



**Australia Telescope Users Committee
Technologies Report - 2007**

- **7mm Upgrade**
- **Compact Array Broadband Backend**
- **Pulsar Digital Filter Bank**
- **13mm receiver for Parkes**
- **Parkes multibeam refurbishment**
- **20/13 and 6/3cm upgrade**
- **Mopra spectrometer**
- **MMIC developments**



7mm Upgrade - timeline

February 07

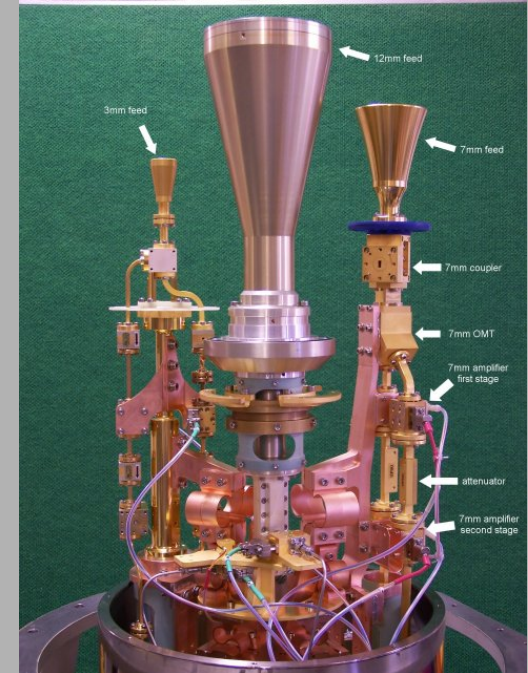
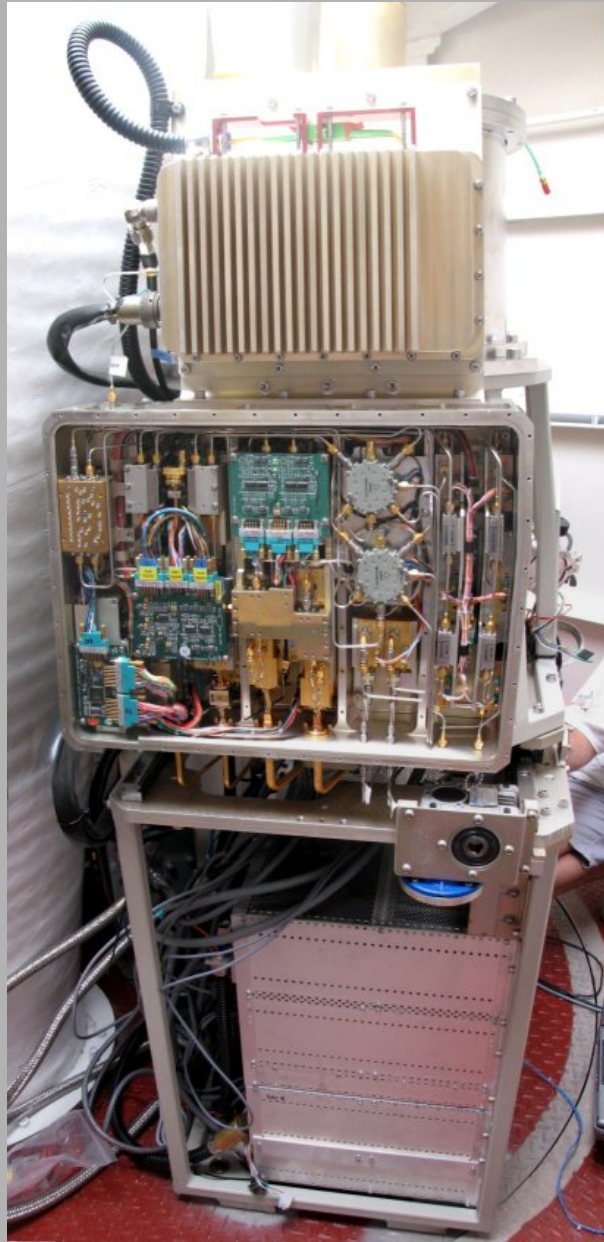
Receivers fitted out and tested with 7mm components in Narrabri labs

March – April 07

Array shutdown to allow the receivers to be installed in the antennas and tested



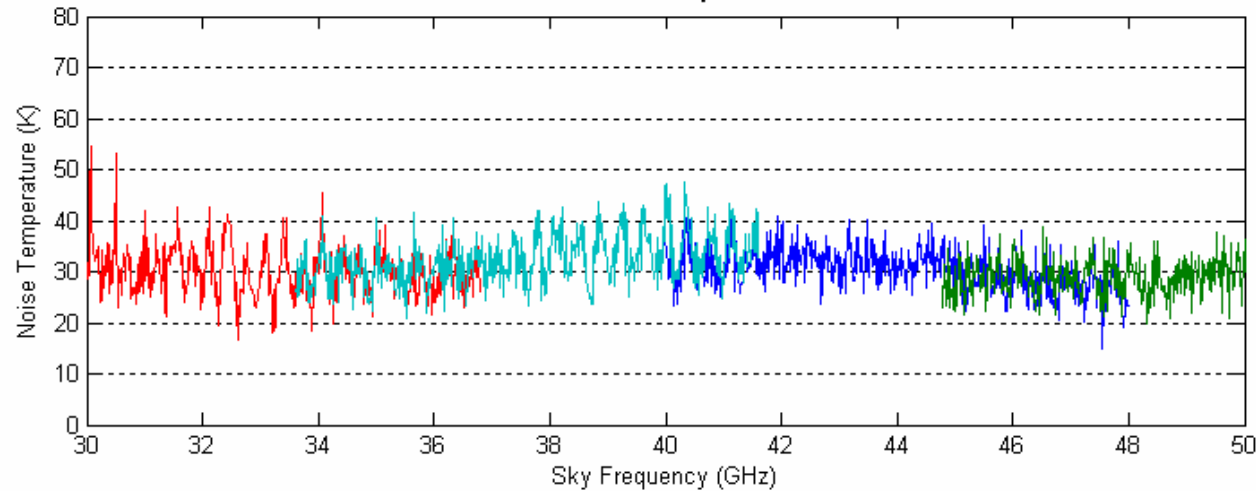
7mm Upgrade – in place



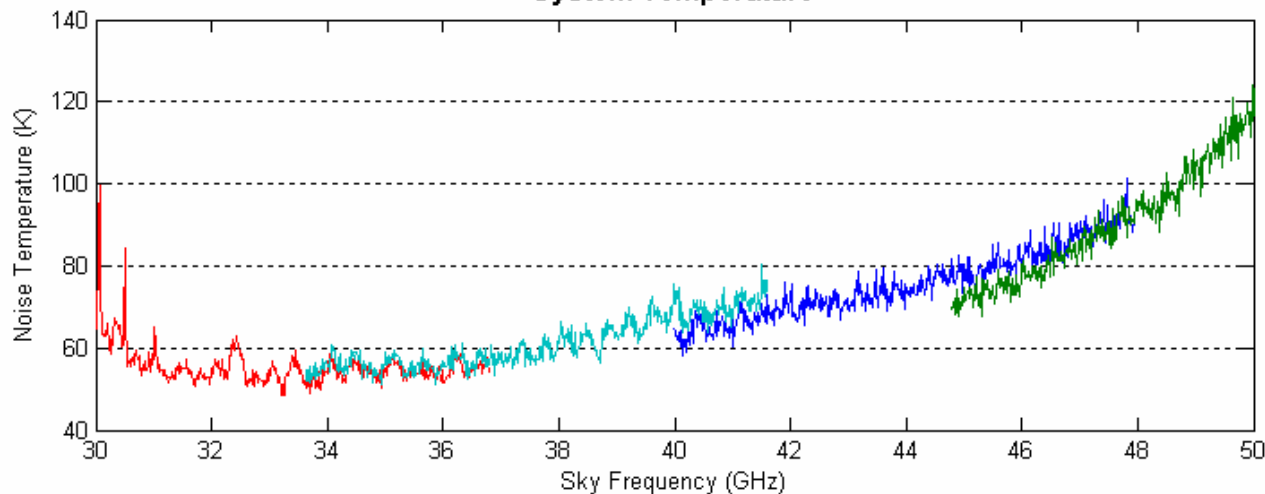
7mm Upgrade – results

Receiver temperatures between 30 and 40 K

7mm Receiver System Performance - CA03 Rx07 A Pol
Receiver Temperature



System Temperature



Main purpose
NASA tracking at
32GHz

Dish efficiencies

60% - 70%

$T_{sys} \sim 38K$

= $33.0 + 2.3 + 2.7$

(rec spill cmb)

G/T avg. ~ 59.5

(dB/K)

G/T array(6) ~ 67.2

(dB/K)

spec. $> 65.7dB/K$

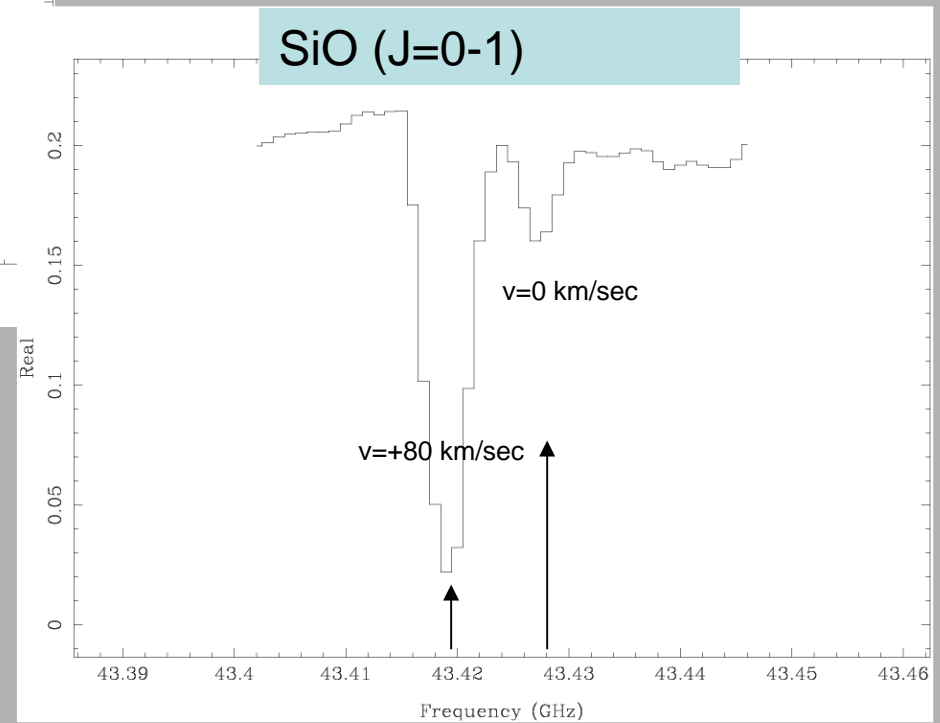
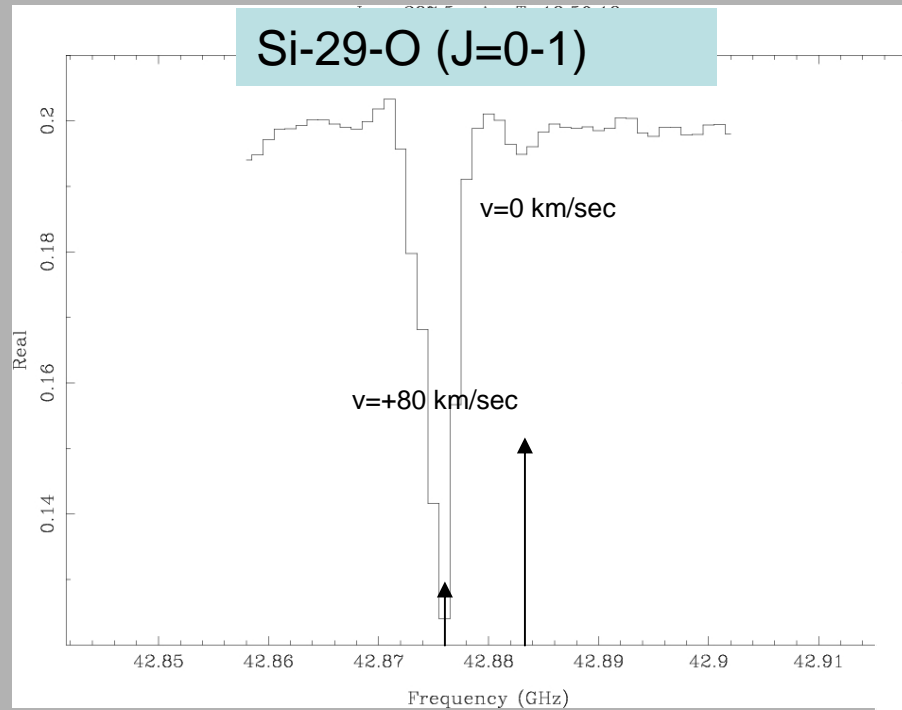
Redundancy?

7mm Upgrade – results

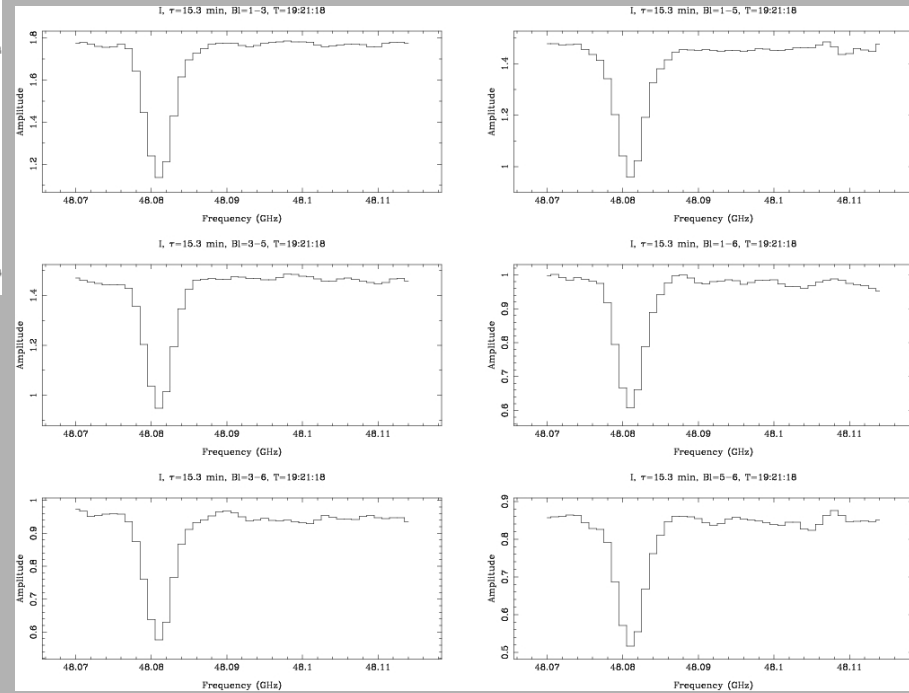
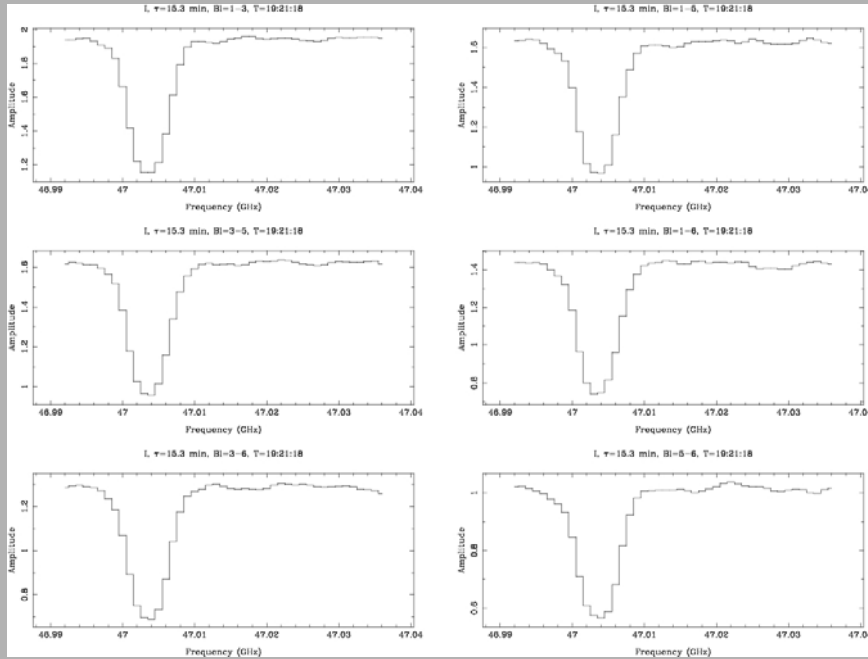
Science

Slide acknowledgement : Ilana Feain

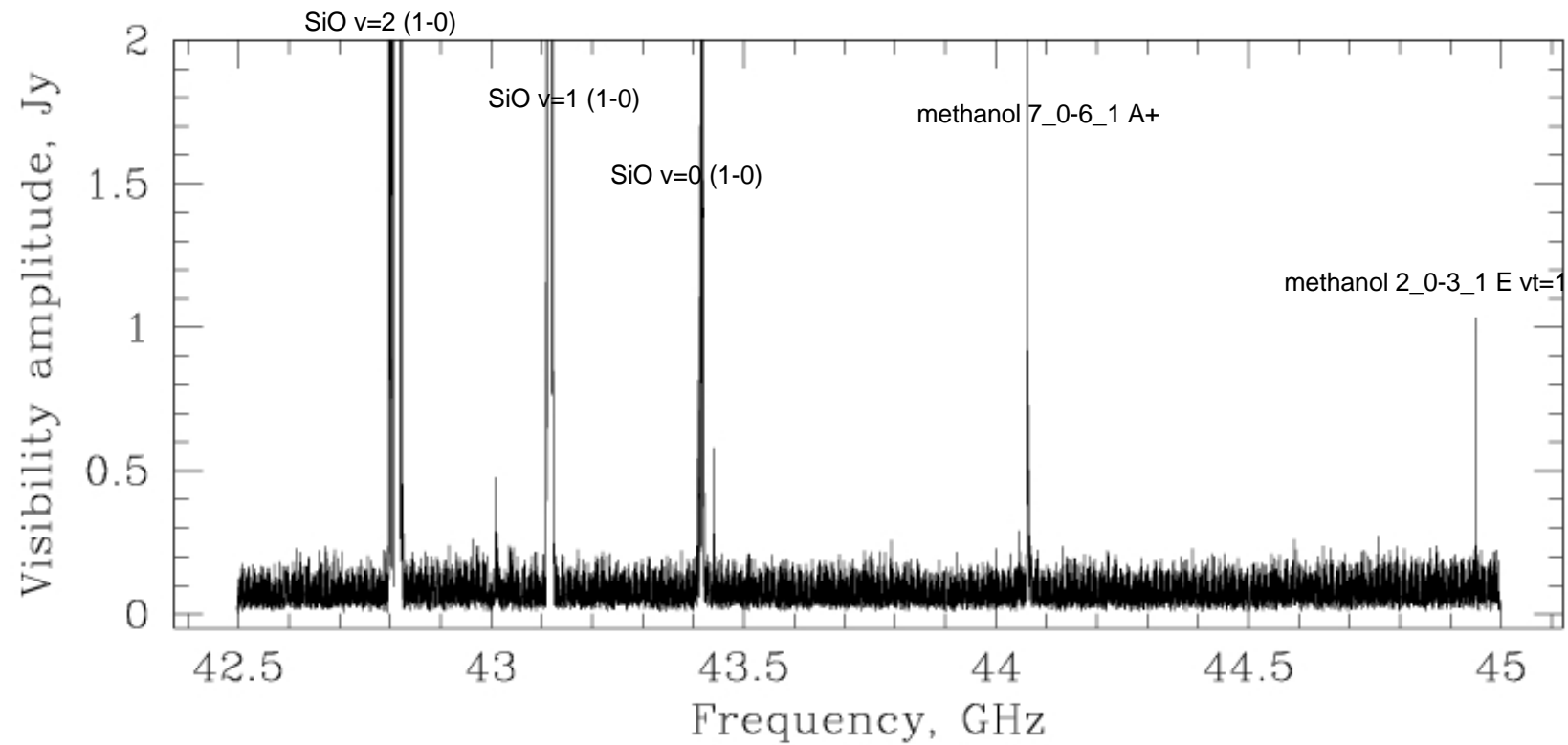
SiO against Sag B2



HCN/HNC @ $z=0.85$ against PKS1830-211

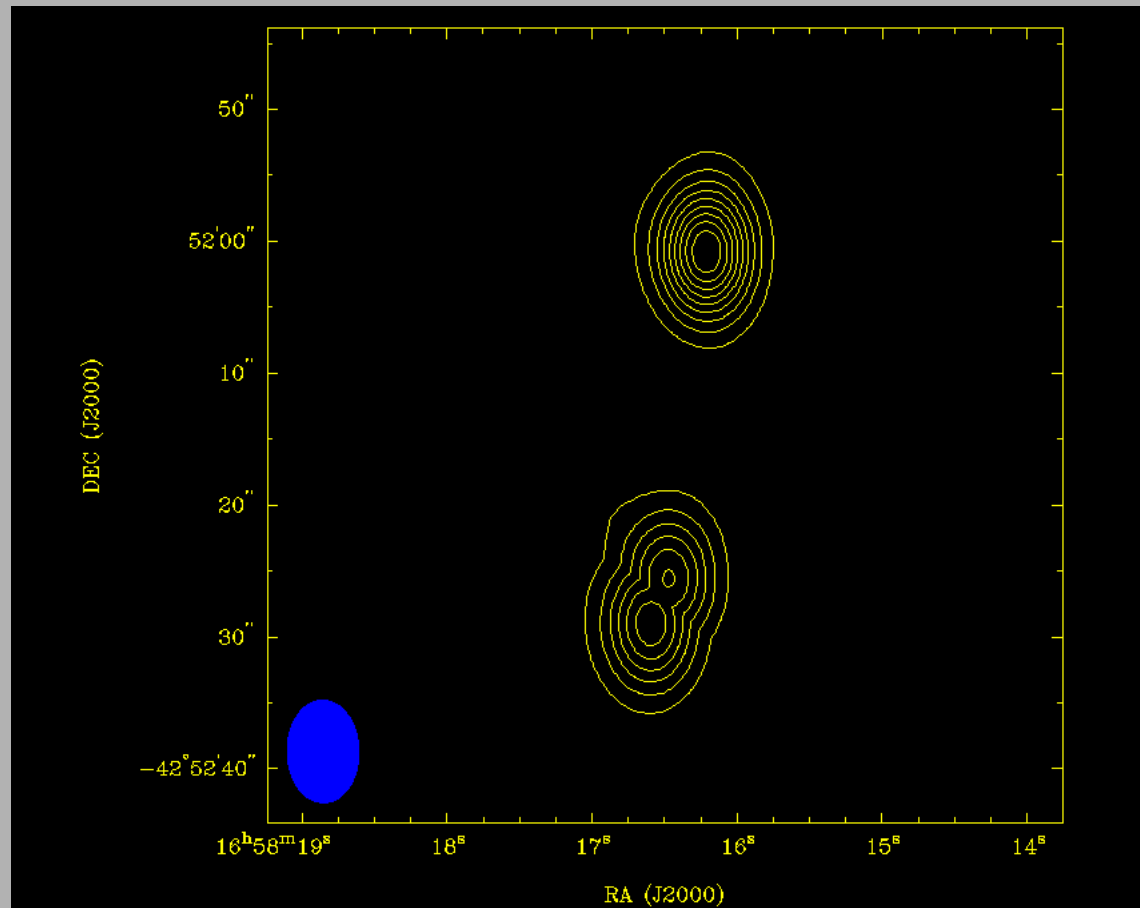


Orion Spectral Scan



G343.12-0.06 (or IRAS 16547-4247)

- The first 36 GHz maser imaged in the southern hemisphere!
- In agreement with 3mm map (Voronkov et al. (2006))



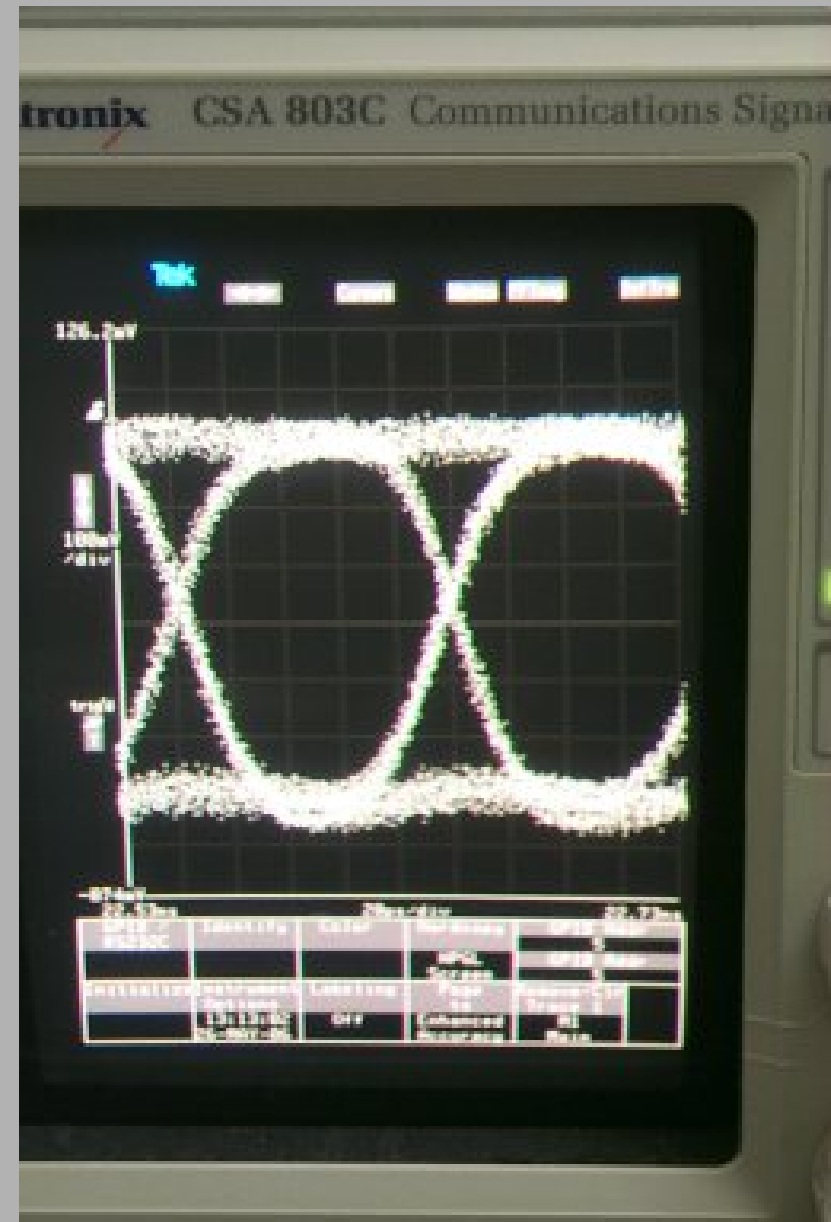
7mm Upgrade – still to do

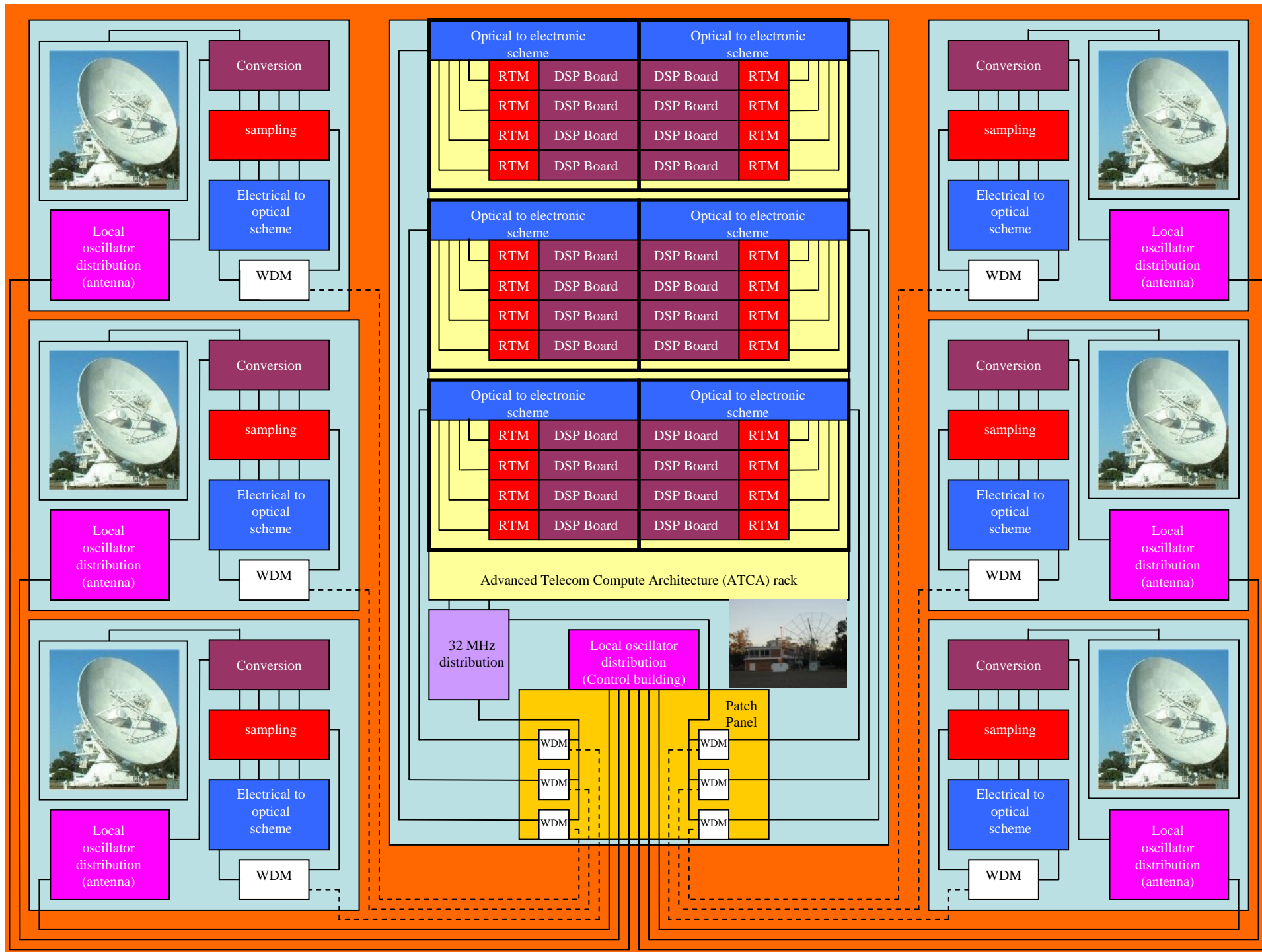
- fabricate spares for cryostats and conversion modules. This includes a spare receiver. 3mm noise injection intended to be incorporated. Mopra could be retrofitted (by Narrabri - 2FTEs for 4 weeks)**
- implement turret safety scheme to prevent rotation when the 7mm system is on axis.**
- implement a tone injection scheme**



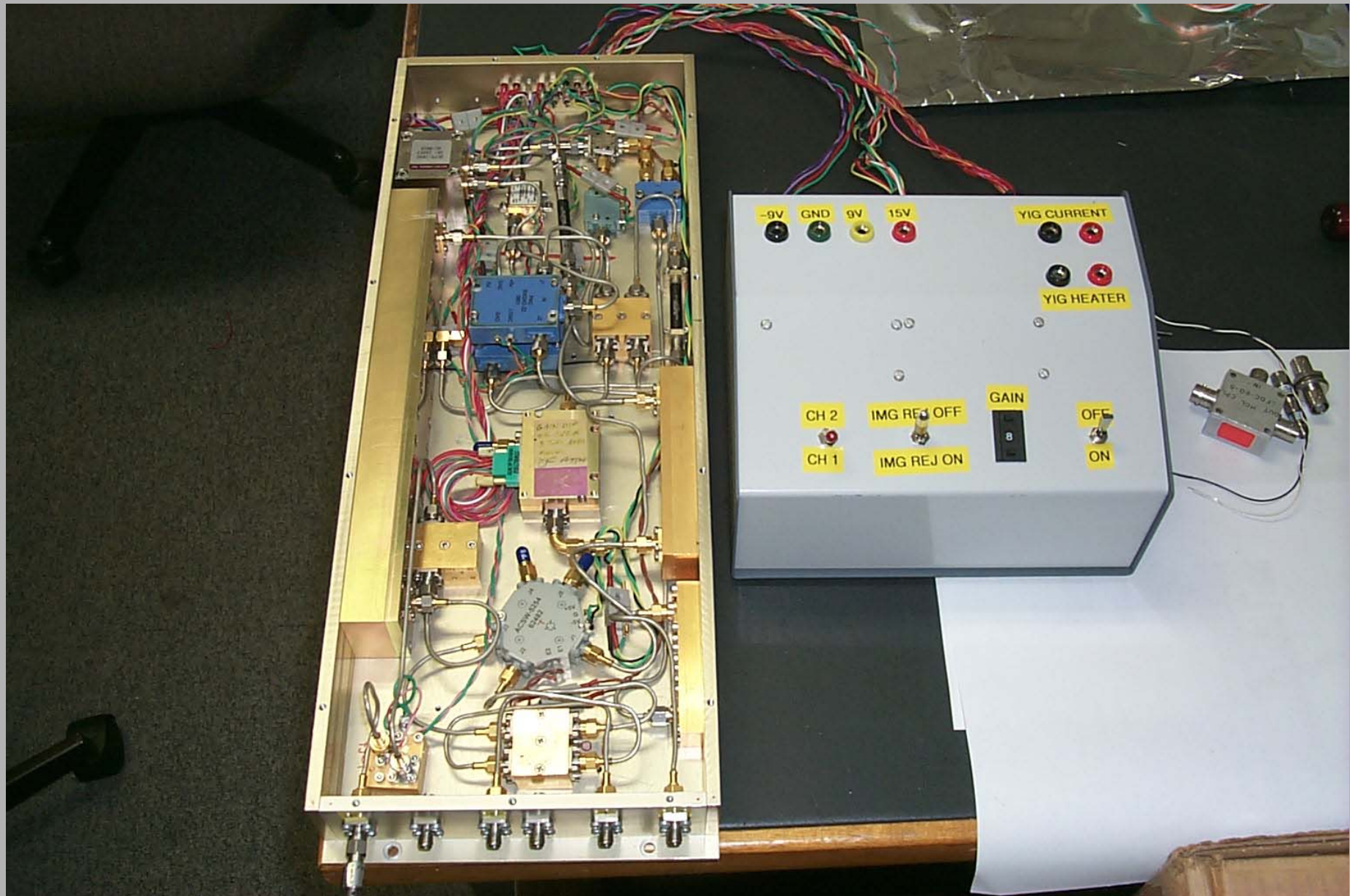
Compact Array Broadband Upgrade – CABB

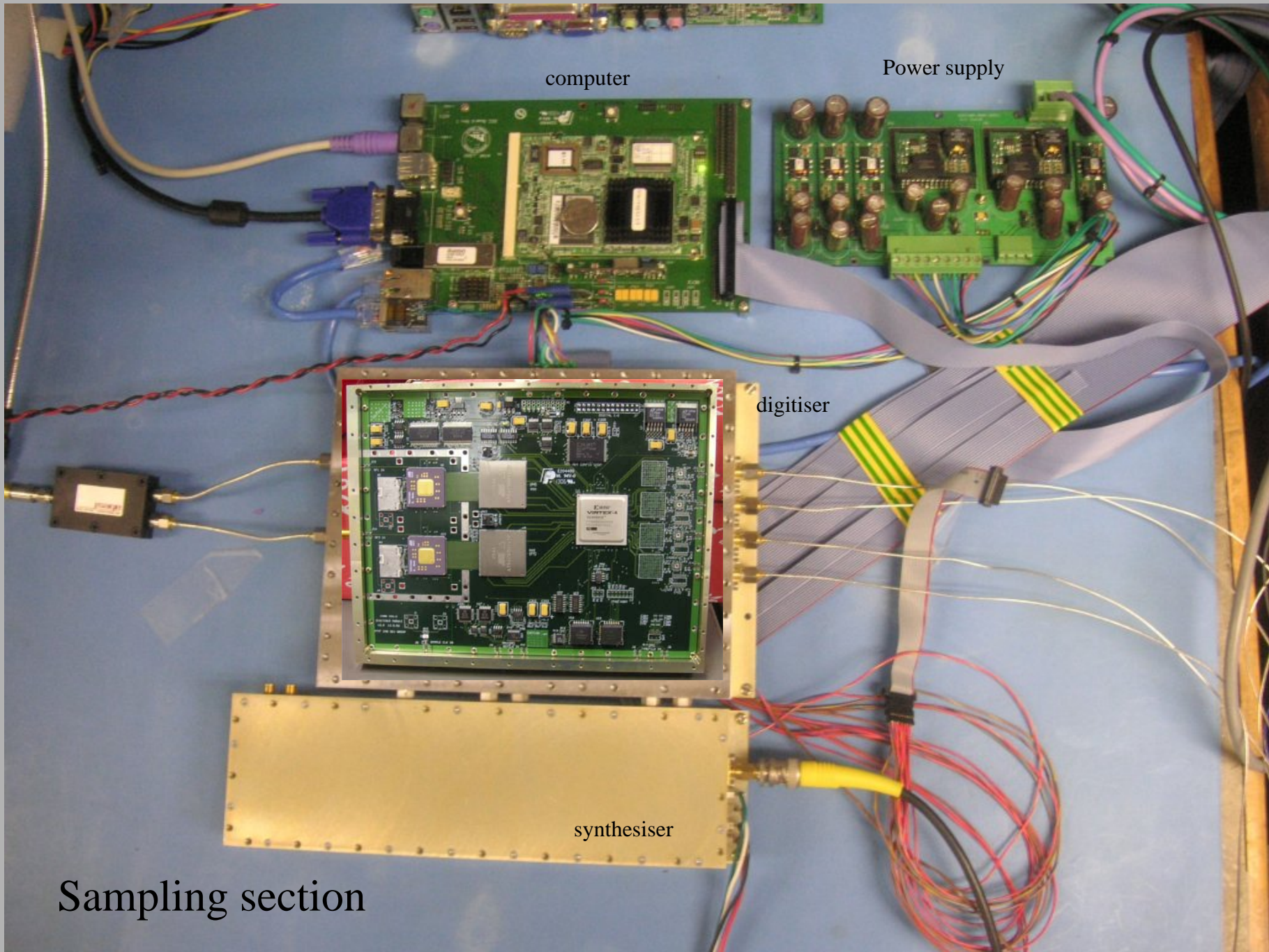
- Significant advances have been made to overcome technology barriers and keep this project moving toward its goal of increasing the bandwidth of the ATCA to 2GHz.
- ‘In lab’ transmission of 40GB/s data was demonstrated in early 2007.





Prototype conversion system





computer

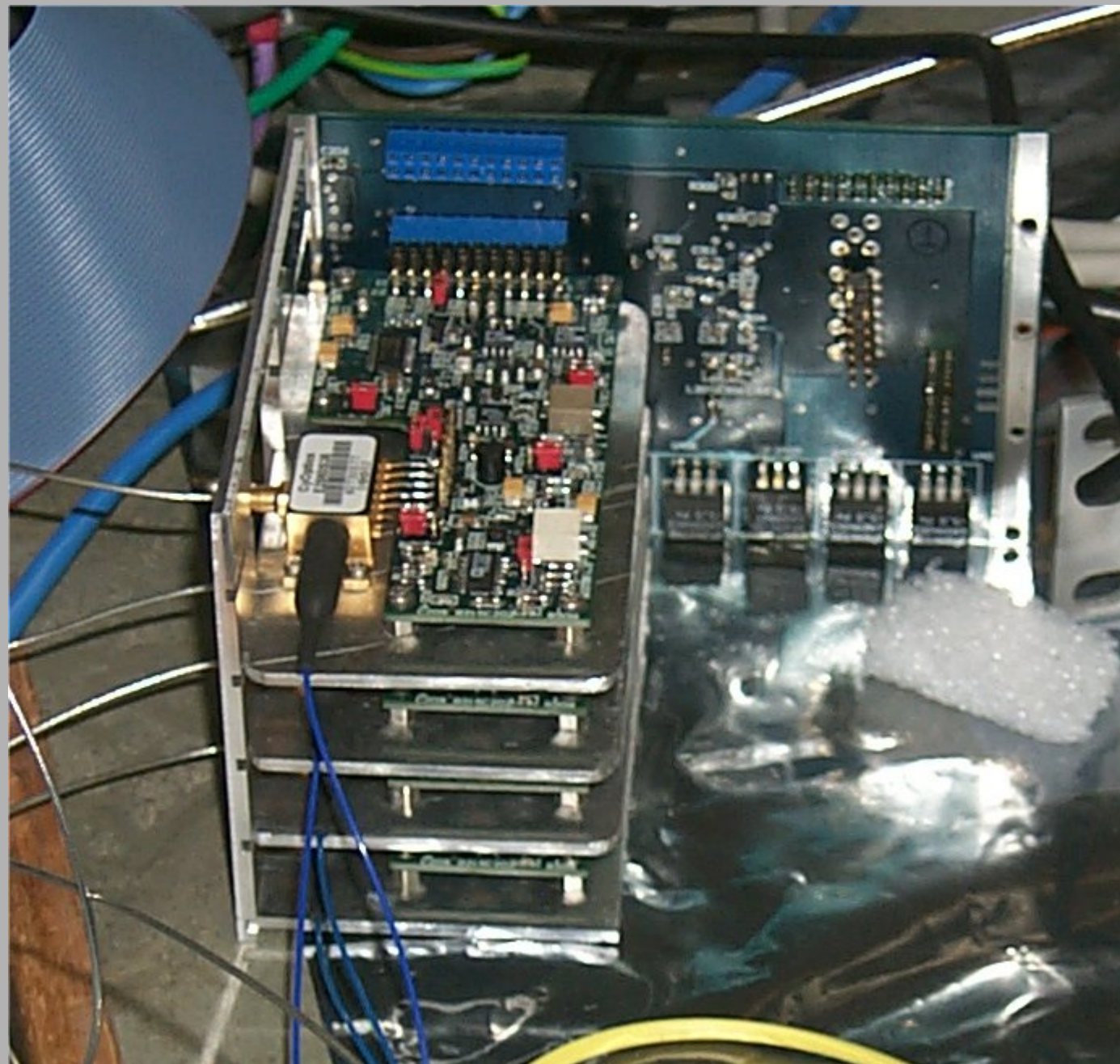
Power supply

digitiser

synthesiser

Sampling section

Electrical to
optical scheme



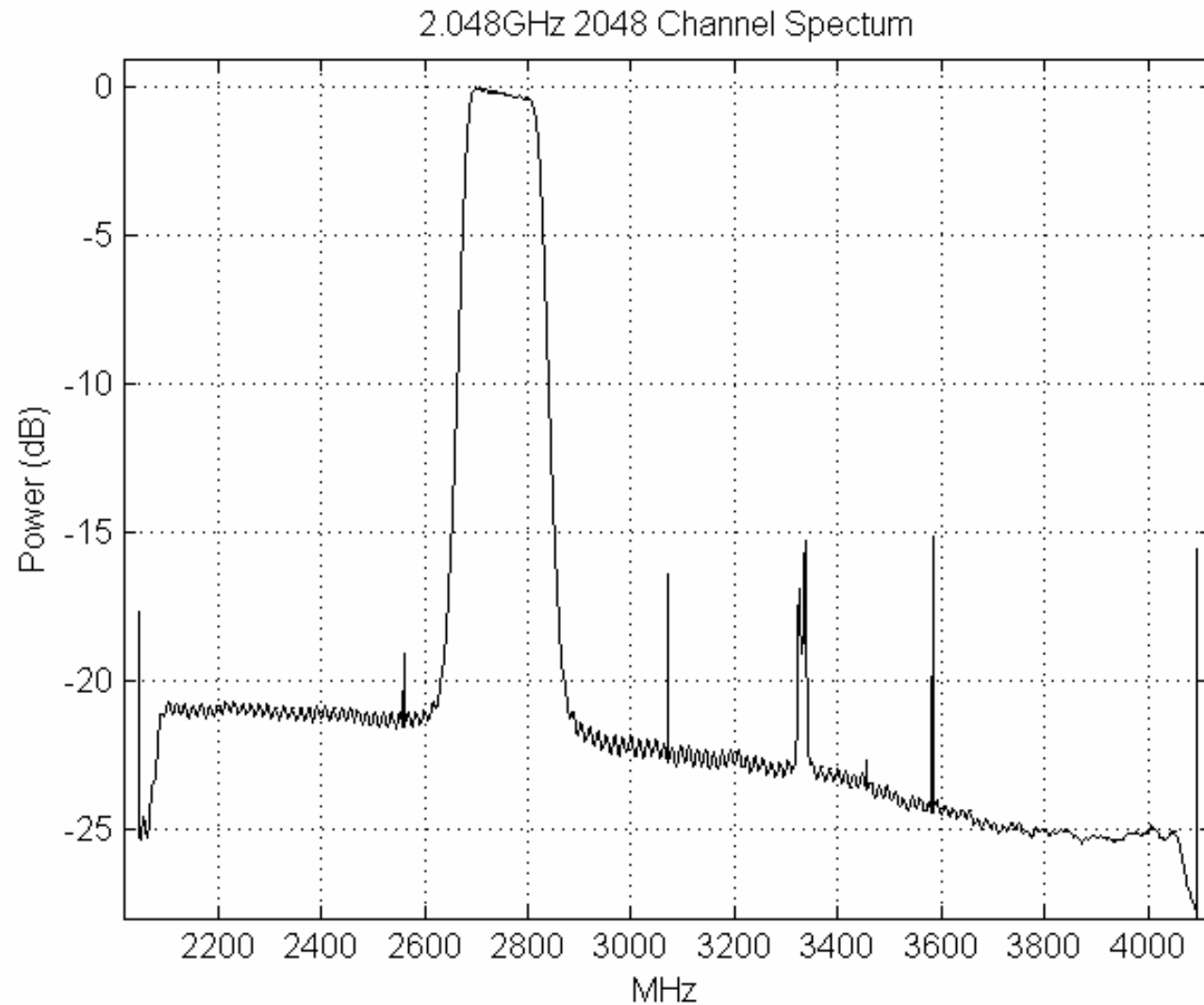
Rear Transition Module (RTM)



Signal processing board



- More recently a 2GHz spectrum has been transmitted through the system and recovered using the newly completed spectrometer created within two of the boards many FPGAs.



Compact Array Broadband Upgrade – CABB

- **Some elements that have already been proven are in, or being readied for, production runs .**
- **A revision of the project plan was conducted early in 2007 and the scope of work in Stage 1 was changed to allow project completion prior to the 2008 millimetre observing season.**
- **Only three antennas will be outfitted with the single frequency Stage 1 systems. This will allow the necessary information on system performance to be gathered without the extra effort and cost of completing six antennas.**
- **Some antenna racks have been installed during the array shutdown**

Pulsar Digital Filterbank

- **The original design for this 1GHz bandwidth, multi-channel spectrometer/polarimeter used a style of FPGA that became increasingly difficult to obtain and the decision was taken to use the prototype CABB board for the initial system.**
- **The filterbank was installed at Parkes in March 2007.**
- **It is currently operating successfully at a reduced bandwidth of 512MHz but a new CABB board to be delivered in late May 2007 will realise the full 1GHz bandwidth operation.**
- **It has generated substantial interest from other observatories.**

Parkes Multibeam refurbishment

- **The receiver is in the final stages of testing 'off telescope' before installation and 'on telescope' tests in early May 2007. This will complete the second and last stage of the refurbishment.**
- **Receiver noise temperature measurements indicate that the system is performing at least as well as before the refurbishment.**

Parkes Multibeam refurbishment

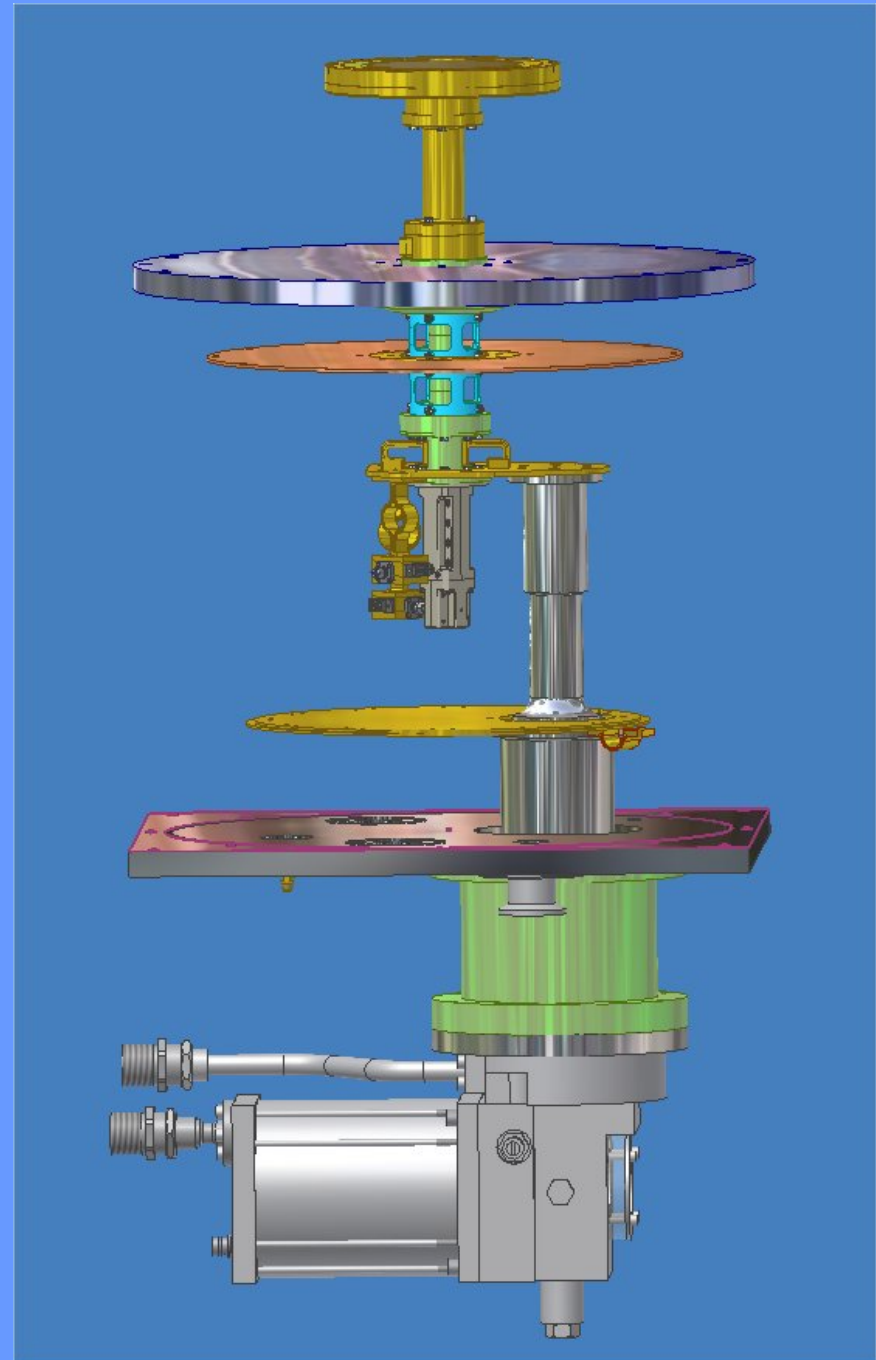
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Mopra spectrometer

- **Work has been done to improve the calibration scheme**

13mm receiver for Parkes

- Substantial amounts of the receiver package design have been completed and fabrication has commenced.
- Some design effort still remains to finalise the input waveguide coupler that will define the waveguide size and allow the rest of the waveguide components to be specified dimensionally.
- The conversion system design is nearing completion and the electronics will be modelled on previous schemes.



20/13 and 6/3cm broadband upgrade.

- Preliminary work has been conducted on redesigning, fabricating and installing fins for one of the 20/13cm receiver feeds. This is necessary to correct polarisation asymmetry at the high frequency end of the band. Testing indicates an improved performance but further analysis is pending.**
- Substantial effort has been put into the new conversion systems required to ensure these systems are compatible with the CABB backend. The 3/6cm design is relatively simple and complete. The 20/13cm system requires an upconversion scheme and a design for a prototype is complete and procurement of components underway.**
- A Narrabri site interference survey is to be conducted in late May 2007 to assess the spectral content of the frequency bands that are to be used.**













MMIC Developments

- The latest 'receiver on a chip' design has been completed with specifications tailored to make it suitable for MiraNda. It has been sent for manufacture. It will be packaged and used as a test bed for determining the practicality of this approach.**
- Indium Phosphide HEMT wafers with both ATNF and FARADAY designs have been received, measured and returned from dicing. They are now being sorted and will provide the main body of spares for the 7mm project.**
- Uncertainty introduced by dealings with TRW and the dwindling support base in the ICT centre has prompted investigations into a different process which uses GaAs substrates with InP performance called 'metamorphic HEMT' or MHEMT. Circuits have been designed and manufactured and await 'on wafer' testing.**

Other considerations

- WVRs
- 115GHz upgrade



		2007	2008	2009	2010
ATCA 7mm upgrade					
CABB					
ATCA cm-wave receiver upgrade					
Parkes 13mm receiver					
Pulsar DFB/RFI					
eVLBI					
xNTD					
MMIC development					
ATCA 115GHz upgrade					
Focal plane array development					
Focal plane array build					
External contracts		