~~ATDOC109~~/5AUG82/RTS/DLJ

PRELIMINARY COST ESTIMATES FOR VLBI IN AUSTRALIA

1. INTRODUCTION

Promoting VLBI in Australia into the major leagues will require some capital and manpower investment, as well as operating funds. This document outlines these requirements under a number of assumptions:

1) The VLBI system is composed of 7 telescopes, a mixture of existing antennas (Parkes, Tidbinbilla, Fleurs, Hobart, Alice Springs), antennas planned for the AT (Culgoora) and the ESA antenna under construction at Carnarvon. Since the VLBI system must of necessity include telescopes outside CSIRO aegis, negotiations will be required with the other agencies/observatories. Note that the Siding Spring location is not included because it does not improve the VLBI array UV coverage and because the Culgoora-Siding Spring-Parkes baselines are included in the medium baseline array of the AT. This represents a change in thinking from earlier ATDOC's.

2) The data acquisition system at each telescope is composed of 8 video cassette machines giving a total recorded bandwidth of 50 MHz. This system should be compatible with systems in the northern hemisphere.

3) 30% of the total available observing time is assigned to VLBI. Existing VLBI programs in the US already use 25% of telescope time, and in Europe 12 to 15% of telescope time.

4) The prime continuum frequencies are 2.3 and 8.4 GHz since Tidbinbilla and Carnarvon have or will have these frequencies and the presence of these telescopes adds considerably to the VLBI system.

../2

5)* The local oscillator system is based on hydrogen maser oscillators installed at Culgoora, Fleurs, Hobart, Alice Springs and Carnarvon. This assumes that Fleurs and Hobart can be upgraded to work at 8.4 GHz and that Alice Springs acquires an 8.4 GHz receiver. Rubidium oscillators will be sufficient if the highest VLBI frequency is only 2.3 GHz. Parkes is stabilised via the microwave link to Culgoora. Tidbinbilla has a hydrogen maser already.

6) The correlator should be capable of playing back 10 stations simultaneously, and have a spectral line capacity of 256 complex channels/baseline. Ten stations allows correlation of 7 Australian antennas, the South African and Japanese antennas, and a possible new Australian antenna (see section 5).

7) The central processing facility (including correlator) is located at an established site with access to appropriate offline computing hardware.

The cost estimates have been made with reference to similar exercises in NFRA Internal Technical Report 165 and the proposal for the U.S. VLB Array.

2. INVESTMENT COSTS ($K)

(a) Field Stations

5 hydrogen masers *	1300
8 data acquisition systems	800
3 cooled S/X receiver systems (Fleurs, Hobart, Alice Springs)	120
3 cooled 18 cm receiver systems (Fleurs, Hobart, Tidbinbilla)	60

(b) Central Processor

12 playback systems (2 spare)	360
Correlator and support hardware	450
On-line computer	200
Tapes and tape storage bins	100
Total	$3390K

../3

* See ATDOC's 104 and 105

3. CONSTRUCTION MANPOWER

(a) Hardware

Correlator + support hardware (fringe rotatots, delay units, decoders, etc.) 25-30 years		700
Receiver systems	10 man years	290

(b) Software

On-line + off-line	15 man years	500
	Total	$1490

4. OPERATING COSTS FOR VLBI ($K)

These have been estimated on the basis of two half-time people at each telescope in the network (7 man years/year) and 6 man years/year at the central processor (salaries + overhead as per ASTDOC61 amount to $430K per annum). It is assumed that the normal operating costs of the telescopes will cover the running of the VLBI observations so that the VLBI operating costs given below are just the additional ones incurred. Negotiation with the relevant authorities on this point will need to occur.

Salaries + overhead		430
Travel		50
Tape transport		50
New equipment		100
Maintenance		100
	Total	$730K per annum

5. NEW INITIATIVES FOR VLBI

1) Antennas

New high-frequency, larger-diameter antennas at the extremities of the network are essential for unambiguous mapping of weak radio structures (D.L. Jauncey, ATDOC in preparation). A possible order of priority for new antennas is:

Hobart (serviced site)
Western Australia (Perth?), Mildura (new sites)
Fleurs (serviced site).

../4

2) Receivers

(a) High frequency

With high quality antennas at all sites, 22 GHz receivers should be built.

(b) Low frequency

843 GHz receivers should be built for the AT and Parkes to allow VLBI observations in conjunction with the MOST.