ATNF ATUC MEMORANDUM

To: ATUC
From: Warwick Wilson
Date: 1 June 2006
Subject **Technology development report**

Parkes 6GHz Multibeam Receiver

ATNF and Jodrell Bank have collaborated in the development of a 7-beam receiver covering the 6 to 7GHz band. Adaptable to either the Parkes or Lovell telescopes, initial installation took place in January 2006 at Parkes. Although delayed by two months due to some last minute design changes brought about by a communication problem between the partners, the late installation has allowed extra capability to be added, to the extent that the receiver can now observe at two frequencies simultaneously. As a result, the large methanol maser survey, which is now under way, is also providing a parallel excited-OH survey. An initial problem with the down conversion system has been rectified, and the receiver is now performing very well.

7mm ATCA Upgrade

Early results of tests of the prototype 7mm frontend components indicate that good performance can be achieved across the full 30 to 50GHz band. A complete 7mm RF chain is being added to the spare ATCA mm-wave receiver, with a view to installing this unit on antenna 6 around early July. This will allow a full on-sky evaluation of the G/T performance, a critical factor for the Ka-band spacecraft tracking application. The project is on schedule for installation by May 2007.

Mopra mm-wave Receiver

The new MMIC-based mm-wave receiver at Mopra now has full capability at 12mm, in addition to the 77 to 116GHz coverage at 3mm. The switched noise injection facility at 3mm has been tested and shown to be a useful addition to the calibration system of the 3mm band. Initial tests of the polarisation properties of the injected noise signal indicate that a similar system, if installed on the ATCA, would provide useful polarisation calibration at 3mm.

The excellent performance of the new Mopra 3mm receiver has demonstrated that ATNF now has the capability to extend the frequency coverage of the ATCA from 105 to 115GHz. Although commitments to the 7mm upgrade would prevent this proceeding in the short term, it remains an interesting possibility for the future.

Mopra 8GHz Spectrometer (MOPS)

MOPS was installed at Mopra in mid-May. The first observing session using the full 8GHz bandwidth is under way. The initial wide-band configuration provides 1K channels over each 2GHz sub-band, a factor of two down in resolution on the specified figure. It is expected that this will be increased to 8K channels in the near future. Initial results are very encouraging, with the simultaneous 8GHz coverage providing lots of entertainment for the users. There are still some issues, mainly to do with the Tsys measurement, which need sorting out.

The design of firmware for the narrow-band, high resolution, mode is nearing completion. This is an adaption of the configuration used at Mopra last year. It will provide at least two tunable ~100MHz wide zoom bands per 2GHz sub-band, with 4K channels across each zoom band.

MNRF2001 – ATCA Broadband Upgrade (CABB)

The redesign of the sampler, forced upon us by the uncertainty in the supply of the special Xilinx FPGAs, is complete and a prototype is being tested. Initial results are very encouraging, with the 10GB/s output data streams looking very good. A complete test of the digital data path, from sampler through to signal processor and including the fibre optic circuits, is planned for June. Initially the CABB prototype signal processor, the same as used in MOPS, will provide the destination for this test.

Schematic design and layout of the final CABB signal processor board is complete. An external contractor, in India, will carry out the routing. The PCB will be manufactured, in China, and we expect to have a prototype available, in Sydney, for testing in July. Grant Hampson and Andrew Brown are to be congratulated for keeping this complex task on schedule.

Pulsar Digital Filterbank

This project builds on the experience gained in the development of digital filterbanks for the CABB project. The aim is to develop a 1GHz bandwidth, multi-channel spectrometer/polarimeter with sufficient time resolution to resolve the fastest ms pulsars.

It now appears very unlikely that the Xilinx FPGAs required to complete the pulsar digital filterbank in its original form will ever become available. Consequently, a decision has been made to use the new CABB signal processor board for the pulsar digital filterbank. Considering the status of the design and fabrication of this board (see above), it is unlikely that a working system will be available much before the end of this year.

SKA Radio Frequency Site Tests

Continuous RFI monitoring measurements were undertaken at Mileura from January 2005. In January 2006 the ATNF mobile RFI monitoring equipment was moved to two nominal SKA station sites in W.A. for a short series of measurements. The complete set of collected RFI data was presented in a report to the international SKA project office in mid-March.

Major new projects

The second and last stage of refurbishment of the 21cm Parkes multibeam receiver will begin in October 2006, almost two years after the first stage was completed, and almost ten years after its initial installation. The remaining original LNAs will be replaced with units produced at ATNF. New and more powerful cryodyne refrigerators will also be installed.

Work has begun on the construction of a new 13mm receiver for Parkes, covering the frequency band 16 to 26 GHz. The new system will provide an improvement of approximately a factor of three in sensitivity over the system that has been available for the last decade, opening up numerous new science targets, and greatly increasing observing efficiency and science outcomes for established programs.