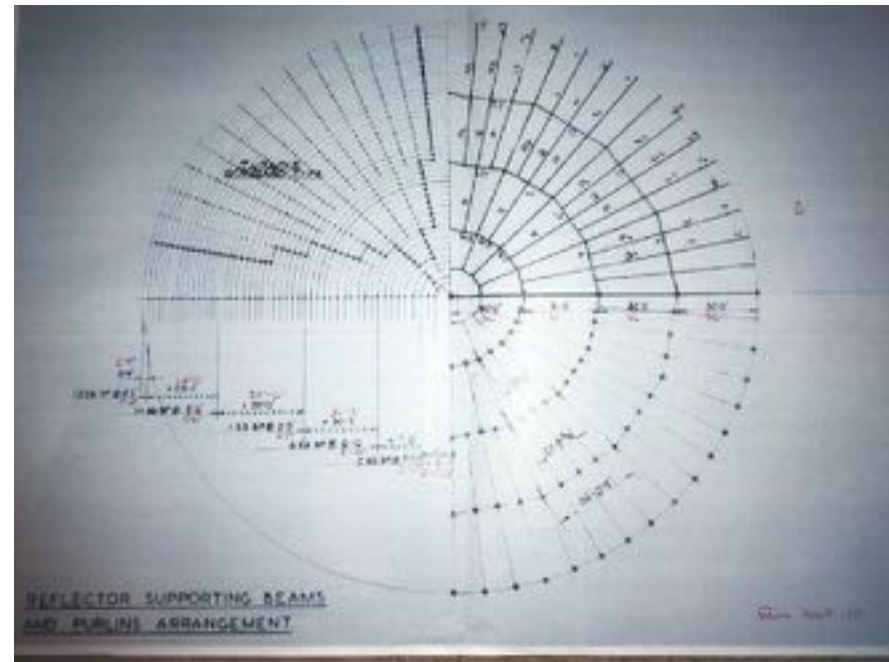
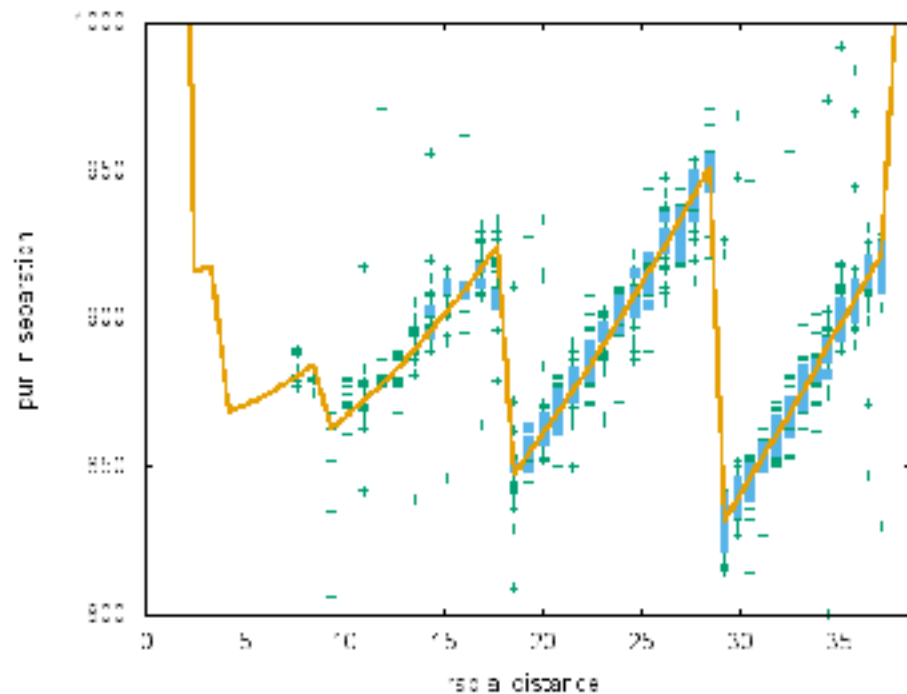


LiDAR Scan (Ogilvie Geomatics)



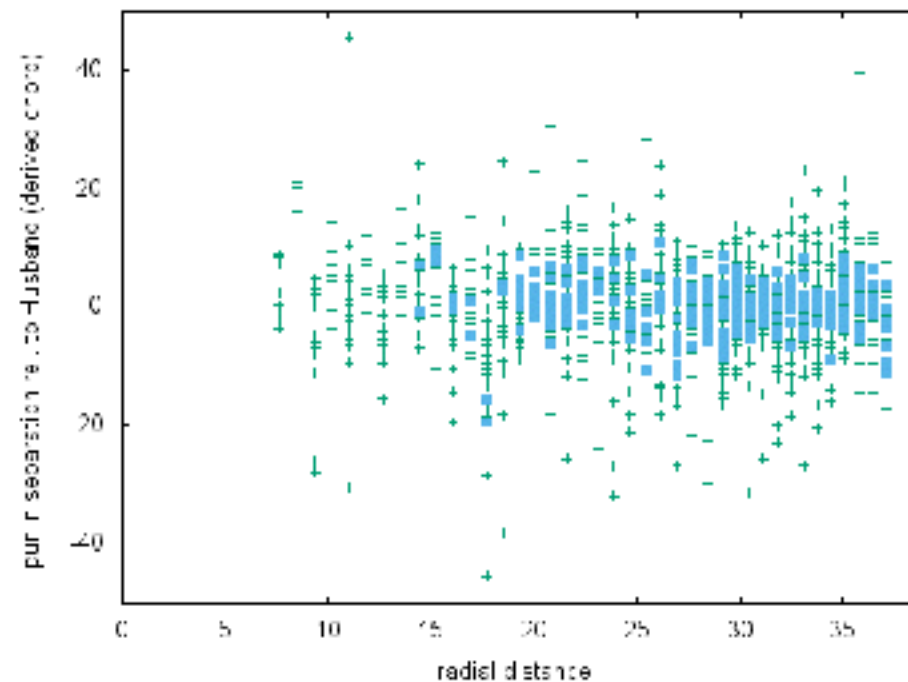
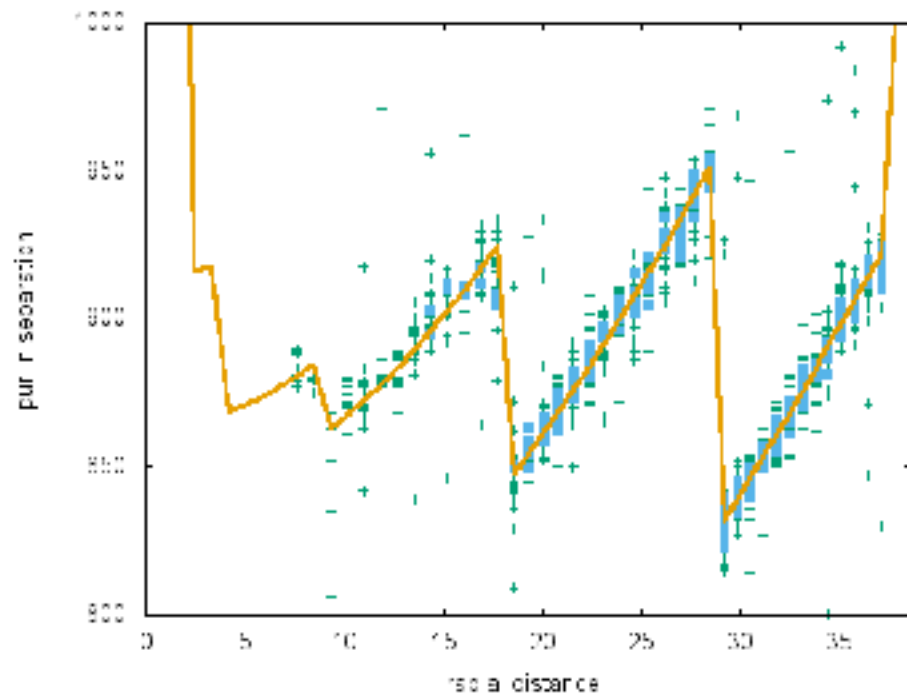


Bowl framework layout



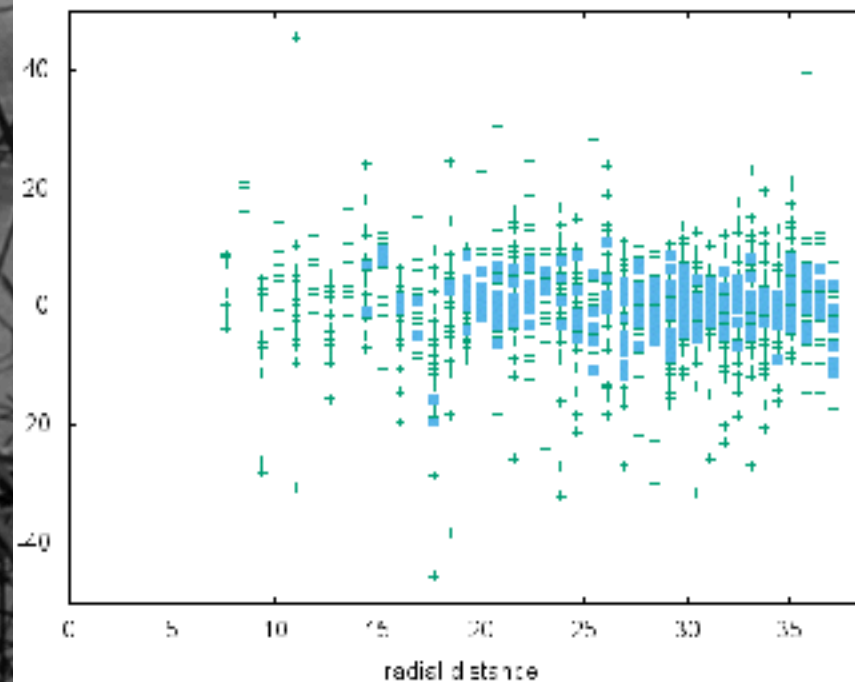
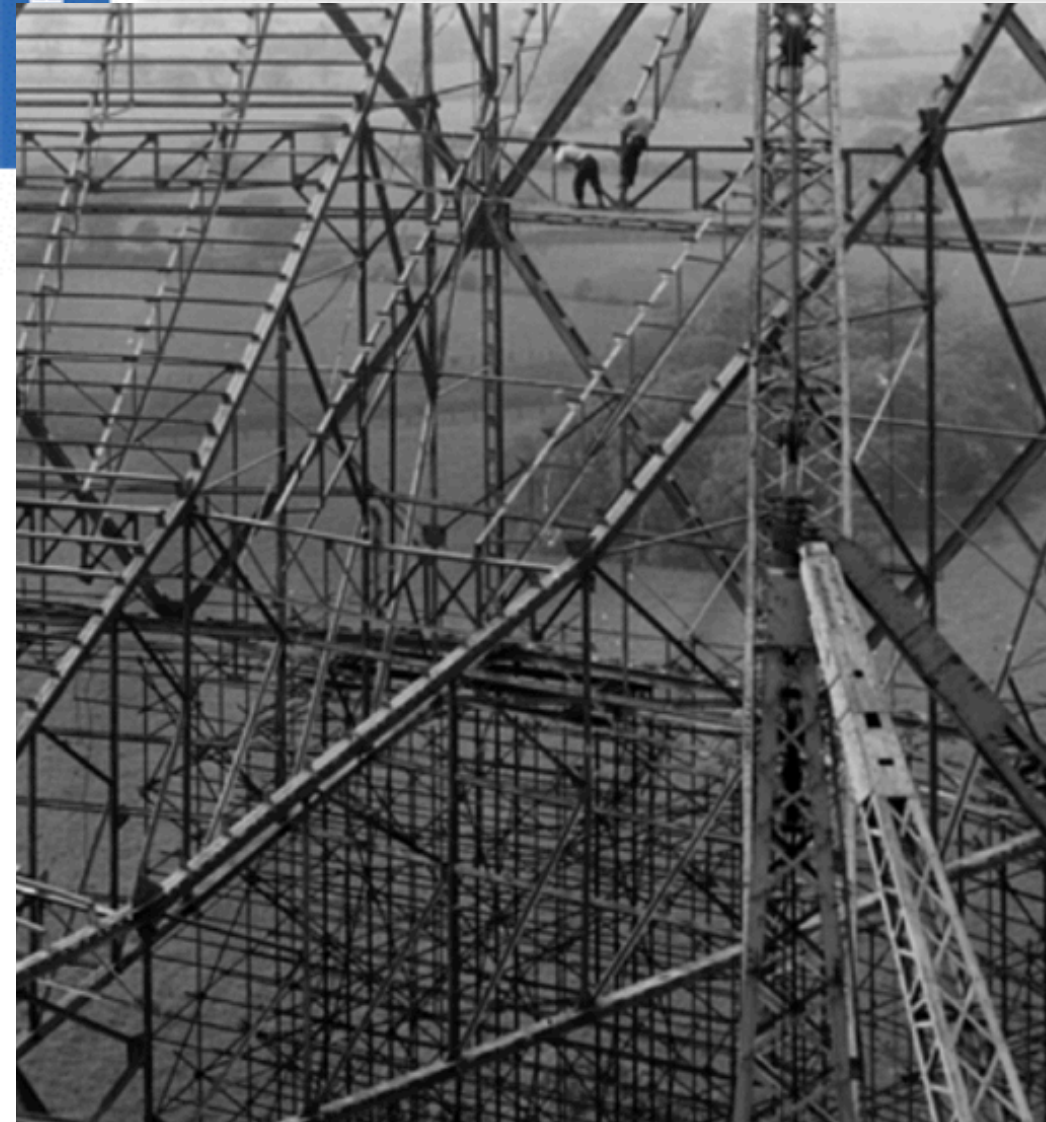
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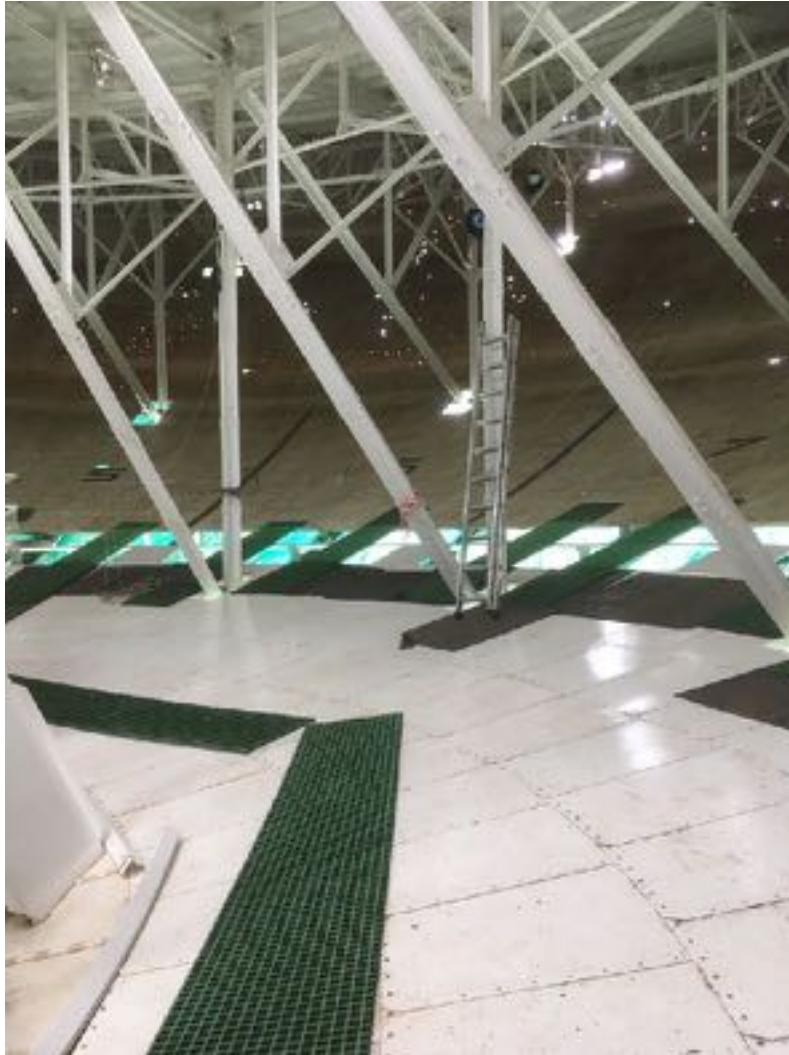
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Bowl framework layout



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Surface replacement 2018



TAZIKER
INDUSTRIAL

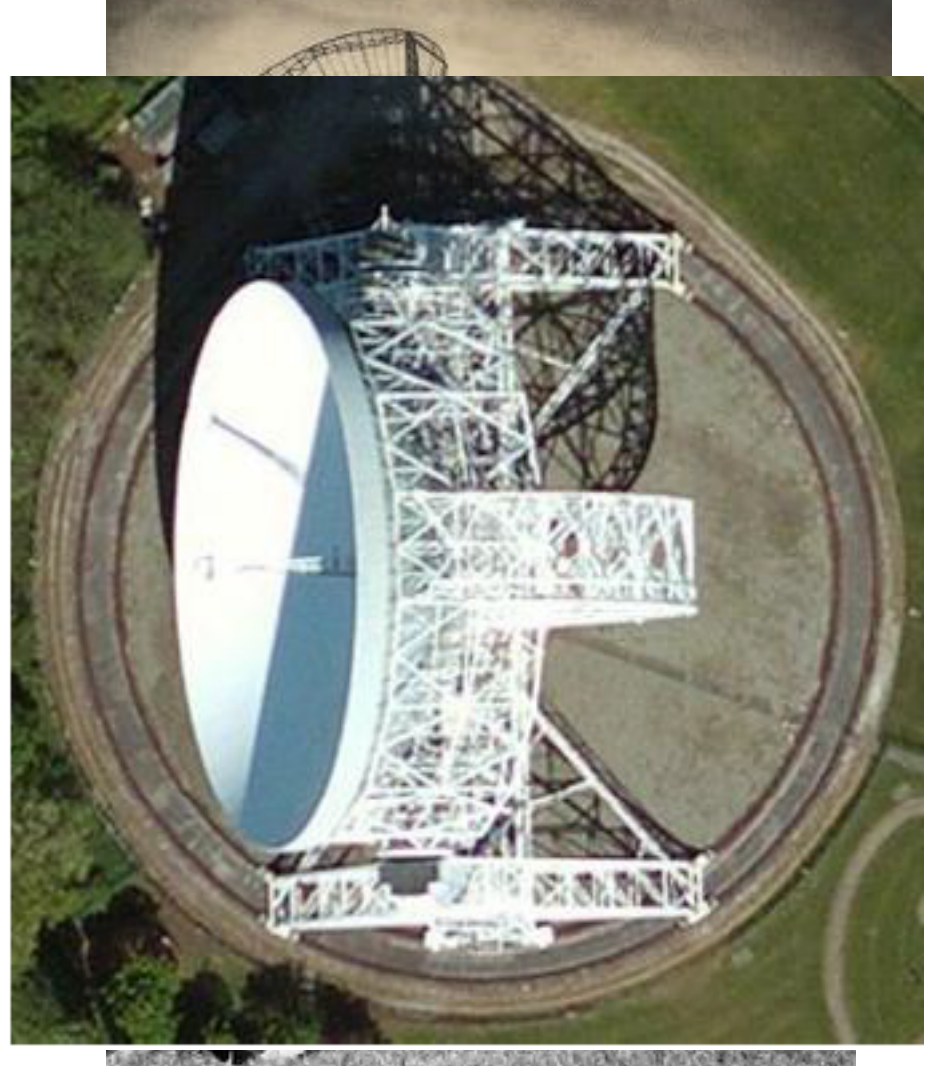
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Conclusion

- Telescopes have many histories: scientific, technological, personal, social, international
- This has been a v. partial engineering perspective, looking at changes in design, their motivation, implementation, and consequences, set against a complex background
- The Lovell (MkI/IA) Telescope [surface] is a unique case of design change during construction and major modification 12 yrs later to add a new surface ... and we have now replaced both 'old' and 'new' surfaces, as well as wide range of major and minor repairs
- In doing so, we continue to learn about and add to its fascinating history



Thanks to Phil Clarke and all the JBO engineering team
James Peters @ John Rylands Archive



