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SQUARE KILOMETRE ARRAY (SKA) SOUTH AFRICA

Update SKA SA & MEERKAT



## New leaders and local communities confirm their support for SKA South

Following the April 2009 General Election in South Africa, the South African SKA Project has briefed the Minister for Science and Technology who spoke about her support for the SKA and the MeerKAT in her budget speech in parliament. The project office also briefed the new Premier of the Northern Cape, Hazel Jenkins and the Director General of the Province, Moira Marais-Martin, on the progress of the South African SKA site bid, the establishment of a protected radio astronomy reserve and the construction of the MeerKAT Telescope. The Premier and the Director General confirmed the continuing and enthusiastic support of the Northern Cape Government for the project.

Following the meeting with the Premier, the South African SKA Project Director Dr Bernie Fanaroff, SA SKA Human Capital Manager Kim de Boer, SA SKA Infrastructure Manager Tracy Cheetham, Department of Science and Technology General Manager Dr Tshepo Seekoe, Northern Cape Government SKA Project Manager Paki Monyobo and the SA SKA Site Manager Dawie Fourie met with and briefed the local stakeholder forum in Carnarvon. The stakeholder forum includes the mayors and municipal managers of Williston, Carnarvon and the district municipalities of Kareeberg and Karoo Hoogland, as well as the principals and teachers of the local schools, representatives of the Agricultural Union, representatives of local business and the tourism sector. The meeting was also attended by representatives of the Tourism, Environmental Affairs and Transport, Roads and Public Works Departments of the Northern Cape Province.

The preparation of the astronomy site at Losberg, the support base at Klerefontein and the infrastructure has created business and job opportunities in the area for local people, and there is huge enthusiasm for the project in these communities.

A small number of farmers and their employees will be affected by the regulations in terms of the Astronomy Geographic Advantage Act which will regulate transmissions in the area which might interfere with the MeerKAT or the SKA. The South African SKA Project and the Department of Science and Technology are working with the Agricultural Union and the affected farmers to implement alternative solutions for services which might be lost, including TV, emergency communications, trunked telecommunications and even internet connections.

The South African SKA Project office facilitated the establishment of a Cyberlab at the Carnarvon High School by the Universal Service and Access Agency of South Africa (USAASA). Forty-five computers have been installed in a specially designed laboratory at the school and the Project and USAASA are working on an interim internet connection to the cyberlab pending the construction of the optical fibre link to Klerefontein and the SKA / MeerKAT site early next year. The South African SKA Project is also working with the Northern Cape's Department of Education, Science and Technology to bring additional maths and science teachers to the area. A programme is being launched to upgrade the knowledge and qualifications of maths and science teachers in Williston, Carnarvon, Van Wyksvlei and Brandvlei.

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# Exciting progress at MeerKAT site and support base

The MeerKAT dish construction shed is fully complete and now houses a 12 m diameter dish mould, which is in its final stages of completion. The project director and members of the Northern Cape Working Group visited the site on Thursday 28 May 2009 and were witness to the EMMS team polishing the mould. The sanding and polishing ensures the mould is smooth and accurate. Seventeen metres (17 m) above the mould is the dish crane for lifting up the molded dishes and positioning them onto the trailer. The trailer has been custom built for the purpose of transporting the completed dishes from the shed to the site (which is 6 km away). The trailer is 4 m wide and 15 m long and was built by Ramkat Trailers in Cape Town.

The KAT-7 site is easily accessible on the new 6 km road which links the construction shed to the site. The foundations for the seven antennas are also complete.

The tender for the grid power and overhead optical fibre has closed and a decision on the contractor is expected early in July 2009. The work will commence shortly after the contract has been awarded. A design and engineering services tender for MeerKAT has recently been advertised and the KAT-7 reticulation tender will be advertised from 5 June 2009.

Renovations at the SKA South Africa Support Base are now also complete. Offices, workstations, a mechanical laboratory, a boardroom and an indoor braai (barbecue) area are now available.



MeerKAT dish construction shed



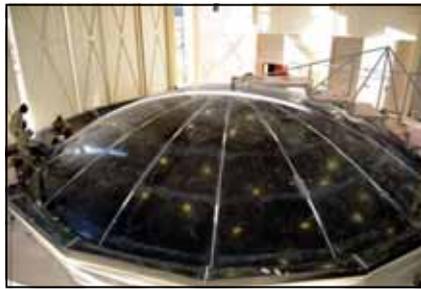
Mobile water source at KAT-7 site



KAT-7 foundation in the foreground with steamroller compacting gravel paving around foundations in the background



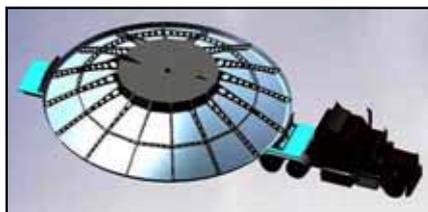
Dr Bernie Fanaroff (SKA South Africa Project Director) testing out the indoor dish crane



MeerKAT dish mould



Sanding and polishing the dish mould



Artist's impression of MeerKAT dish being moved on the custom-built trailer



MeerKAT dish trailer (4 m wide x 15 m long)

## Media coverage

Read the article *MeerKAT coming on track during IYA 2009* which was published in the May 2009 edition of *Quest* [www.ska.ac.za/download/clipping\\_qu\\_may2009.pdf](http://www.ska.ac.za/download/clipping_qu_may2009.pdf)

# KAT-7 (prototype) system engineering update

## Antennas

The pedestals and other components of the seven KAT-7 prototype antennas have been delivered to the telescope site in the Karoo during June 2009. The team commissioned and assembled an industrialization model in Pretoria in order to minimize the amount of work that will be required on site. The dishes will be moulded on site on a mould that has been set up to an accuracy of 0.5 mm. The first fully tested and commissioned antenna will be handed over to SKA South Africa by the contractor BAE in early August 2009.

## Feeds and cryogenic system

The design and development on the feed and cryogenic system have been completed. The horn was tested at a testing range and actual vs. theoretical performance correlated very well. An innovative OMT (orthogonal mode transducer) design meant that weight budgets could be achieved. A significant amount of development went into the design and manufacturing of the cryogenic system. A test unit that has been running for months provides a high level of confidence that the cryogenic system will perform as specified.

## Radio Front End (RFE)

Design reviews have been completed for all the "stages" of the RFE system. The next step is to get an integrated system in the lab to do performance testing prior to integrating with other subsystems or integrating in the Karoo. Tests at temperatures below what is expected in the Karoo (tested to 50K, while 70K is expected) proved that the Low Noise Amplifier, integrated with the cryogenic system, perform as predicted.

## Digital Back End (DBE)

SKA South Africa collaborates with

the University of California at Berkeley in the ROACH development. In return for our contribution to the design work, the South African project will get a percentage of the boards once they have been manufactured. The hardware required for the first two working antennas (the so-called "fringe finder") has been delivered and early testing on that has started. The aim is to test these boards on the GMRT during June/July 2009 prior to integrating them into the fringe finder system. In preparation for producing the boards for the KAT-7 hardware, the last manufacturing issues on the DBE are currently being ironed out.

## Software development

Since software is the "glue" that keeps the system together, the software group continually interacts with the rest of the technical team and scientists to ensure that the software will cater for everybody's needs and will be what scientists expect. It is expected that a fully simulated system will be up and running by the end of June. The group has also been working on ways to process the large amounts of data from MeerKAT in real time and on simulations to predict performance from antennas based on their beam patterns and mount types.

## XDM (Single prototype dish at HartRAO)

A significant amount of effort has gone into finalizing the work on XDM to ensure that the team get the learning from the prototype that we set out to do, and documenting these learning outcomes. This has provided valuable insight into testing of subsystems prior to deployment and yielded a new understanding of the level of engineering and concept exploration required to get a system running efficiently and reliably.

To find out more about MeerKAT and read regular updates, visit [www.ska.ac.za/meerkat](http://www.ska.ac.za/meerkat)

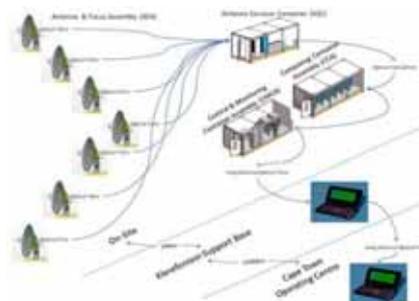
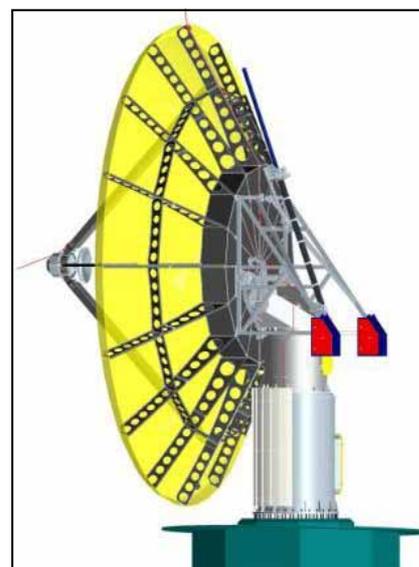


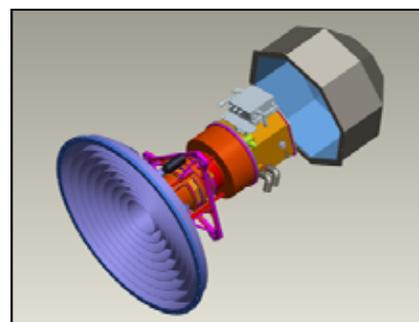
Diagram of KAT-7 system



CAD image of completed KAT-7 antenna



Testing of feed horn



Mounted feed package

## C-BASS dish installed at MeerKAT support base

The South African SKA Project, together with the Hartebeesthoek Radio Astronomy Observatory and Rhodes University is collaborating with Caltech, Oxford University and Manchester University on the C-BASS (C-Band All Sky Survey) project. Two antennas will be used in this experiment: one at the Owens Valley Observatory in California, and one 7.6 m antenna at the Klerefontein support base of the South African MeerKAT telescope.

Two antennas were purchased by the South African SKA Project from the local telecommunications service provider, Telkom, at an extremely low price for use in this experiment. The South African antenna has now been erected at Klerefontein - see photos. Charles Copley, a former MSc student from Rhodes University, has written the control and monitoring system for the tele

scope and has project managed the testing, moving and installation of the antenna from Pretoria to Klerefontein. Another former Rhodes student, Oliver King, is building the receivers as part of his PhD at Oxford University.

The C-BASS project is intended to undertake an all-sky, total power and linear polarisation measurement to obtain a precise map, in the C-Band, of the Stokes parameters of the Galaxy. Whilst this map will be important for astronomy in general, its main function is to enable extrapolation of measurements of the total power and linearly polarized emission of the Galaxy to the bands that will be used by the Planck satellite. One of the major objectives of Planck is to detect the B-mode in CMB polarisation, which requires very precise subtraction of the Galaxy foreground.



C-BASS dish being lifted into position



Completed C-BASS antenna with control and instrumentation container in the front

## SKA South Africa celebrates the arrival of RFI-shielded containers

An informal function took place at the South African Astronomical Observatory (SAAO) in Observatory, Cape Town, SAAO on Friday, 29 May 2009, to celebrate the arrival of four RFI-shielded containers for the Karoo Array Telescope (MeerKAT) project.

Shipped over from The Netherlands, these containers are especially designed and outfitted to accommodate all the electronic equipment that the MeerKAT team needs to control, monitor and operate the radio

astronomy telescopes that are being built in the Northern Cape Province. The initial KAT-7 and the subsequent MeerKAT radio telescopes are pathfinders for the Square Kilometre Array (SKA).

The purchase of RFI-shielded containers was seen as the perfect solution to obtain a portable shielded environment within the extremely tight timelines of the project. Furthermore, they will enable the MeerKAT engineers to conduct early

integration in Cape Town, at a convenient and accessible venue, before all the infrastructure at the Karoo site has been installed.

Comtest, the Dutch company that designed and built the containers, is a world leader in the development and production of shielded rooms. They have participated in large turnkey projects such as ESA ESTEC's Maxwell EMC test chamber and ASTRON's LOFAR project.

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## SKA South Africa celebrates the arrival of RFI-shielded containers cont...

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Richard Lord, one of the telescope system engineers, helped to finalise the container design specifications and, together with Carel van der Merwe, SKA SA Infrastructure/Ancillary system engineer, attended the acceptance testing procedure at the Comtest factory.

The shielding effectiveness of the four containers exceeds 120dB when measured up to 3 GHz. TF Design have been subcontracted to install a cooling solution for the computer cabinets inside the containers, since the electronic equipment generates a lot of heat.

Ian Newlands, Managing Director of International Forwarding Service Cape (Pty) Ltd, was responsible for coordinating the shipment of the containers to South Africa, their clearance through customs, and their transport to the SAAO. Ian, a passionate amateur astronomer, said that he had frequently arranged the transport of equipment out to the South African Large Telescope (SALT) in Sutherland, and that he was excited to be part of this project.

Cynthia Strydom, personal assistant to the current director of the SAAO, Dr Phil Charles, remarked that the presence of the containers on the grounds of the observatory, the media attention around the MeerKAT and SKA projects, and the fact that 2009 has been declared the International Year of Astronomy have all combined to spark a great deal of interest in both optical and radio astronomy.

According to Willem Esterhuysen, the MeerKAT Project Manager, the Site Services Container and the Antenna Services Container will be shipped to the Karoo site by the end of August 2009. The Computing Container and the Control & Monitoring Container will remain in Cape Town until early next year in order to complete integration work for the next phase of the KAT-7 project.



One of the RFI-shielded containers arrive at SAAO



An open RFI-shielded container



Inside finishing of the RFI-shielded containers

### Media coverage

Read the article written by Kelvin Kemm entitled *Looking back to the beginning of time* which was published in Business Report on 22 May 2009

[www.ska.ac.za/download/clipping\\_br\\_22may2009.pdf](http://www.ska.ac.za/download/clipping_br_22may2009.pdf)