



## **The Square Kilometre Array Observatory : status overview and plans for Indian participation in this mega-project**

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### **Extended Abstract**

The Square Kilometer Array (SKA) Observatory (see [www.skao.int](http://www.skao.int) for details) is a state of the art, global project that aims to build the biggest and most sensitive radio telescope, for addressing a wide variety of cutting edge science goals. The observatory will be co-located in Australia (SKA-Low) and South Africa (SKA-Mid), with operational headquarters in the United Kingdom. At present, 12 nations (including India) are participating in this mega-science project that is expected to revolutionise radio astronomy, while driving the growth of many important new state of the art technologies. Participation from industry on a large scale will be an important ingredient in the final design and construction of the SKA, which is split into 2 stages : Phase-1 and Phase-2.

During 2014-2021, the SKA project successfully completed the detailed design of and early prototyping of SKA Phase-1. It has recently entered into the construction phase, after the formation of the new governance vehicle – an Inter-Governmental Organisation (IGO), called the “SKA Observatory (SKAO)” – that came into existence in early 2021. In July 2021 the SKAO Council approved the start of construction of SKA Phase-1. Actual work at the project sites in South Africa and Australia started around early 2022, and is now in full swing. The implementation will happen in a staged manner (called Array Release targets) and is expected to go on till 2028, with early science verification activities commencing from 2026, and the SKA Phase-1 observatory becoming fully operational by around 2030.

India, with its strong tradition in radio astronomy research and building of world-class facilities (such as the GMRT near Pune, which is a SKA pathfinder facility), has been a participant in the SKA activities since the very beginning. The Indian astronomy community has built up a strong case for using the SKA for carrying out cutting edge science, and also contributed to SKA precursor facilities. The SKA science case document by the Indian astronomy community was produced in 2016, which has gone through subsequent revisions. National level SKA science working groups were set-up in India to mirror the international SKA science working groups (quite a few of which have had significant participation from Indian astronomers). More than 20 institutions from India are currently involved in SKA related activities, coordinated by the SKA India Consortium (SKAIC), making it a truly national level effort. During the design and bridging stages of SKA Phase-1, India has contributed actively to the project, with a lead role in the successful design of the complex Telescope Manager (TM) system, the brain and nervous system of the SKA observatory, and participation in some other systems. A significant active partnership with Indian industry has been built up during these efforts.

A DPR for the full range of activities to support India’s participation in the construction phase of SKA Phase-1 (covering 2022 to 2030) was prepared and submitted for approval in 2021. After going through the various steps in the process, this DPR obtained the final approval by the Cabinet of the Government of India in December 2023, which cleared the way for India to sign the treaty and join the SKAO Council, as well as the funding request for all SKA related activities till 2030. During the construction of SKA Phase-1, India will be involved in a range of activities, covering software for Observatory Management & Control (OMC) and also Data Processing (DP) work packages, digital hardware and firmware for SKA-Low station signal processing system, and possibly contribution in one of the SKA-Mid receiver systems. The plans include having a SKA Regional Centre in India that will host SKA data and support data analysis pipelines for use by the Indian astronomy community. Many of these activities will be carried out in close collaboration with Indian industry.

Details about these ongoing activities and future plans related to the SKA mega-project and India’s participation in the same, will be presented in this paper.