



KAT prototype kicks off at HartRAO

By Willem Esterhuysen

The Karoo Array Telescope (KAT) team is working towards an antenna structure that will offer a design solution to meet the stringent technical and cost requirements of the much larger Square Kilometre Array (SKA). If they succeed, it will ensure significant involvement of local industry in constructing the SKA.

The KAT team aims to have the full KAT array of twenty antennas installed at the Karoo site by December 2009

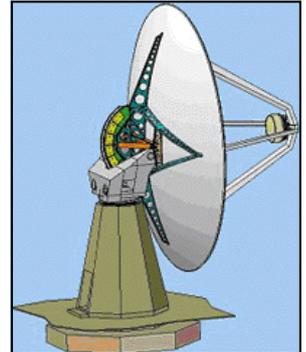
The construction of a KAT prototype antenna kicked off during August 2006 with the drilling of test holes at the construction site at the Hartebeesthoek Radio Astronomy Observatory (HartRAO).

The results from this core drilling will provide important information on the soil conditions and the location of bedrock where the antenna will be anchored. The next steps will be to pour the foundations and to manufacture the antenna.

The antenna structure is the biggest structural and mechanical portion of the building of the Karoo Array Telescope (KAT). It consists of a concrete pedestal, a composite dish, a simple backup structure, the feed support legs and a feed rotator (this is required to prevent rotation of the field relative to the detector). Its novel design and the materials used in the manufacturing of the dish should produce significant cost savings. IST Dynamics in Pretoria is designing and developing the prototype dish, while MMS Technologies in Centurion is a partner



Core drilling at KAT prototype site at HartRAO.



CAD Model of KAT antenna structure design.

in the manufacturing process.

The prototype dish will be on site at HartRAO by March 2007, and should be commissioned by July 2007. The KAT team aims to have the full KAT array of twenty antennas installed at the Karoo site by December 2009.

Inside this issue:

KAT testbed takes shape in Cape Town	2
Bigger and better telescopes on the cards in Prague	2
KAT team releases powerful new array configuration tool	3
HartRAO dishes up exciting science for Minister	3
SKA and KAT on stage at INSITE	3
Tomorrow's telescope engineers	4
Building SA's high-tech astronomy skills	4
KAT team reports back from Down Under	5
Looking for postgraduate supervisors	5

Upcoming events of interest

4 - 8 September 2006

EWG, EWG task forces, Joint SKA science-engineering-operations meetings, Paris, France

October 2006

South Africa celebrates Astronomy Month

4 - 6 December

SKA Calibration and Imaging Workshop, Cape Town, South Africa

29 - 30 March 2007

SKA Pulsar Key Science Project meeting, "Pulsar Searching and Thai-ming 2007-SKA", Krabi, Thailand

KAT testbed takes shape in Cape Town

By Simon Ratcliffe

The KAT team is building a small radio telescope, called the Prototype Equivalent Demonstrator (PED) on the grounds of the South African Astronomical Observatory in Cape Town. The PED will provide a test platform and a hands-on radio astronomy opportunity for the team.

The engineers on the PED project have completed basic specifications and identified appropriate hardware for the project. They will base their digital receiver section on the Universal Software Radio Peripheral (USRP) from Ettus research, thus benefiting from a large amount of supporting software available through the GNURadio project. The PED's end-to-end receiving chain consists of a simple L-Band feed-horn, 1420 MHz Low Noise Amplifier, USRP receiver and a PC.

The team achieved "first light" on this setup recently when preliminary tests with a simple whip antenna verified that it could accurately receive and graph the GPS signal at 1575.42 MHz, thus confirming the functionality of the software backend.



PED project team members.



PED hardware.

Join and participate!

KAT Science and Engineering wiki

Participate in discussions and collaboration with the KAT team and other developers and end users of the KAT by joining the "KAT Science and Engineering wiki" at www.kat.ac.za.

SKAnet

SKAnet is an email list which keeps subscribers updated on news and latest developments about the Square Kilometre Array South Africa project. Join the list at www.ska.ac.za.

In the media

Science, 18 August 2006
Candidate Sites for World's Largest Telescope Face First Big Hurdle.

Engineering News, 11 August 2006
South African-Australian radio astronomy cooperative project now under way.

Read these articles online by visiting www.ska.ac.za/media.html

Bigger and better telescopes on the cards in Prague

By Adrian Tiplady

The importance of new generation telescopes across the spectrum, bigger and more powerful than ever before, featured prominently at the XXVI General Assembly of the International Astronomical Union, held in Prague from 14 - 25 August 2006. Numerous plans were presented to construct the next big instrument in gamma-ray, X-ray, infra-red, optical and radio astronomy.

The IAU event offered a wide variety of presentations, symposia and discussions covering topics ranging from the evolution of distant galaxies to near-earth objects.

The debate on the definition of a planet attracted enormous media attention, with Pluto's status as one of the nine planets in our solar system at stake. Pulsars were well covered with presentations on the future of pulsar astronomy with new generation instruments. The significance of South Africa's planned Karoo Array Telescope for long-term pulsar programmes was thoroughly recognised. In another popular session Dr Jill Tarter of the SETI (Search for Extra-Terrestrial Intelligence) Institute made a compelling case for "alien hunting" as big science, based on the existence of organisms living in extreme conditions on earth.



The Astronomical Clock found in Prague's Old Town Square.

HartRAO dishes up exciting science for Minister Mangena's visit



It's huge! Minister Mangena and Dr Mike Gaylard at HartRAO's 26 m telescope.

Following Cabinet's recent approval of the establishment of South Africa's first space agency, the Minister for Science and Technology paid a visit to the Hartebeesthoek Radio Astronomy Observatory on 15 August 2006, where perfect observation conditions and an enthusiastic team welcomed him.

The programme for the visit aimed to provide Minister Mangena with a global view of what the activities at HartRAO entail, and kicked off with a visit to the 26 m-radio telescope. Clearly impressed by the sheer size of the antenna as it tilted towards him, he listened as Dr Mike Gaylard described some of the upgrades to the antenna since it was built in 1961. Having seen the new high accuracy surface panels close-up, the delegation moved on to the workshop where they took a closer

look at the "bed of bolts" used to manufacture the panels. Next stop was the Satellite Laser Ranger where the Minister could see a satellite being tracked first-hand.

More fascinating science awaited the Minister at the telescope control room. As luck would have it, the Vela pulsar, closely monitored at HartRAO, glitched two days before the visit. Dr Claire Flanagan briefly explained how the systems at the Observatory are set up to lock on to the pulsar after such an event and also the significance of the occurrence. After the stop at the control room, the minister met several students from the Space Geodesy Programme, where he took a keen interest in enquiring about their various projects. Also on the day's agenda were visits to the electronics, microwave and mechanical workshops where the Minister was introduced to the innovative ideas and skills staff put to use to create and maintain the various pieces of equipment used at the Observatory. At the Visitor's Centre the Minister witnessed science demonstrations in action and even investigated the influence of gravity on his own weight. The quick-paced visit concluded with the delegation enjoying welcome refreshments, during which a folder containing background information on the facility, was handed over to the Minister. As the group departed, the sky clouded over, almost as if the perfect conditions at the start of the day were granted especially for the Minister's visit.

View a photo essay of the Minister's visit at HartRAO: www.hartrao.ac.za

SKA and KAT on stage at INSITE

From 24 - 27 September 2006 South Africa's Square Kilometre Array (SKA) and Karoo Array Telescope (KAT) projects will be on display at INSITE in the Sandton Convention Centre. This is the annual science, innovation and technology showcase of the Department of Science and Technology. More information at www.insitex.co.za.

Two public lectures will focus on South Africa's future plans for radio astronomy:

SKA, KAT & C-BASS: Beasts in a Radio Astronomy Reserve

Prof. Justin Jonas, South African Square Kilometre Array Project Scientist
14:00 - 15:30 Tuesday 26 September

Competing for the Science World Cup:

Constructing the KAT

Anita Loots, Pr. Eng., Karoo Array Telescope Project Manager
15:45 - 17:15 Tuesday 26 September

Both lectures will be held in Boardroom 4, Level 1 at the Sandton Convention Centre. Because seats are limited please email Tseli Mohapi at info@ibstrat.co.za if you would like to attend.

The SKA / KAT stand will feature a digital virtual visit to the Karoo Array Telescope, as well as a model of one of the antennas and a terrain model of the KAT on site. Fact sheets, brochures and activities for learners' will be available to the general public.

KAT team releases powerful new array configuration tool

By Jasper Horrell

The Cape Town-based KAT team has released a powerful software tool for the design of interferometric radio telescope layouts. An interferometric radio telescope (such as KAT) is one that combines the signals from arrays of elements, such as a number of receiving dishes, rather than a single dish. The team intends to make the tool available to the astronomy community via the KAT web site at www.kat.ac.za soon.

"AntConfig", as the tool is known, is the brainchild of Dr Mattieu de Villiers, one of the KAT software engineers. It combines a highly visual and interactive front-end with a powerful and novel array optimization back-end to make array layout design easier than ever before.

AntConfig allows the user to specify physical layouts and move antennas around manually or by using the built-in optimisation routines. You can also view the array's performance by looking at a number of performance metrics and images such as point spread function, effect on loaded sky scene and numerical performance. The user can load standard configurations from files, or use a mouse to create new layouts. Once the user has specified ideal point spread function, the program will iteratively create new layouts to reach the desired performance. Dr De Villiers is currently preparing a journal paper about this novel optimisation technique.

The KAT team developed AntConfig as part of the CONRAD software collaboration (www.conradsoftware.org) with the ANTF of Australia. The South African KAT and Australian xNTD teams are both using AntConfig in refining their telescope array layouts.

Tomorrow's telescope engineers

Three scholars in grade 9 and 10 at the LEAP Maths and Science School in Cape Town were the winners of an extremely challenging schools' competition sponsored by the Department of Public Works. They had to produce a detailed design and scale model of the future Karoo Array Telescope.

Nzwana Nkolwana, Nyameka Mguzulo, and Lindelwa Mini (f.l.t.r. in photo) presented their project with confidence and pride to a team of judges from South Africa's Square Kilometre Array project, the construction industry and the Department of Science and Technology. Each of them won a laptop computer, as well as a bursary to cover study fees in matric or first year at university during 2007.

This competition is part of an initiative of the 2014 Youth Foundation within the Department of Public Works. This Foundation offers a wide range of activities to attract talented young people to the construction sector, including mentorship programmes and holiday schools for 14 - 15 year old learners.

The challenge to design a new radio



telescope support facility was put to participating schools in Limpopo, Mpumalanga and the Western Cape. The competing teams received a detailed brief and scholars had to produce designs including floor plans, elevations, sections and a site plan. They also had

to build a model to scale and produce a report on the design project. The judges considered their understanding of basic engineering principles, and specifically looked at the telescope's visitor centre, computer centre, costing models and the foundations for the dishes.

Building SA's high-tech astronomy skills

South Africa is fast becoming a hub of high-tech astronomy facilities. But investing in steel, concrete and glass is not enough. High tech facilities need high-level skills. The Department of Science and Technology (DST) has therefore launched a range of activities aimed at developing local brainpower to keep local astronomy globally competitive.

"Astronomy is clearly of strategic importance in South Africa," says Dr Tshepo Seekoe, Manager: Science Platforms at the Department of Science and Technology (DST). "Just look at the investment the government is making to promote multi-wavelength research in South Africa. New projects such as the Karoo Array Telescope are going to present huge opportunities, not only during their construction phase, but also for ongoing research."

The DST is working on a ten-year plan for astronomy in South Africa to ensure the success of Southern Africa as a world-class hub of cutting edge astronomy. The "Astronomy Geographic Advantage Programme" (AGAP) will provide a framework to develop and sustain a critical mass of expertise in astronomy and related areas. It will address the production and effective dissemination of new knowledge and research outputs, as well as public engagement with research. The AGAP strategy will also integrate the needs and capabilities of local industry, and will interconnect existing astronomy support initiatives such as the SKA Bursary Programme, the KAT internships and the National Astrophysics and Space Science Programme.

"We want our researchers and research outputs to become much more visible to the international research

community," says Dr Seekoe. "To achieve this, we need to get South African research into top international journals and much more prominently into popular scientific publications around the world. This will demand of our researchers to sharpen their communication skills and to take public engagement far more serious!"

In planning for the future of astronomy in South Africa, the DST will also consider some of its other instruments used to develop capacity where there is a current or potential gap in expertise in high priority areas. "Within universities we use "centres of excellence" and "new research chairs" as funding instruments, while science councils are ideal for our "professional development programmes," Dr Seekoe explains. "Another instrument is the "innovation postdocs" that are linked to focus areas within the DST."

KAT team reports back from Down Under

By Thomas Kusel

Five engineers from South Africa's Karoo Array Telescope team spent two weeks in Australia during August 2006 to get a first-hand look at radio astronomy Down Under and to glean valuable information about the development and commissioning of radio telescopes in remote regions.

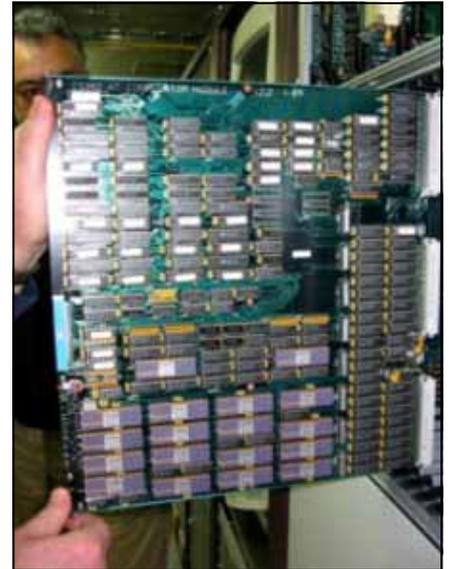
The visit kicked off with a week at the Australian Telescope Compact Array (ATCA) in Narrabri, about 500 km west of Sydney. The South Africans were amazed at the massive scale and high operating costs of the facility in this rural part of Australia. They got to know the staff and all the technology components well and even did their own observation. This was a useful exercise to experience the system as a user, from proposal to observation to data reduction.

During the second week at the Australian National Telescope Facility (ATNF) in Sydney they focused on getting to know the local technology development experts. The South Africans made full use of the opportunity to gain expertise in fields such as digital signal processing, antenna design and software development.



Looking under the bonnet

It was informative to get to know the system by looking at all the technology components from feed, RF receiver, digitiser, correlator to data processor. The pictures below show photos of the correlator room and some of the custom-made processing modules.



Aerial photo of the ATCA.

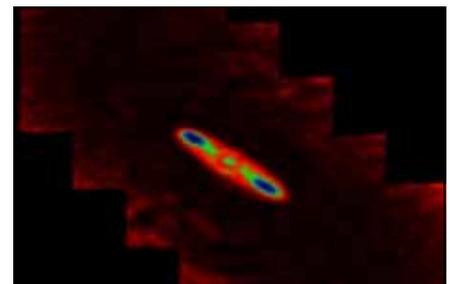


Image from the KAT team observation using the ATCA.

Looking for postgraduate supervisors

South Africa's SKA/KAT project needs more supervisors and postgraduate students to join its Bursary Programme.

The Department of Science and Technology has allocated enough funding to support 76 students and senior researchers up to 2009. Kim de Boer, Assistant Project Manager at the SKA South Africa project, manages the bursary programme.

Relevant research topics will typi-

cally be in the field of astronomy, physics, mathematics, various fields of engineering and computer science.

A detailed list of relevant research topics can be downloaded from www.ska.ac.za/bursary/supervisors.html.

Please visit the web site above or contact Kim de Boer kdeboer@ska.ac.za or telephone (011) 442-2434 for more information.



Kim de Boer manages the bursary programme.

All systems go for SA's space agency— The cabinet has approved the establishment of SA's first space agency, which will be tasked with co-ordinating the use of space technology and local space science research. The agency is expected to reduce duplication and offer international space agencies, such as the National Aeronautics and Space Agency, a single point of contact in SA.