

## ATNF ATUC MEMORANDUM

**To:** ATUC  
**From:** Tasso Tzioumis  
**Date:** 1 June 2006  
**Subject:** VLBI report - LBA Operations & eVLBI

### 1) Operations

In the past 6 months there were 2 major LBA observational sessions, 8-17 March and 11-17 May. No major technical problems were reported from any observatory.

The disk-based VLBI recording system and software correlation at Swinburne has been increasingly replacing S2 tape-based observations. In the May session only 2 x 12h observations were recorded on tape. The transition to disk systems is currently limited only by disk availability.

Two of the H-masers that have been showing problems were refurbished in March by visiting Russian experts. It is planned that 3 more H-masers will be refurbished in the next financial year.

All observational setups on the LBA now include real-time fringe testing on the Swinburne correlator. This has greatly improved the reliability of the LBA.

The scheduling of LBA observations has been streamlined. Communications and information exchange is now via Web Wiki pages and this has greatly improved LBA operations and observing documentation.

### 2) 2005 LBA statistics

Overall the LBA achieved a 94.5% success rate, about 2% improvement on the previous year, to a large extent due to the success of real-time fringe checking. Most of the telescopes continued with success rates over 97%, and the Parkes 6% failure rate was mostly due to high winds (4.8%). A summary is given in the tables below.

Telescope	Parkes	ATCA	Mopra	Hob	Ced	Tid	Hart	Kokee	Shang	LBA
Hours obs	332	334	334	318	272	50	114	48	17	346
% success	94	98	97.5	97	97.5	100	99	100	100	94.5

LBA allocated time	19 days	
Disk-tests	56 hrs	14%
Observations	346 hrs	86%
Time lost due to weather		4%
Time lost due to other failures		1.5%

### 3) eVLBI Project

#### a) Fast network connections

The broadband "last-mile" fibre links to the telescopes were constructed in the period December 2005 to February 2006. The AARNet3 backbone was lit at the end of January 2006.

The ATNF worked closely with AARNet to define, purchase and install the required interfaces from the telescopes to the fibre links. The network became available for testing during the March 2006 LBA session.

Many network tests were performed and the highlights include:

- Tests achieved network speeds exceeding 900 Mbps between Marsfield and each of the ATNF antennas. Peaks of 940 Mbps were reached, close to the expected 950 Mbps maximum on the 1 Gbps fibre.
- Data was written directly from the telescope to disks in Sydney. Speed was limited by the computers and disks and not by the network
- Network tests to UWA via Sydney and the CeNTIE fibres to WA achieved speeds > 700 Mbps
- First fringes were obtained with the fringe-testing software running on the Cray XD1 in UWA. These were for only 64 Mbps (1 channel of 16 MHz) but the limits were on the hardware setup and disks and not on the network.

Further tests were performed in the May 2006 LBA session. The real-time fringe-testing system was switched onto the fast links and was limited primarily by the slower links into Swinburne.

The "last-mile" fibre connections were bought from AARNet and ownership is now fully by CSIRO and ANU (for Mopra). The construction costs were paid by CSIRO corporate in May 2006.

However, the AARNet3 1 Gbps links to the observatories were turned off on 29 May!! This is due to legal issues concerning the regional network agreement between AARNet and CSIRO. The issues involve indemnity and liability clauses and have been referred to the AARNet board for legal review.

#### b) Disk-based recording

The new computers and disk-based VLBI recording system has been commissioned at all LBA sites and is working extremely well. The same systems were used for the connections to the fast network.

The disk systems can now be routinely used at 256 Mbps at all LBA antennas and at 512 Mbps at the ATNF sites, using 2 DAS units. Most LBA observations in the May session were recorded on disk.

Tests have achieved 512 Mbps rates for a single DAS using new cables and connectors, which seem to have solved the timing problems previously encountered. This enables 512 Mbps operation at all LBA antennas and 1 Gbps operation at the ATNF antennas. The 1 Gbps operation was successfully tested between Parkes and the ATCA in March 2006. However, more testing will be performed before these are made widely available for LBA observations.

#### c) Software correlators

Software correlators have been developed by the Swinburne University of Technology using their supercomputer cluster and a Cray computer at UWA.

Such correlators will be the only VLBI correlators for the disk-based system and for high data rates, until the new CABB correlator at Narrabri comes online in about 3 years.

The FX version of the Swinburne software correlator has been commissioned and it is now used for all correlation, including real time fringe tests. This correlator performs very close to real time by utilising 30-40 supercomputer nodes.

The next version of the FX correlator, due in mid 2006, will include "streaming" inputs without the need for disk buffering. This will enable real eVLBI for the first time in Australia and tests are planned.

**d) 5<sup>th</sup> e-VLBI workshop**

The 5<sup>th</sup> annual international eVLBI workshop will be in Haystack in 2006, where the 1st workshop was held in 2002. It will be held in the period 17-20 September 2006 and will include a large component of network issues.

**4) LBA evolution**

**a) Transition to disk systems**

The availability of reliable disk-based recording systems and the software correlators makes possible the transition of LBA operations from the aging S2 tape-based system to the new disk-based system. This also offers significant upgrades to LBA capabilities i.e. a x2-3 increase in sensitivity and huge (unlimited?) increases in spectral line channels.

As a first step, Swinburne and ATNF are negotiating an agreement for Swinburne to assume responsibility for all LBA correlation later in 2006. Swinburne will also manage the transition from tapes to disks over approximately the next 12-18 months.

Full disk operation will be achieved once enough disk capacity is acquired by the LBA partners. A LIEF proposal has been submitted to the ARC to fund the necessary data acquisition and extra nodes at Swinburne for LBA correlation.

Operator support of correlation on the old LBA correlator will cease by the end of 2006. Under current plans the S2 tape-system should be decommissioned in 2007.

**b) Telescope support**

ATNF and University of Tasmania have also been negotiating on National Facility support of LBA operations at the Hobart and Ceduna observatories. ATNF has agreed to fund the initial request from UTas for the next financial year and review and plan for future support.