THE SKA STATION ANTENNA AND BEAM FORMING DESIGN

Report on the Working Group Discussions held at Jodrell Bank

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The group discussed various technologies being investigated by some of the participating institutions of the SKA consortium for the station antennas of SKA. Table-I gives brief comments about the expected parameters of six different approaches being investigated. This comparison is rather preliminary. However, further details may be obtained from the viewgraphs of the Status Reports and other presentations given by various speakers at the Jodrell Workshop, which are being collected by the organizers of the Workshop.

The group recommended that all the concerned institutions should give an approximate cost of their designs for a common frequency of 1.4 GHz in units of $\$/(m^2/^oK)$, atleast one month before the Berkeley meeting, which is to be held in July 2000. Explanatory notes may be given to these cost estimates, in order to assess the degree of their accuracy or their tentative nature. In addition, the lower and upper frequency limits of the station antennas and $Aeff/^oK$ at these frequencies and at 1.4 GHz may also be provided. Finally, the likely year of demonstration and/or years of completion of a preliminary and final study reports giving the expected performance parameters of the station antennas, details of the beam forming scheme, rfi cancellation capabilities, calibration methods for achieving the required dynamic range at 1.4 GHz may also be provided before the Berkeley meeting. Most of the groups indicated that Phase-I of their design efforts is likely to be completed over the next 2 to 3 years, whence it should be possible to make an assessment of the merits of their design.

TABLE :1 BRIEF SUMMARY OF PRELIMINARY ASSESSMENT OF STATION ANTENNAS AND BEAM FORMING DESIGNS

Jodrell Workshop : Recorded by G. Swarup

Item	Parabolic Dish		Cyl. Par. Doublet	Luneburg Lens	Phased Array		LAR	FAST
	Small ~ 5-8 m	Medium Size ~8-25 m			UHF	VHF LOFAR		
Coordinators	USA S.Weinreb /J. Dreher	India G.Swarup	Australia P. Hall	Australia Peter Hall	NFRA A. van Ardanne	NFRA A. van Ardanne	Canada P. Dewdney	China Y. Qui
Frequency Coverage (GHz)	0.3 to 22 GHz	0.1 GHz to 10 GHz	0.1 GHz to 22 GHz	0.3 GHz to 5 GHz for (5 m & 0.2 to 2 GHz) for 10 m :	0.1 GHz -2 GHz 300MHz (may be 2 arrays) arrays)	10 MHz - (may be 2	0.2 - 20 GHz	0.1-5 GHz
Multi-Beam (W/O sub-arrays)	No	No	One Dim.	Yes	Yes	Yes	No	No
Instanta-neous BW	~ 20:1 Low eff	~ 2:1 High Eff.	~ 10:1	~ 10:1	~10:1	~10:1	~10:1	~2:1
Inst. FOV	Med.	Med	Med.	Large with No. of Rxs (∝ to N)	Large	Large	Small	Small
Comments + VE	Mature Tech-nology	Mature Tech-nology	Needs Further studies; Combines reflector & phased arrays tech.	Multi-beaming (Upgrade Path)	Flexibi-lity ; RFI nulling	Flexibi-lity ; RFI nulling	Upgrade Path	Easier Data Processing; low RFI at the site
Comments - VE	Shado-wing ? mainte-nance ?	Shado-wing ? mainte-nance ?	Needs further Studies	Unknown Cost	Frequ-ency limita-tions	Frequ-ency limita-tions	Mainte-nance prob (accessib -ility)	Sky Coverage limitations
Year Study Report	JPL (Study 2002), SETI (2001)	TIFR/ RRI 2001/ 2002	?	Study Report (2001-2002)	THEA (July 2001)	LOFAR (Study) 2001/ 2002	Study Report 2001/ 2002	Study Report 2001/ 2002
Year of Demonstra-tion	2002/ 2003	2002/ 2003	?	3 m-Lens 2002	2002/ 2003	2002/ 2003	?	?

SUMMARY : 1) Phased Array have advantages at lower frequencies
2) Reflectors for higher frequencies.
3) Too early to consider hybrid designs