



MeerKAT coming on track during IYA 2009

South Africa is one of the countries that has put in a bid to host the Square Kilometre Array.

The International Year of Astronomy 2009 has special significance for South Africa's Northern Cape Province, where construction on the Karoo Array Telescope, known as 'MeerKAT', has started.

A team of engineers and radio astronomers have been developing, testing and fine-tuning the design and layout of this high-precision radio telescope over the last few years. In 2007 the team built a single dish (antenna) at the Hartebeesthoek Radio Astronomy Observatory to test a new kind of dish based on composite materials instead of steel, and to test the design. The single dish is also being used to test all the other components required to operate a radio telescope (the receivers, the software and the digital back-end).

Now phase one of MeerKAT – the construction of the first seven dishes (called KAT-7) – is underway on site in the Karoo. The civil engineering team is working hard to complete all the road construction, power lines, workshops and staff accommodation at the site. They are also building a large shed where the dishes will be assembled and they are busy digging trenches for onsite reticulation (power and optic fibre). The optic fibre to Cape Town will be part of the Infracore backbone.

The team plans to have the first KAT-7 dish on site by mid April 2009 and all seven dishes on site by December 2009. MeerKAT will eventually consist of up to



SKA South Africa team, Johannesburg office, with project director Dr Bernie Fanaroff in the middle, front row.



The SKA South African engineering team, based in Cape Town.

80 dishes, each 12 m in diameter. The telescope will cost about R1 billion and should be operational by 2012.

Aiming for the SKA

MeerKAT is part of a hugely more ambitious astronomy project - South Africa's bid to host the Square Kilometre Array (SKA). The SKA will be a radio telescope so powerful that it will be able to look back in time to the Big Bang. South Africa is competing against Australia for the SKA.

The world's radio astronomers have to

consider the competitive bids from South Africa and Australia and should announce their final decision on where to locate the SKA by 2011. 'Our site is as good as the Australian site and better in many respects,' says Dr Bernie Fanaroff, the Project Director. 'Local construction and infrastructure costs are less than those in Australia.'

In the mean time, MeerKAT serves as a 'pathfinder' for the cutting-edge technologies of the SKA. 'It will prove that South Africa can deliver on a high-tech,

The phased array at the heart of the Square Kilometre Array (artist's impression).



mega instrument and that we have the capability, professionalism, capacity and track record to operate and maintain it optimally' adds Dr Fanaroff.

Balancing cost and cutting-edge technologies

According to Anita Loots, one of SKA South Africa's Associate Directors, the major challenge of the SKA and MeerKAT projects is the balance between generating cutting-edge technologies on the one hand, and the need to keep costs down on the other. 'We have to develop ultra-fast signal and data processing capacity, combined with sophisticated computing, data mining and archiving abilities, while we also need the technologies to build very sensitive receiver antenna systems, including low-noise amplifiers,' she explains. 'However, if costs spiral out of control, it will undermine the feasibility of the telescope itself. This means the engineers must find creative solutions to make the systems more affordable.'

Loots explains that South Africa's contribution to the SKA design focuses on a number of key areas. Local engineers are working on the antenna design and the materials necessary to construct the antennae. They are also looking at digital signal processing and the development of next-generation correlators that are scalable and flexible, able to process data extremely fast and also store huge amounts of data.

South Africa has been welcomed into the international SKA community, based on our excellent track record of delivering top scientists and engineers for the project over the last two to three years, according to Loots. 'This clearly shows that South African engineering training competes with the best

in the world,' she adds. 'Our newly qualified engineers have no problem in joining and even leading SKA and MeerKAT teams.'

People skills to power SKA and MeerKAT

The SKA South Africa Project, including the building of MeerKAT, is one of the biggest science and engineering projects currently in South Africa. It presents an incredible variety of challenges and opportunities and requires skills across a wide range of disciplines such as digital signal processing, RF engineering, antenna design and software development. That is why the South African SKA Project is supported by a targeted 'Youth into Science and Engineering Programme' to develop highly skilled young scientists and engineers, explains Kim de Boer, who leads this capacity building programme from the SKA project office in Johannesburg. 'The young people supported by this programme will serve South Africa, and our African partner countries, in key areas of economic development,' she adds.

The programme offers comprehensive bursaries to students in engineering, mathematics, physics and astronomy at undergraduate and postgraduate level. Bursary students benefit from regular workshops and student conferences where they interact with the world's leading astronomers. To date more than 80 postgraduate students from South Africa and the rest of the African continent and 36 undergraduate students are studying or have studied with SKA bursaries and are on their way to being a part of South Africa's exciting future in radio astronomy. Find out more at www.ska.ac.za/studentsupport/

Protecting radio astronomy's future

South Africa's new Astronomy Geographic Advantage Act will declare Astronomy Advantage Areas for both radio and optical astronomy. According to the Act, at least 12.5 million hectares around the proposed SKA core area can now be protected from future radio frequency interference. □

About the SKA

Following an intensive bidding process, South Africa and Australia are now the only two countries on the shortlist as a possible location for the SKA. The international radio astronomy community will announce their decision on where to build this powerful telescope in 2011.

If South Africa wins the SKA bid, the core of this giant telescope will be constructed in the Karoo region of the Northern Cape Province. However, the SKA is so huge that outlying stations will be spread over several countries, including Namibia, Botswana, Mozambique, Zambia, Mauritius, Madagascar, Kenya and Ghana. To obtain the required sensitivity and resolution for the SKA approximately 4 000 antennae will be spread over 3 000 km. The antennae will be grouped in stations of about 30 to 40 each. The combined collecting area of all these antennae will add up to one square kilometre.

At about 50 times more sensitive than any other facility on Earth, the SKA will be powerful enough to explore the origins of galaxies and probe the edges of our Universe. It will search for Earth-like planets and potential life elsewhere in the Universe, test theories of gravity and examine the mystery of dark energy.

The SKA instrument is estimated to cost about 1.5 billion euro (about R20 billion). Construction is likely to start in 2014 and will take place in phases over several years.

Find out more at www.ska.ac.za