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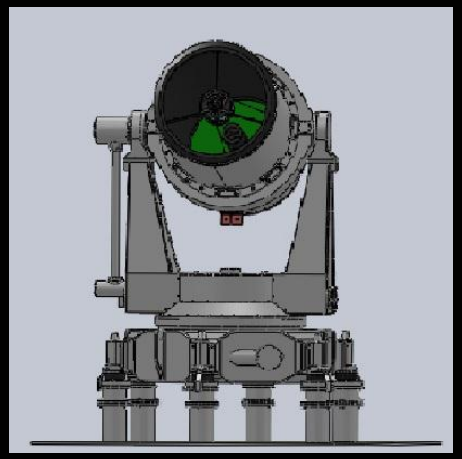
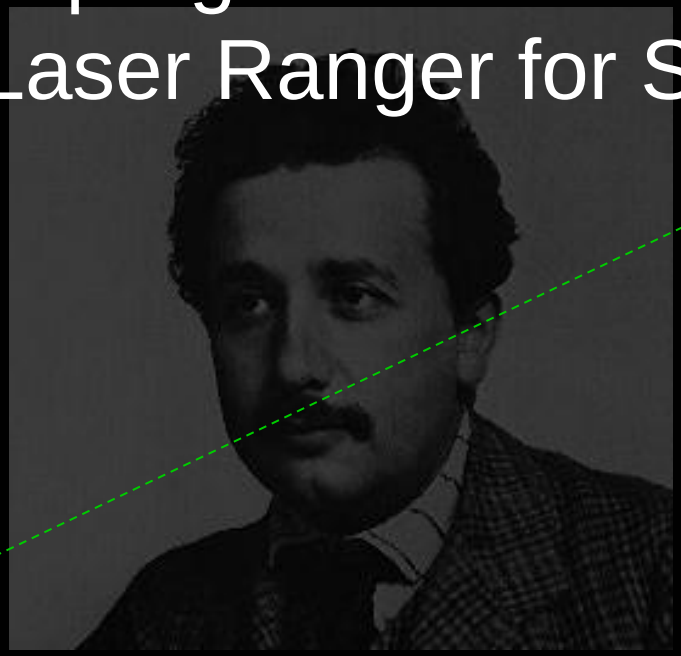
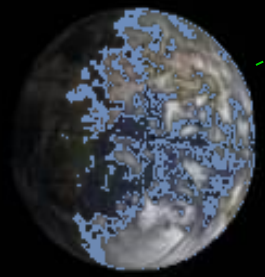
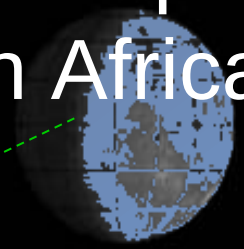
Challenges and progress with the development of a Lunar Laser Ranger for South Africa









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Space Geodesy Programme
Hartebeesthoek Radio Astronomy Observatory
In collaboration with Observatoire de la Côte d'Azur

18th International Workshop on Laser Ranging
- Pursuing Ultimate Accuracy & Creating New Synergies -
11-15 November 2013 Fujiyoshida, Japan


2 VLBI antennas, VLBI2010 antenna
construction starting 2014

No LLR currently in Southern Hemisphere; The SA LLR will be part of the GGOS network and part of the NASA SLR network

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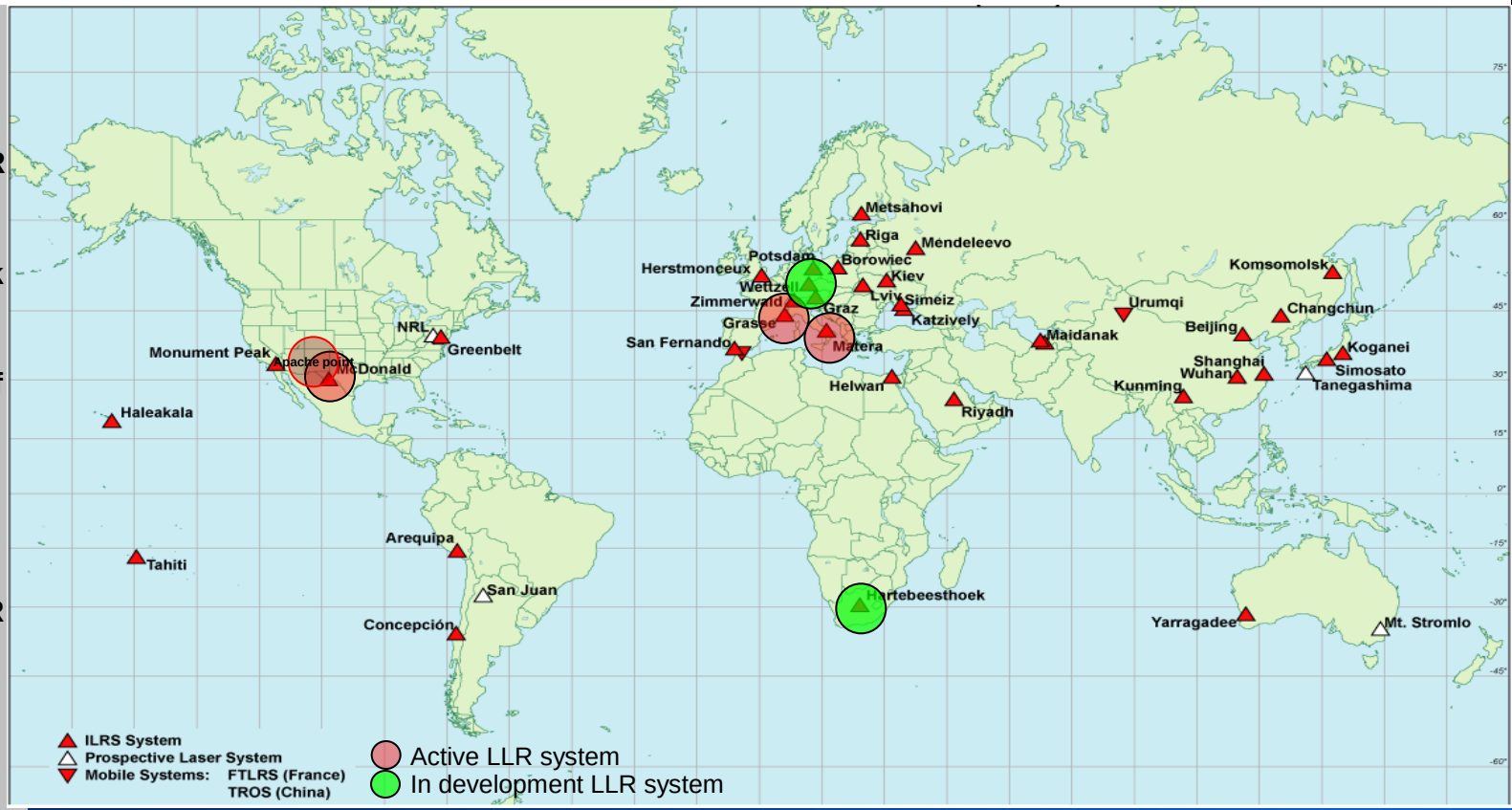
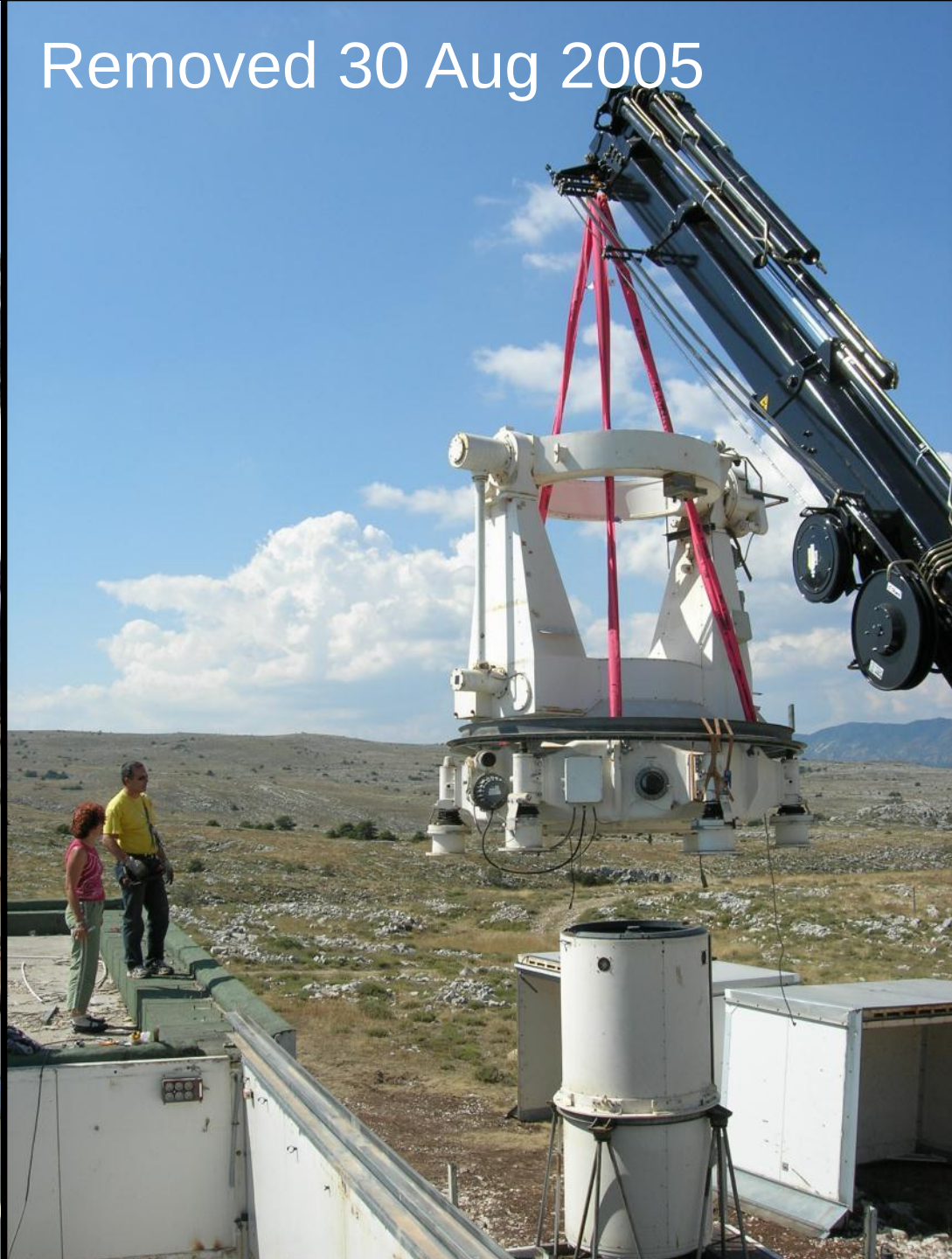
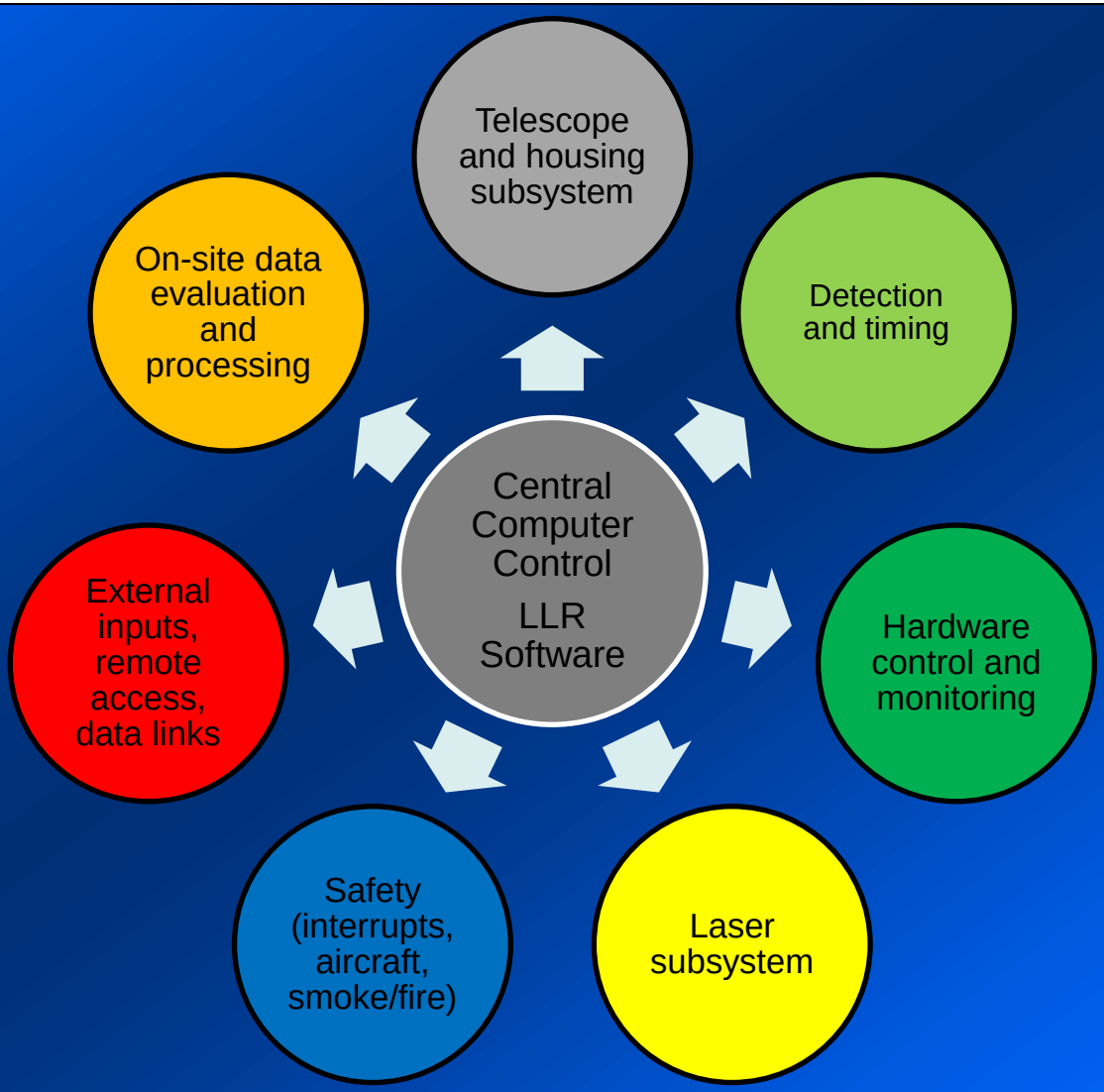
- A Southern Hemisphere LLR will strengthen the geometry of the LLR network and should improve the determination of the orientation of the Moon
- A dual system S/LLR will provide added coverage of SLR data in an area very sparsely covered
- Currently 4 active LLR systems, 2 in development



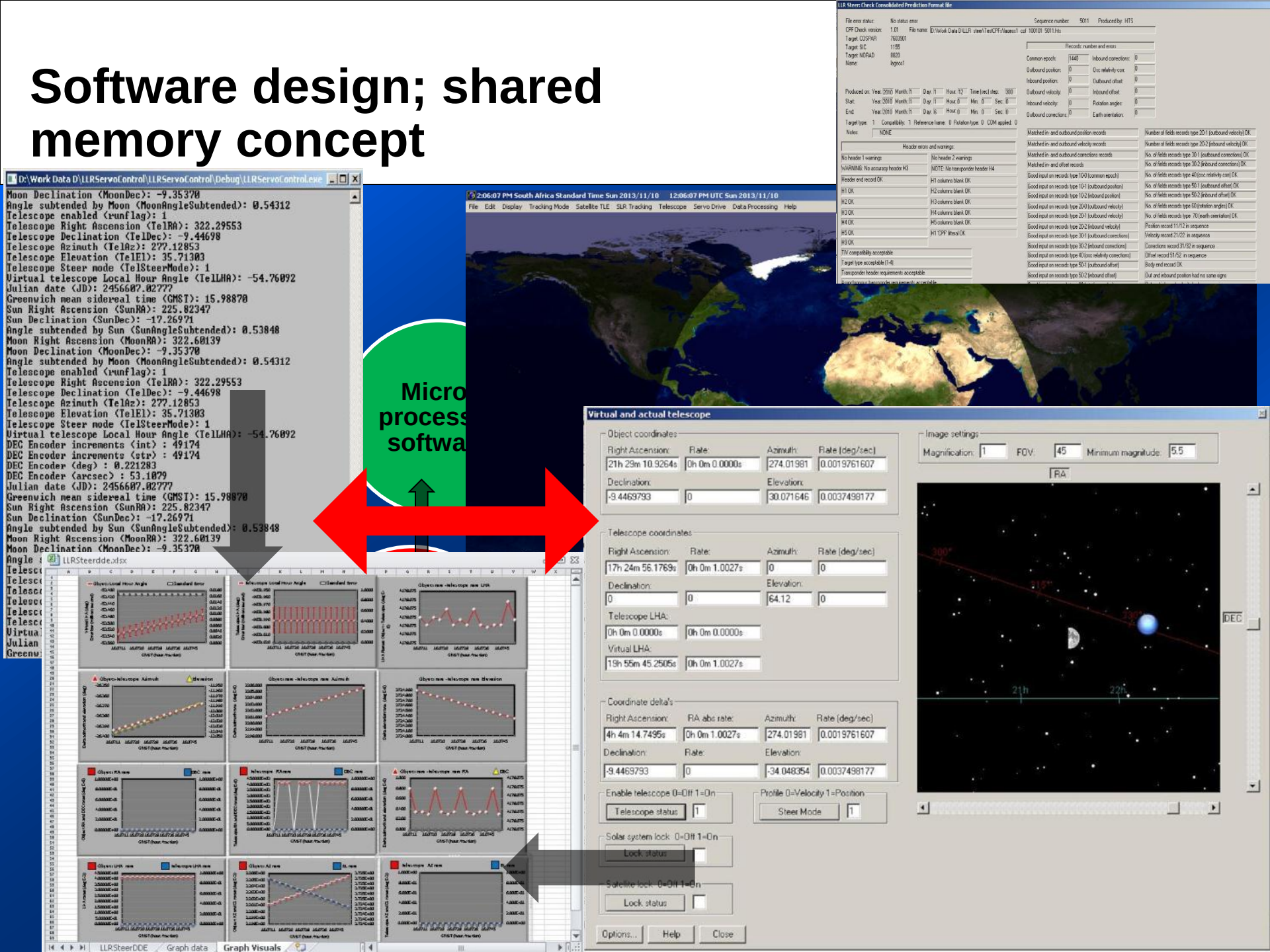
The concept of an LLR for the southern Hemisphere was discussed at the13th International ILRS Workshop (October 2002) in Washington at an LLR breakaway meeting, where community support was given in principle. I had previously discussed the idea with Etienne Samain (OCA, France). Originally I had tried t o obtain use of a 30" telescope at Sutherland, South Africa, proposal at SAAO meeting 26 April 2003.

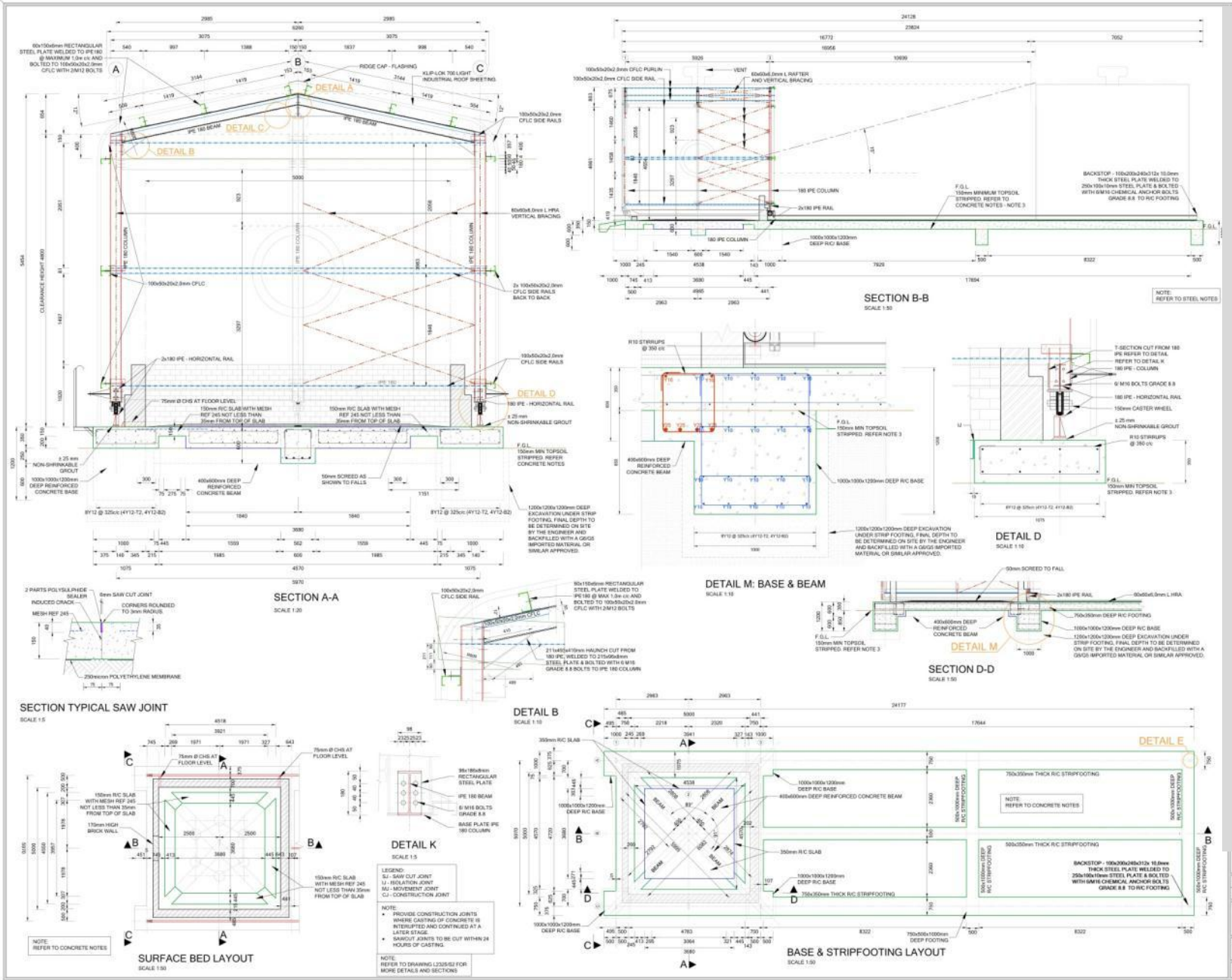

Removed 30 Aug 2005

Overall design concept is software-centric



Software design; shared memory concept





Telescope housing

- 2.5 minutes to open and move away
- Can be dismantled and moved to final location
- Large enough to allow maintenance access via crane
- All metal construction
- Steel reinforced massive concrete floor
- Housing runs on tracks via electrical motors
- 1 ton crane to remove gearbox and instruments

‘Temporary foundation’

- Telescope housed in run-off enclosure
- Crane to assist in disassembly and refurbishment
- Totally nuts and bolts construction to facilitate future removal to appropriate site
- Stable and massive foundation for tests

50 cubic metres of concrete…

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Run-off enclosure on steel tracks

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Tie to ITRF via GNSS
Mount installed 2 June 2011
Much restoration work ahead!

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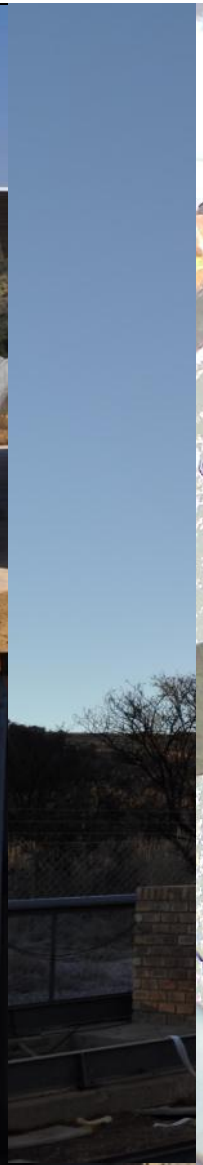

Gearboxes were removed, disassembled, refurbished, modern oil

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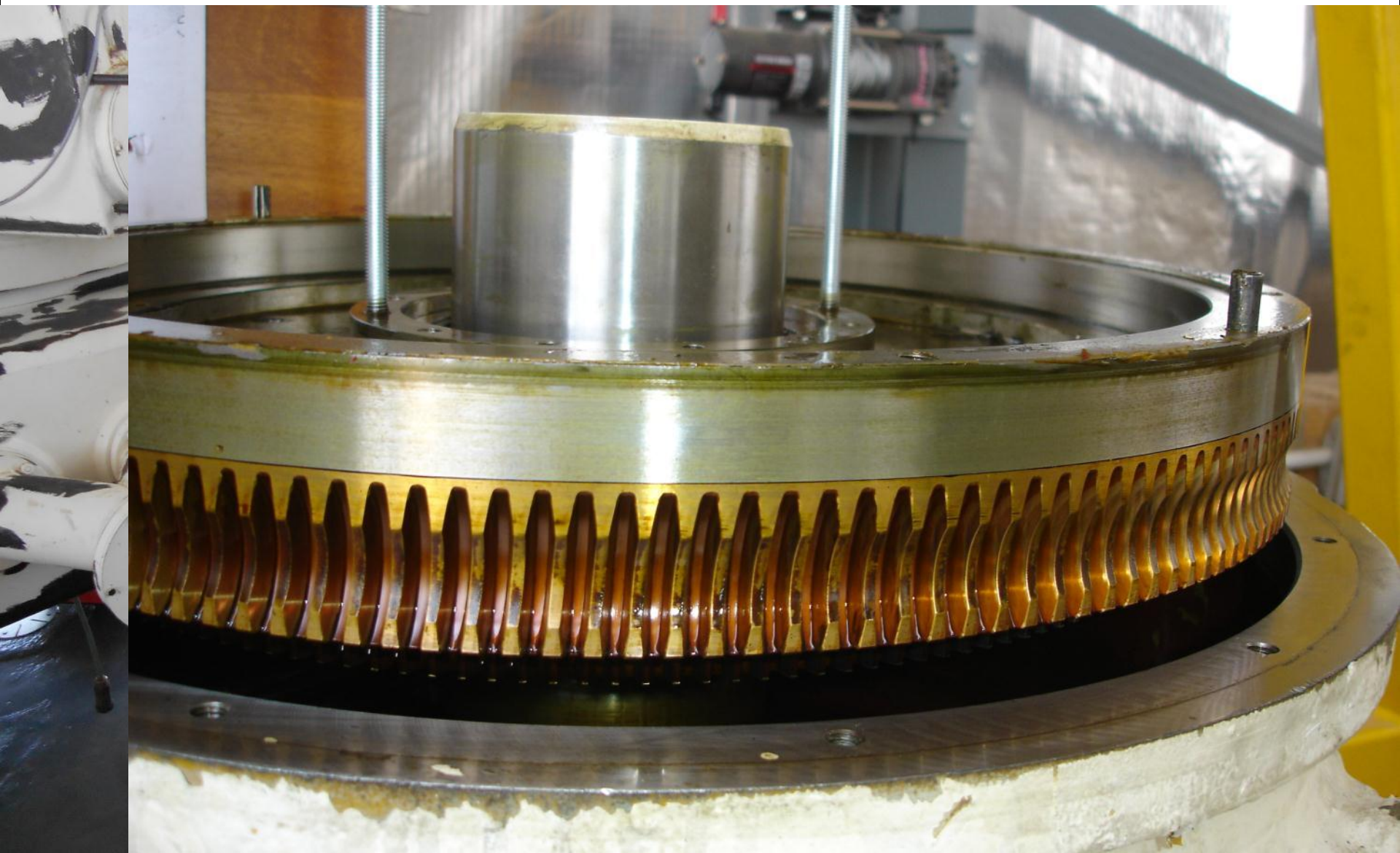

Tube has been restored

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All panels and Az-El mount repainted with heat reflecting paint

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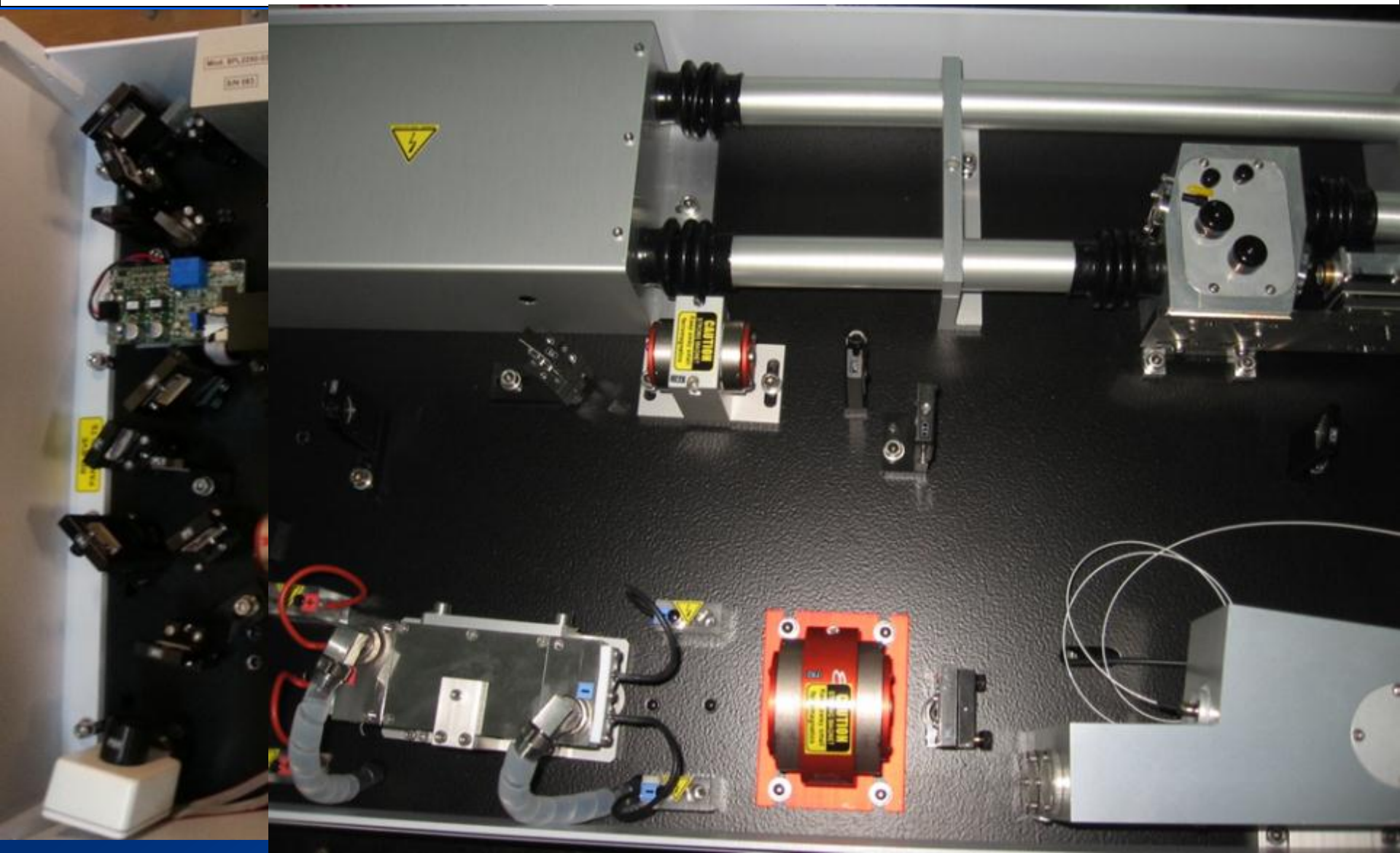
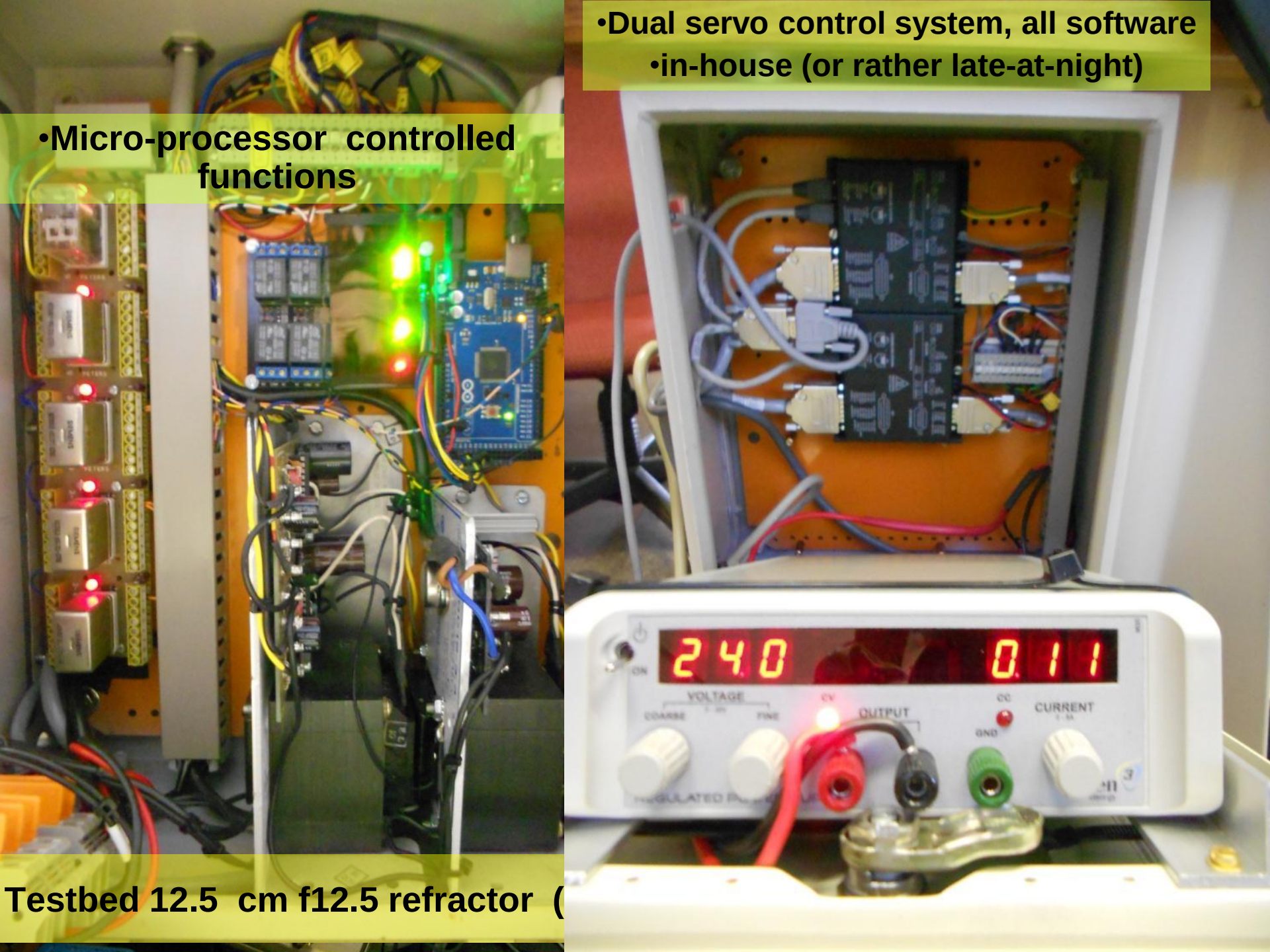
KEEP THIS DOOR
CLOSED
FOR REPTILES

Laser system by Cybioms Corporation

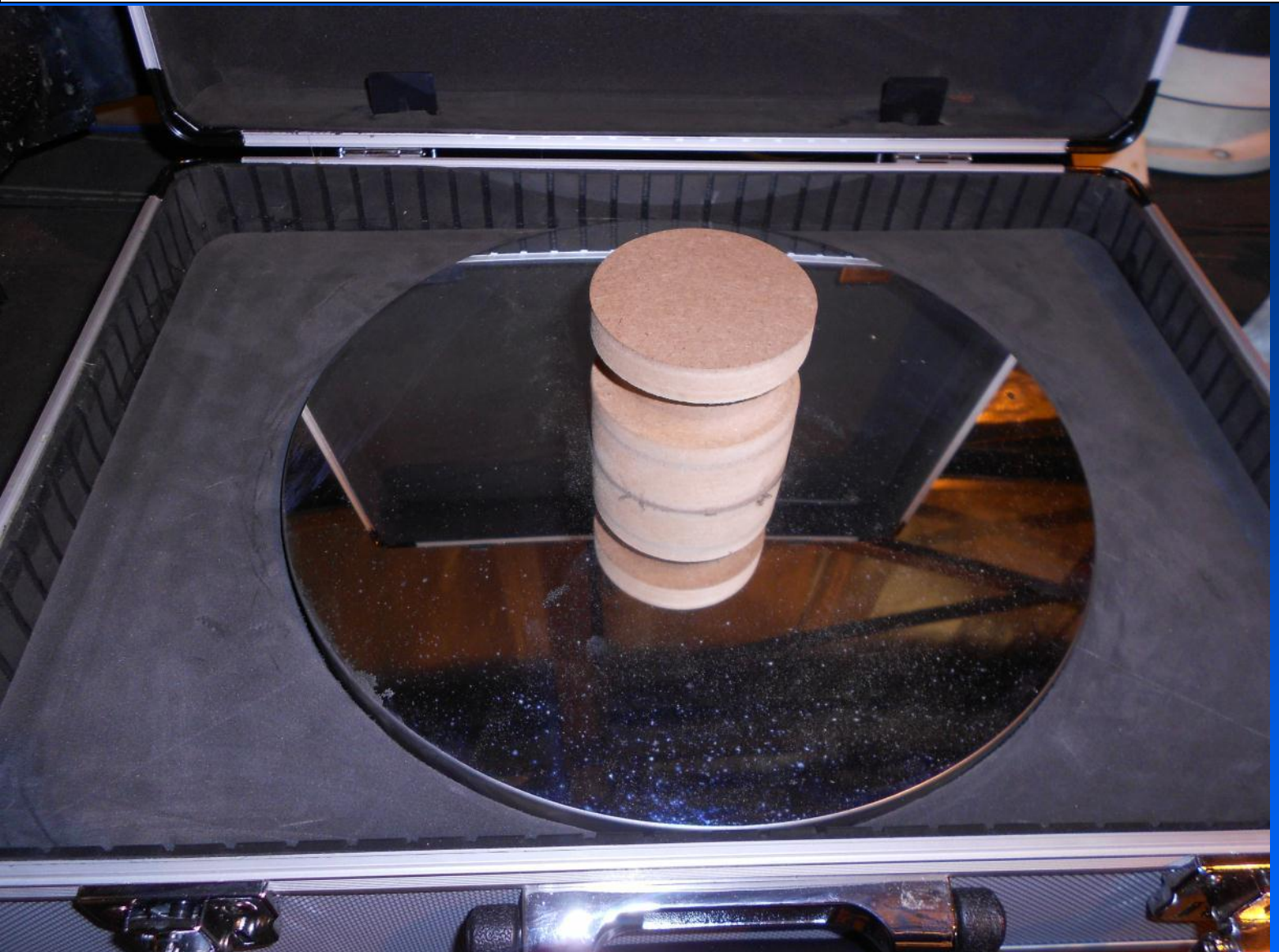
100 mJ, 20 Hz, <80 ps; 1KHz, 0.5 mJ

NRF National Research Foundation | HartRAO Hartebeesthoek Radio Astronomy Observatory




•Micro-processor controlled functions
•Dual servo control system, all software
•in-house (or rather late-at-night)
Testbed 12.5 cm f12.5 refractor (
240
011
VOLTAGE
COARSE
FINE
OUTPUT
CV
CC
GND
CURRENT

Main and secondary to be re-aluminized and coated



Control centre based on 12 m shipping container; clean air filters

Control centre designed for desert conditions

- Insulation panels fitted externally and internally
- Rubberised floor
- Dedicated air conditioner in laser room
- Positive air pressure to keep dust out

UPS 20 KVA

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Control room

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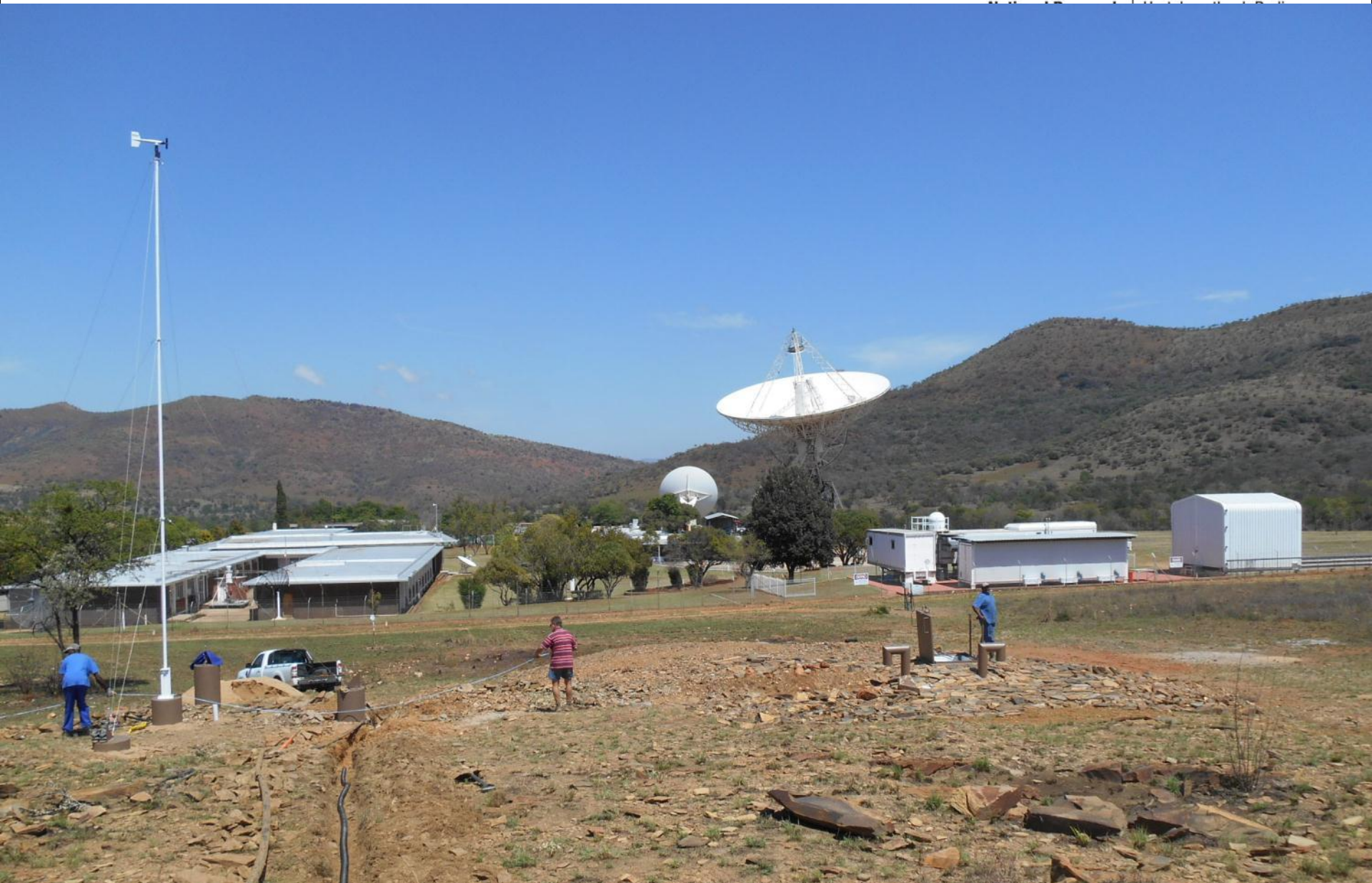
Project completion 2015? 2016?
Where will the system be located?



Thank you!

Acknowledgements

Thanks to the LOC for a fantastic workshop!

Projects such as these depend to a large extent on international collaboration. We specifically thank OCA (France), NASA (USA) and Cybioms Corporation (USA).

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