Results from Questionnaire on Projected AT use

R.P.Norris

4 August 1984

1.0 SUMMARY

A questionnaire on projected AT use was recently circulated to members of the Astrophysics group and others, in an attempt to see if the planned computing facilities and LBA configuration are adequate for the demands that will be made upon them. Fifteen replies were received, and their contents are summarised and digested here.

The small sample involved in this survey obviously limits the confidence in the results. On the other hand, some decisions (particularly on the software side) have to be made now, and the results of this survey do give some guide as to what may be expected.

Probably the most useful result to emerge is that we may have been over-estimating the computing load. Most observations do not stretch the system to its limits. On the other hand, this view must be tempered by the probability that most proposals are based on experience with current telescopes, and so more ambitious projects might be stimulated by experience with the AT.

Another interesting result was the number of projects proposed for the LBA. A wide variety of projects was proposed for both synthesis and non-synthesis observations.

2.0 COMPACT ARRAY

2.1 Mix of line/continuum observations

One question asked the expected mix of continuum/line observations. Replies to this question indicated that 80% of observations would be continuum. On the other hand the ratio of line to continuum projects was about 50/50. Thus we may expect at least about half the observing to be continuum projects. This clearly eases the computing load, which is dominated by the line observations.

2.2 No. of days per source

Perhaps suprisingly, it appears that few projects require the high dynamic range which would necessitate, for example, 15 day observations. Of the 25 projects proposed for the CA, only one (recombination lines) required more than 8 days per synthesis. The average number of days per synthesis was 4.5 . The results were as follows:

No. of days per source	1-2	3-4	5-6	7-8	>8
% of projects	16	48	16	12	4

These results indicate that most observers require a lower dynamic range than expected. Consequently, the number of maps/year is larger, and the implied computing load higher than expected.

An additional observing mode was suggested, in which many (perhaps thousands) of sources might be observed for only a few minutes each, in order to get statistics of source structures.

2.3 Number of maps per synthesis

This quantity depends on the number of channels to be mapped in line observations, and the number of polarisations (or Stokes' parameters) to be measured for all observations. No line observations needed to map more than 256 frequency channels, although upto 2048 channels would need to be observed in some cases. The average number of

maps/synthesis was 176. The proportions were as follows:

No. of maps per synthesis	0-2	3-4	5-64	128	256	512	1024
% of projects	24	32	12	8	8	4	12

These numbers are probably somewhat lower than expected, therefore easing the computing load.

2.4 Bandwidths

The entire range of bandwidths seem to be required. As expected, many (and possibly all) continuum observations simply needed the maximum bandwidth available. The small sample of line observations seem to make use of most available bandwidths.

2.5 The need for 4 simultaneous frequencies

One mode allows the simultaneous use of four different frequencies in one polarisation only. If linear polarisation is used on the telescopes, this one polarisation would have to be one linear polarisation, and so the maps might in some sense be incomplete. Nevertheless, there were seven requests for this facility. These requests fell into the following categories:

1. observations of the four ground state OH lines at L band
2. observations of the four NH_3 lines at K band, or 3 NH_3 transitions plus the H_2O transition.
3. bandwidth synthesis for astrometry
4. measurement of Faraday rotation at <5GHz.

3.0 THE LBA SYNTHESIS ARRAY

3.1 Bandwidths

Of the eighteen proposals, eleven were continuum projects, and would benefit from the maximum bandwidth

possible. Of the remaining line projects, three were observations of H_2O and SiO masers for which a bandwidth of 10MHz is sometimes restrictive. In particular, observations of extragalactic masers ideally require bandwidths $\gtrsim$20MHz.

3.2 Hobart

Four proposals required the resolution offered by a telescope at Hobart. A Hobart telescope was considered desirable for an additional eight proposals, leaving six proposals that would not need the Hobart telescope.

3.3 Maps per synthesis

The eleven continuum proposals would have a negligible effect on the computing load. Five of the line projects required only a few (~5-20) maps per synthesis, and two required 200 maps per synthesis. Since the uv spacing of the LBA limits the useful size of most maps to relatively small maps (typically 128x128), the modest computing demands of the LBA may be considered negligible against the demands of the CA.

4.0 THE LBA NON-SYNTHESIS ARRAY

4.1 The use of the non-synthesis array

Thirteen projects were proposed for the non-synthesis array, compared to the eighteen for the synthesis array. This emphasises that there is a great deal of useful astronomy to be obtained from long baseline interferometers even if synthesis maps cannot be made. The computing requirements for such non-synthesis observations are generally negligible compared to those for synthesis observations. It should therefore be possible to use profitably most of the available time on telescopes such as Siding Spring and the Culgoora 6km dish, even when other telescopes are not available for synthesis observations.

A particularly important facet of this might be 843MHz observations using, for example, Molonglo, Parkes, Siding Spring, and Culgoora 6km. This array would in fact also be capable of synthesis mapping. Two of the thirteen proposals were for observations at 843MHz, using the Molonglo synthesis telscope as one element of the array. One of

these also requested the Hobart telescope at 843MHz.

4.2 Short observations

Eight of the thirteen proposals were for sequences of short (~hours) observations. Such observations might be particularly useful for filling-in between synthesis observations, and a standby list of such sources could be made available to those planning long synthesis runs.

5.0 CONCLUSIONS

1. Probably about 50% of the compact array observations will be made in the continuum mode. Each source will require an average of 4.5 days of observation, and the average number of maps per synthesis will be about 176. Thus we may expect about 40 maps per day from the compact array. This is very much smaller than has been assumed when calculating the computing load. Although the chances of this being an underestimate may be high (people may not yet appreciate the potential of the AT, etc.) it does indicate that the planned computing facilities are at least adequate to cope with the type of astronomy which is currently anticipated by astronomers at Radiophysics.

2. There is a great deal of astronomy to be done by the LBA in both its synthesis and non-synthesis modes of operation. Compared with the 25 projects proposed for the CA, there were 31 projects proposed for the LBA (18 in its synthesis mode, and 13 in its non-synthesis mode). Most (14/18) of the synthesis projects would benefit from a bandwidth wider than 10MHz, and most (12/18) would benefit from a telescope at Hobart. Other telescopes, such as Molonglo, would also be useful for some observations.

6.0 APPENDIX

Partially-digested summaries of the replies to the questionnaire are presented here. The following abbreviations have been used:

c	continuum
d	desirable
eg	extragalactic
is	interstellar
m	maximum
sim	simultaneous
-	no details given in reply

COMPACT ARRAY

Title	Freq (GHz)	BW (MHz)	Nchan obs	Nchan map	Ndays obs per src	Npol	
High energy Solar flares	42	m	c	c	5	2	high time resn
Quiet Sun	0.4/1.4/2.7	m	c	c	>6	2	
Solar limb oscillations	42-50	m	c	c	>4	2	high time resn
OH/HI in N4945	1.4/1.6	5	1024	120	>4	1	
HII regions	1.6	0.6	512	60	>4	2	
H20 in gals	22	20	2048	100	2?	4	
Recomb lines (H,He,C,Mg?,S?)	all	>20	256	256?	max	1	need v. high dynamic range
Solar	LF?	m	256?	256?	1	4	
RS CVn	2/10/22	m	c	c	few	4	
Thermal stars	2/10/22	m	c	c	few	4	
Xray srcs	5/10	m	c	c	4	4	
HII reg	5/10	m	c	c	4	4	
SNR	5/10/22	m	c	c	4	4	
Wide field QSOs	10	m	c	c	4	4	
HI in HII reg &mol clouds	1.4	.25	128/256	128	8	2	
cont in HII reg &mol clouds	1.4	>15	c	c	8	2	
Wide field mapping	1.6,5,22	100kms	1024	250	4	4	
Absorption	1.4,1.6,5,22	60kms	512	250	4	4	
Coronal em from stellar systems	0.4-8.0	10	512	<5?	4	2	
Survey of gal clusters	0.4/2.3	m	c	c	4	3	
Compact eg sources	-	10	c	c	-	4	
Phase stab over 6km	l/s/c/x/k/q	80	c	0		1	
Eval of bandpass effects	c	80	1000	0		2	
H2CO	4.8	2.5	512	30	4	1	
NH3	22	10	512	30	4	1	

LBA SYNTHESIS ARRAY

Title	Frequency (GHz)	BW (MHz)	Nchan (obs)	Nchan (map)	Hobart?
Coronal em frm stellar systems	L,S,C,X	10	512	<5	n
RS CVn	22	10	c	c	y
compact gal nuclei	10	10	c	c	n
Circ poln of eg sources	2.3/10/22	m	c	c	d
Tropo & iono phase stab	S,C,X,K	m	c	c	y
H20 in LMC	22	10	512?	few?	n
6cm OH in Sgr B2	5	1?	512	few	-
eg H20 masers	22	10/20	512	few	n
poln of eg jets	all	m	c	c	n
is masers	1.6,22	40kms	1024	20?	d
Flare star source sizes	10	10	c	c	y
RS CVn source sizes	10	10	c	c	y
Thermal radio stars	2.3/10/22	max	c	c	d
Compact extragalactic srcs	2.3/10/22	max	c	c	d
Xray binaries	10	10	c	c	d
OH masers	1.6	1.25	200	200	d
H20 masers	22	10	200	200	d
Active galaxies	?	10	c	c	d

LBA NON-SYNTHESIS ARRAY

Title	Frequency (GHz)	No of srcs	No of days/src	No of tels	Ptic tel?
Solar electron-cyclotron maser sources	1.2 2.4 (sim)	-	4	3	n
Flare star sizes+spectra	10 22 (sim)	>2	2-3	3	Pks/Culg
RS CVn sizes+spectra	10/22	>4	2	3	Pks/Culg
Thermal radio stars (quicklook)	2.3/10/22	100	0.1	2/3	Pks
Compact eg sources quicklook	2.3/10/22	100	0.1	2/3	Pks
Compact hf mapping	?	100	0.1*n	3+	Pks
Xray fluxes	?	100	0.1*n	3+	Pks
Xray variables	?	100	0.1*n	3+	Pks
Scattering discs of pulsars	843	10-20	0.1	3	pks/most/hob?
Astrometry of psr's & stars & prop motions	lf?	-	-	-	n
compact struct in gals	10	200	0.1	2	pks/tid or pks/Cul
coronal em from stellar systems	0.4-8.0	10-100	100*0.1?	3+	max sens
eg steep spectrum	0.4-0.843	1000	1	3+	MOST/Pks