ATNF ATUC Memorandum

To: ATUC
From: Simon Johnston
Date: 2 June 2005
Subject **xNTD Science Meeting Summary**

The New Technology Demonstrator (NTD) is the ATNF's SKA technology demonstrator for wide field-of-view, low frequency solutions. The Extended New Technology Demonstrator (xNTD) builds on these solutions to create a viable scientific instrument. As flagged by ATUC at the last meeting, the ATNF organised a one-day science workshop 'Science with the Extended New Technology Demonstrator', held at the ATNF Marsfield site on April 6th. In excess of 50 people attended from a broad range of institutions, with representation from Perth, Adelaide, Melbourne, Hobart, Canberra and the Sydney region. There were 15 speakers covering a broad range of science topics; the speakers were asked to evaluate their science within a `strawman' set of specifications for the xNTD. The full agenda can be found on the web at http://www.atnf.csiro.au/whats_on/workshops/xNTD/.

The xNTD is clearly seen as breaking new ground both scientifically and technologically, especially in the area of focal plane arrays, valuable for the way ahead to the SKA. There are clear areas of the technology where international collaborations are being established with a number of partner countries. The development of the Mileura site in Western Australia and opportunites for co-sharing the site with other instruments is seen as a key ingredient to the success of the xNTD.

Some of the scientific goals for the xNTD, as highlighted by the speakers, are as follows:

- Almost nothing is currently known about HI in galaxies at redshifts above 0.1. A single 40 square degree pointing of the xNTD, if observed for 90 days, would yield in excess of 20000 HI detections of M* galaxies out to a redshift of 0.2.
- The recent HIPASS survey detected ~5000 galaxies out to z~0.01. A survey of the whole southern sky with the xNTD, lasting 150 days, would detect at least 40000 HI galaxies with M* galaxies detected to z~0.05.
- A continuum survey of the southern sky would return more than 10^6 sources to a 5 sigma detection limit of 0.4 mJy in only 7 days observing. Such a catalogue can be used e.g. to measure the CMB dipole moment and the integrated Sachs-Wolf effect (expected from dark energy models) at z~1.
- A by-product of the continuum survey is the measurement of polarization for 10000 sources across the whole sky. This would give an accurate picture of the magnetic field structure of our own Galaxy and start to determine the inter-galactic magnetic field (in combination with red-shift measurements for a small fraction of the polarized sources).
- The xNTD would be extremely powerful for detecting variability at the 1% level for 100 mJy sources and the 10% level for 10 mJy sources across the whole sky, giving for the first time a comprehensive picture of the radio-variable sky.
- A compact configuration for the xNTD could realise a Galactic HI survey to 0.1 K across the southern sky. Science outcomes include unravelling the disk-halo interaction and studies of Galactic halo clouds and High Velocity Clouds.
- Large scale radio surveys, both in continuum and spectral line, are needed to complement vigourous activities in this area at other wavebands over the next 5 years.

The meeting was extremely useful for the xNTD project team with vigorous discussion about the required angular resolution and frequency range of the instrument, and the scope of the correlator. Areas of common science between the xNTD and the upgraded Sydney

University Molonglo Telescope (MOST) were aired and new possibilities were raised about the potential to apply the focal plane array technology to the Parkes telescope. I would like to thank the participants for a very productive meeting.

Advice sought

This memo is information for ATUC and does not require any action. A complete science case will form part of the overall project plan for the xNTD in due course. The NTD/xNTD team welcomes any input from the user community.