ATNF ATUC MEMORANDUM

To: ATUC

From: Tasso Tzioumis

Date: 07 June 2005

Subject: VLBI report - LBA Operations & eVLBI

1) Operations

There were 2 VLBI sessions in the last 6 months, 9-14 March and 12-20 May, 2005. No major problems were reported from any observatory.

Operations at the ATNF correlator have been keeping pace with the observations. Almost all correlating and initial data checking is now done by the correlator operator.

The main VLBI system remains the S2 tape-based recording system and the LBA correlator at ATNF. However, about 15% of the time is allocated to the new eVLBI disk-based systems, both for technical tests and test observations. Correlation is done in software at Swinburne.

2) VLBI webpages

Further upgrades to the web pages have been made.

- A list of "standard" observing modes has being compiled
- Standard setup files for SCHED are available
- A VLBI array sensitivity calculator has been implemented (Adam Deller) and it is now available.
- A WIKI page has been developed (Emil Lenc) to provide interactive up-to-date information on the observational setups and issues during the session

A more extensive webpage revamp is planned.

3) 2004 LBA statistics

The annual LBA operational statistics have been produced for the ATNF 2004 annual report. Overall the LBA achieved an 91.5% success rate, a 2% improvement on the previous year. A summary is given in the table below.

Most of the telescopes continued with success rates over 97%, but telescopes are vulnerable to single-point failures with a large impact on a VLBI session.

The Parkes 6% failure rate was almost entirely (5.7%) due to high winds. The ATCA lost a significant amount of time due to an error in polarisation identification at 22 GHz. Ceduna suffered a power failure in a single session, with consequent problems for drives and clocks.

Telescope	Parkes	ATCA	Mopra	Hobart	Ceduna	Tid	Hart	Kokee	**LBA**
Hours obs	302	312	356	362	245	49	103	22	**401**
%success	94	90	98	99	93	100	97	100	**91.5**

4) Huygens spacecraft tracking

This unique event took place on January 14, 2005 and generated huge publicity. The 3 ATNF and the 2 UTas antennas that are part of the LBA participated in this event successfully. However, the frequencies and setup of this observation was very non-standard as the spacecraft signal at 2050 MHz is outside our normal bands. Parkes and Mopra developed modified front ends and IF conversion modules to cover all the desired frequencies. This cost about ~A$40k funded from ESA funds via JIVE.

The Huygens recording used the newly developed disk-based system at 512 Mbps. It also highlighted the lack of fast data links to the observatories as we had to rush the disks by charter plane to Sydney. Then the data were transferred to JIVE via fast (1 Gbps) international links. Details have been covered in internal and external media coverage.

5) eVLBI Project

a) Fast network connections

The network connections to the telescopes are planned as part of the AARNET3 Regional Network. AARNET has produced detailed costings after the tendering process late last year and they are ready to proceed. Agreement and financial commitment is needed by the major stakeholders like CSIRO and ANU. The proposal for funding (~A$2M) is now with the CSIRO executive.

There is a push to get the telescope links in place for an international eVLBI demonstration at the iGRID meeting in San Diego in late September. It is an ambitious deadline but it has helped in focusing the efforts by AARNET to meet this deadline.

The funding model for these developments has not yet been finalised within CSIRO. The ATNF has agreed to an interim proposal to fund half of the running and amortisation costs, at about A$200k per year.

The network will offer 1 Gbps connections at startup and the backbone will be running at 10 Gbps. The faster rates will be needed when the CABB correlator is operational and VLBI-enabled, at about 2008.

b) Disk-based recording

In the absence of fast network connections, telescope interfaces have been developed for writing directly to disks. The disk systems provide a buffer for the slow networks and a tool for the development of the necessary hardware and software. Progress to date includes:

- Successful disk-based operation at 512 Mbps was demonstrated by the Huygens observations. To achieve this the ATNF antennas have been equipped with 2 DAS systems each.
- Tests have been initiated to achieve 512 Mbps for a single DAS. This will enable 512 Mbps operation at all LBA antennas and 1 Gbps operation at the ATNF antennas. There are still some problems with timing and noise that need to be solved.

Limited disk storage was acquired as part of the Huygens support, paid by ESA. However, disk costs can be very high and are a limiting factor.

c) Software correlators

A software correlator has been developed at the Swinburne University of Technology using their supercomputer cluster. This software correlator is a critical part of the eVLBI system. It will be the only VLBI correlator for the disk-based system and the LBA correlator for high data rates until the new correlator at Narrabri comes online in about 3 years.

Software correlators are currently much slower than real time and only limited observations can be supported. The storage of the raw data on disks is also a significant cost. Development continues to improve performance and a research project is underway to develop a much faster software correlator on a Cray supercomputer.

d) Real-time fringe testing

The disk recorders and the software correlator have made possible the "near real-time" detection of fringes from all VLBI antennas. Data is recorded on disk and a small amount (~0.1 sec) is transferred via the (slow) ftp connections to Swinburne, correlated and posted on the web. Fringes can be detected in about 20-30 secs.

This fringe-testing system has been automated and it is now an integral part of operating the LBA. Tests are conducted for all LBA observations and have already increased VLBI network reliability.

e) NZ fringe tests

The first fringe tests with an antenna in NZ were recorded in May 2005 and work is continuing. Main limiting factor is availability of an antenna in NZ. A 6m dish was used in May and a 15m dish may be available in future.

f) New Norcia

The equipment developed for Huygens at Mopra will be used to produce a portable VLBI terminal. This can then be used at other telescopes like New Norcia. Discussions have been initiated with ESA on gaining some access to the telescope at New Norcia but progress is slow.

g) 4th e-VLBI workshop

The 4th international eVLBI workshop will be held in Sydney on 12-14 July. It includes a full day of networking issues at the request of the networking community. The website is now operational and registration is underway (http://www.atnf.csiro.au/vlbi/evlbi2005/).

6) Upgraded National Facility LBA capabilities

The development of the disk-based VLBI recording system and the Swinburne software correlator has enabled new capabilities for the LBA. Operation is now possible at 512 Mbps (x2 in sensitivity) and with ultra-high spectral resolution.

Limited time (~24 hours/semester) has been offered in the OCT05 semester and details are given in the ATNF web pages (**www.atnf.csiro.au/vlbi/**). The time available is limited by disk costs and software correlator support.

Extensive user support will be provided, including assistance with proposal preparation, scheduling, observing and data reduction.