How the largest radio telescope will benefit us all

Dense aperture array – one of three potential collector technologies

The Square Kilometre Array (SKA) is an international project to design and build the largest radio telescope ever conceived.

The UK is a lead member of the project, now in the design and technology development phase involving more than 50 institutes in 17 countries.

Construction is planned to take six years starting in 2016. SKA will be an extremely technically challenging project. Most radio telescopes consist of one large antenna to receive the radio waves from space. SKA will combine an array of small antennas over a proposed collecting area of one square kilometre – one million square metres. This will be 100 times larger than the current largest radio telescope and means that developing new technologies to build and operate the telescope will be crucial.

Designed to answer key questions in astrophysics and astronomy, such as the role of dark energy and dark matter in our Universe, the demands of developing, constructing and operating this mega-science infrastructure project will also result in extensive economic and social benefits to the participating countries.

The major SKA non-scientific benefits are:

• driving innovation in information and communication technology - the SKA will push the technologies of computation and communications to the limit; indeed it is only through projected innovation that the SKA is affordable. Through the development and implementation of high-performance many-core processing systems, new techniques and potential markets will emerge. The major players in the Information and Communication Technology (ICT) industry are very motivated to use the SKA to create new solutions to meet the demanding requirements. The availability and exploitation of new technology brings benefits to society and opportunities for industries of all sizes; for example financial, commercial, environmental monitoring and communications markets.

The SKA will also drive phased array technology, using very large numbers of receivers, as well as the signal processing systems to combine them. This has application in the communications and satellite receiver markets.

• a global model for 100% renewable energy - the SKA will have considerable energy needs, concentrated in remote, desert areas. The use of renewable energy for this iconic project can pioneer remote power generation with low running costs, unaffected by fluctuations in global

fuel prices and a very low carbon footprint. Such a renewable energy strategy would accelerate technology development in the areas of scalable energy generation and storage, distribution, efficiency and demand reduction.

• a model for improved global science/industry linkages - the SKA will use a high volume of components that are in the commercial mainstream. The combination of academic requirements with system design and industrial capability of innovation, development, volume manufacturing and deployment brings the opportunity to lead the development of new techniques for 'megaproject' management and effective global collaboration. The profit and benefits realised over a long timescale, will build capacity and prestige for those who engage.

Industry and academic engagement will be maximised through the use of formal consortia during the development and construction of the SKA major systems.

• impact on human capital development and employment - the SKA will enable a new generation of astronomers and astrophysicists to probe the cosmos and bring employment opportunities in a wide range of associated fields.

The SKA, by its scale and scope, will inspire generations of young people into science. Not only because astronomy appeals to our natural curiosity but also as a stepping stone to many other fields of science and technology including engineering, aerospace, mathematics and the natural sciences.

UK industry is already actively engaged in the project, which will become stronger in the pre-construction phase. There are many opportunities for industrial collaboration in which the technology spin-offs of the project are exploited.

The development, construction and operation of the SKA facilities will impact many areas and will provide long-standing economic and social benefits to the UK, consistent with the long-term investment it requires.

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