IEMT Demonstrator Review – Chinese Demonstrator

Preliminary Draft by S.Ananthakrishnan and Graeme James, 28 June 2004

The main purpose of the project is to produce a SKA technology demonstrator as well as a stand alone telescope at the low frequency end of up to 2000 MHz, with possible extension to 5 GHz.

In engineering terms, it is a total concept and will demonstrate those facets of the KARST which exclude synthesising of apertures, correlator backends etc. In view of its modern design, the KARST demonstrator (FAST), which is modeled after the Arecibo telescope, will have a much better declination coverage.

The scale of the FAST project has two components. While the reflector overall dimension is 500m in diameter, the actual area used at any one time is 200-300m. However, the sophisticated engineering involved in the feed design and the adaptive reflector tiles entails considerable labour and effort. If we combine the two, the scale appears to be ~5% of SKA project effort. The total cost of the project is estimated to be ~USD 60M, of which the Chinese astronomers have obtained a funding of USD 2M, which is being used for making a 1:10 scale model of FAST by the autumn of 2005. It is not clear from the report whether and when the remaining budget will be sanctioned. The key institution is the National Astronomical Observatory, China (NAOC) of the Chinese Academy of Science (CAS) and has involved 30 Chinese institutes and two foreign institutions. The coordination is fully controlled by NAOC.

The main strengths of the FAST project are that of (i) large reflector size giving high sensitivity and hence easy total flux measurements; (ii) low RFI in the KARST region and (iii) low labour costs in China.

The weaknesses mentioned in our earlier review remain, namely that KARST concept has too few antennas for the SKA configuration, Galactic Centre may not be covered, frequency coverage may be limited to 2-3 GHz, etc. Further, while the building of a FAST prototype will be a great achievement for NAOC, the proponents need to specify tighter time limits for completing the project. The software issues related to the FAST and later KARST have to be worked out (even if they are not major issues); the detailed costing remains to be done; the industry involvement has not been spelt out in any detail.

Although all the basic concepts of FAST are being tested in the laboratories, in the field and via simulations, what is being built is only a “Demonstrator of the Demonstrator” (DoD), for which too specific milestones need to be spelt out. Again, although the DoD will clarify a number of concepts involved in the FAST project, it will not be sufficient from the IEMT point of view for scaling the DoD to the level of SKA, or to be able to take any final decision regarding the use of such reflectors for the SKA configuration, unless dramatic progress is made on the FAST project between the years 2006 and 2008.

The report has not specifically addressed the various issues raised in the IEMT reports. However, serious efforts have been made by the proposers to study the working of the focal plane assembly and much experience has been gained by them. The FoV is also being increased from a few minutes of arc to half a degree by adopting the Aperture Array Technology and multi beam concepts are being explored.

In summary, in the opinion of the above reviewers, IEMT is likely to have reservations in considering the DoD as a scalable model for SKA, within the time frame of IEMT decision making process.

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Quantitative scoring will be done during discussions at the Penticton IEMT retreat.