NEWSLETTER

Volume 08

July 2005

P.O. Box 2, 7990 AA Dwingeloo, The Netherlands
Oude Hoogeveensedijk 4, 7991 PD Dwingeloo
Tel.: +31 (0) 521 595 270/271
Fax: +31 (0) 521 597 332
www.skatelescope.org

FROM THE INTERNATIONAL SKA PROJECT OFFICE

It has been another busy six months in the international SKA project. In Europe, South Africa and Australia, detailed planning is in full swing for three SKA pathfinder instruments, SKADS EMBRACE + 2-PAD*, KAT, and the xNTD. These development efforts explore different aspects of the technical design involving phased arrays either at the foci of small dishes or as stand-alone flat tiles. In China, encouraging progress has been made on the 30-m FAST demonstrator. It is also good to see that the Allen Telescope Array in the USA expects to have 42 antennas in place later this year. A concerted effort to involve industry in the SKA project is underway and an Industrial Liaison Task Force has been established to set international policy for those interactions. The Australian report gives an example of progress on this front.

Earlier in the year, the ISPO Working Groups and Task Forces set out roadmaps for their activities in the coming couple of years. Preparation of a number of papers and other documents for face-to-face discussion during the SKA 2005 meeting in Pune is a top priority for the WG's. Examples are the drafts of the engineering system White Papers (EWG), preparation for the analysis of the site proposals (SEWG and SimWG), and trade-offs between science and technical design (SWG and EWG).

The international RFI monitoring program got underway in April with the visit to the South African site by the ASTRON team under contract to the ISPO. One month's worth of RFI data from South Africa is currently being analysed at the same time as the team prepares to visit the Dawodang Depression in Guizhou Province in southern China. Australia is next, followed by Argentina. First impressions of the South African data show that the measurement campaign proceeded according to plan.

The candidate sites are hard at work preparing their proposals, due at the end of the year. In its meeting in Guiyang in China in March, the ISSC established an International Site Selection Advisory Committee (ISSAC), to be chaired by Prof. Richard Hills, to provide an independent analysis of the strengths and weaknesses of the different proposals by mid-2006.

Other major discussion points for the ISSC in China were the options for the technology selection outcome, the ISPO budget, and preparation for the June Heathrow meeting of funding agencies and governments at which an informal review of the SKA was to take place. The ISSC held a telecon following the Heathrow meeting to discuss the outcomes, and agree on various courses of action. Actions to be taken in the near future included identifying a Design Reference Concept for the SKA, adopting a two-stage process for the site decision, and generating a comprehensive project plan. More on these topics in future Newsletters.

A major Press Event on European astronomy was held on 7 July organised by the European Commission and hosted by JIVE in Dwingeloo, The Netherlands. The Outreach Committee led by Michael Kramer generated a splendid 28-page booklet on the international SKA project in time for the press event. The booklet can be downloaded from the home-page of the website, and ordered as hard copy from the ISPO (secretary@skatelescope.org).

Richard Schilizzi
Director

* SKADS = SKA Design Study (Europe), EMBRACE = European multi-beam radio astronomy concept, 2-PAD = two polarisation array demonstrator, KAT = Karoo Array Telescope (South Africa), xNTD = extended New Technology Demonstrator (Australia)

NEWS FROM THE COMMITTEES

EWG - ENGINEERING WORKING GROUP

Much of this year's activity in the SKA engineering area has focused on starting the work of the EWG task forces; these bodies, listed in the last Newsletter, are responsible for producing draft SKA system and sub-system whitepapers by the end of 2005. Current details of the task forces, their terms of reference, and membership are available via the SKA web site.

Recent task force activities include:
- production of a "straw man" system overview paper by Dick Thompson
- organization of a series of June 2005 technical meetings or sessions, and associated task force business meetings, by Sandy Weinreb (IEEE MTT-S), Parbhu Patel (Dwingeloo Focal Plane Array) and Tim Cornwell (Dwingeloo Wide-Field Imaging)
- formation of a new 10-member Industry Liaison Task Force (ILTF), to be chaired by Peter Hall.

In the case of the June meetings, Sandy, Parbhu and Tim have worked with colleagues (notably Wim van Cappellen, Robert Braun, and Jan Noordam) to highlight key SKA issues, many of which will be discussed in the task force whitepapers. While there will no doubt be other summaries of these meetings, my own impression is that the engineering community – staring squarely at the challenges of demonstrators and timescales – is moving naturally towards enhanced practical collaboration. Mechanisms discussed in the Netherlands include choosing particular emphases in regional demonstrators, exchanging personnel, and implementing contracts (or MOUs) between groups to rationalize the delivery of key components (e.g. FPAs, correlators and software). All the June workshops were profitable and well-attended, and the SKA project is indebted to organizers and sponsors. Watch the SKA website for links to proceedings of the meetings.

Wim van Cappellen exemplifies a calm engineering approach at the Dwingeloo FPA workshop

Tim Cornwell and Jan Noordam (bottom) entertain the audience by sharing a point of violent agreement at the Wide Field Imaging workshop held in the same week.

The next three to four months will see some solid task force work; the intention is to have early drafts of whitepapers available for discussion at SKA 2005 (Pune) working meetings. The technical whitepapers are particularly important because they will provide the central resources for groups compiling initial SKA technology proposals next year. However, the ILTF report is also important, since it is already clear that industry interactions will have a significant impact on both the engineering of the SKA and the project's structure.

Still on industry matters, following the written report on the European industry day in the last Newsletter, streaming video of the various presentations is now available on the SKA web site (1). A DVD containing compressed video files can also be supplied by the ISPO on request.

At the time of writing (early June) the special SKA engineering issue of *Experimental Astronomy* was approaching the composite proof stage. We have initial orders for over 150 copies of what is now a 400-page, hardbound, book containing 36 refereed articles. Much work from many quarters has gone into the book – titled "The Square Kilometre Array: An Engineering Perspective" – but it will undoubtedly be a great resource within the SKA community and a useful briefing document for professionals working in other fields or projects.

As well as writing the task force whitepapers, the EWG is planning its review of the demonstrator project updates to be submitted by consortia before July 31, 2005. While neither the submissions nor reviews will be as lengthy as the initial 2004 documents, there will be important updates covering, for example, the hybrid Small Dish - Focal Plane Array SKA demonstrators planned in South Africa and Australia. At ISSC-13, held recently in China, it was agreed that the SD - FPA proponents would collaborate to provide a concept white paper; this will also be reviewed by the EWG prior to SKA 2005.

On the international project engineering front some recent priorities have included coordination of a site water vapour characterisation document (SKA memo 59, by André Erasmus, (2)), assistance in the management of the international RFI characterisation program (see report from South Africa in this Newsletter) and associated data assessment initiatives, and preparation for the start-up activities of the ILTF. An interesting part of the industry studies involved a visit to IBM's Zürich research laboratories, and to CERN in Geneva. The global technology outlook from a giant like IBM turned out to be fascinating from an SKA viewpoint, while standing deep in the beam tunnels of the Large Hadron Collider (LHC) really underlined the term "mega-science". It was clear to all of us - Richard Schilizzi, Tim Cornwell and myself - that there was much to gain by building both the IBM and CERN links. Fortunately, many of our counterparts in these (and other) organisations are fascinated by the SKA, and it looks as though we can expect some solid input to our engineering and policy taskforces.

One request from the recent ISSC-13 meeting was for the ISPO to further update the registers of intellectual property and industry links. A first round update has now been done but regular input to, and maintenance of, the registers will be increasingly important in allowing SKA R&D bodies to share IP and deliverables with confidence. With slippages in all major SKA technology demonstration programs, increased collaboration is going to be important if we are to have credible SKA demonstrators operating in time for a 2009 technology selection.

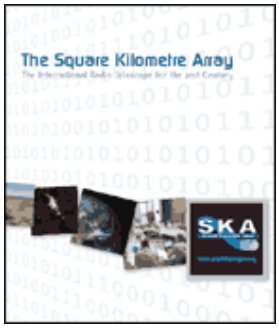
Peter Hall
Chair, Engineering Working Group

(1) http://www.skatelescope.org/IndustryDay/presentations.htm.
(2) http://www.skatelescope.org/PDF/memos/59_Erasmus.pdf

OUTREACH COMMITTEE

The activities of the outreach committee in the past six months have concentrated on the production of a new booklet describing the exciting science and technology related to the SKA project.

The material has been put together in a close collaboration with the Engineering Working Group, the Science Working Group and the ISPO.



A number of design concepts for the booklet were developed and discussed by the Outreach Committee and members of the ISSC, before a consensus was reached on its present form. The difficulty lay in judging the appropriate level and language for the target audience which is considered to be mixture of journalists, the general public, fellow scientists and engineers and funding agencies.

The booklet was published at the beginning of July in time for an international press conference organized by the European Commission at JIVE. Copies will be available, both in print, and on the website, in the coming weeks. A PDF file is available on skatelescope.org (1).

Let me express a big Thank You to all our colleagues who have helped to produce the booklet by providing comments, striking images, text, careful reading and, last but not least, encouragement when it seemed difficult to merge so many different opinions into a single design! I sincerely hope that you will like the final result.

Since the work on the booklet was quite time consuming, work on the short animation, which is to be presented at the IAU General Assembly in Prague in 2006, has paused but will resume as soon as the booklet is published. The meeting at Pune will be a good opportunity to collect ideas and suggestions.

Stayed tuned for our activities in Pune that we will prepare with the organizers during the coming few months.

Michael Kramer
Chair, Outreach Committee

(1) http://www.skatelescope.org/PDF/SKA_Booklet.pdf

SEWG – SITE EVALUATION WORKING GROUP

In September 2004, the Request for Proposals to site the SKA was issued by the ISPO. At present four proposals are anticipated from Argentina, Australia, China and from South Africa. These are due by December 31, 2005. The RFI portion of these proposals are due on March 17, 2006. In the meantime, ASTRON, under contract to the ISPO, has begun independent RFI monitoring of the four sites. Their results will be submitted to the ISPO early in 2006.

Members of the SEWG with Peter Hall and Richard Schilizzi at the KARST region.

The SEWG met in Guiyang, China in March 2005 and reviewed the timeline of the site selection and discussed the necessary preparations for the evaluation of the siting proposals. An independent International Site Selection Advisory Committee (ISSAC) is being established to judge the proposals. The task of the ISSAC will be to review the proposals for candidate sites according to the 'Principles of Siting Evaluation' and the 'Evaluation Criteria' as specified in the RFP, and present their findings to the ISSC.

A KARST depression in China for an Arecibo type radio telescope.

The siting evaluation will be based on:
- The ability of the site to maximize the science return
- The infrastructure costs
- The operational costs, and
- Physical and organisational issues

The Evaluation Criteria are:
- The Quality of Science
  - (a) Short and long term radio frequency interference and protection issues
  - (b) Array configuration and performance
  - (c) Ionospheric and tropospheric conditions

- Infrastructure, Climatic and Costing Issues
  - (a) Climatic issues
  - (b) Physical site characteristics for Stations
  - (c) Impact of land-use and urban centers
  - (d) Existing infrastructure
  - (e) Data interconnects
  - (f) Costing – capital and operating

- National Attributes for Siting the SKA
  - (a) General issues
  - (b) Government and departmental interaction
  - (c) Support for astronomy and the SKA facility

The ISSAC will be charged with making a preliminary ranking of the proposals and providing an analysis of the strengths and weaknesses of each proposal. The ISSAC will provide a final report of their findings to the ISSC in the summer of 2006.

The ISPO with input from the SEWG and its Task Forces, the SimWG, the SWG, and the EWG, will provide assistance as requested by the ISSAC for clarification and interpretation of items in the proposals.

To facilitate this process, an RFI Assessment Task Force is being established under the Chairmanship of Steve Ellingson. This Task Force is charged with making a factual evaluation of the ASTRON RFI surveys and of those presented by the proposers. These results will assist the ISSAC in their deliberations.

At the meetings in China, the SEWG also reviewed the progress on various relevant documents that are in preparation:

--"Protection Criteria for the SKA" by Willem Baan, concerning RFI thresholds.
--"Towards Radio Quiet Zones" by Tasso Tzioumis.
--"Precipitable Water Vapor at SKA Sites" by David A. Erasmus.
--"SKA Site Considerations for Key Science Projects" by the Science Working Group.
--"SKA Array Configurations" by the Configuration Simulations Task Force.
--"Steps to Register the SKA with the ITU" by Wim van Driel.
--"SKA and RFI from Satellites" by Tom Gergely.

These reports should be available soon in final form.
The SEWG plans to meet in Pune in conjunction with the SKA meetings early in November 2005.

Yervant Terzian
Chair, SEWG

SimWG – SIMULATIONS WORKING GROUP

As foreshadowed in the last SKA newsletter, the Configuration Simulations Task Force (CSTF) has recently completed a comprehensive document outlining guidelines for those consortia proposing sites for the SKA. These guidelines specify the constraints on SKA configurations, for the purposes of siting, as well as guidelines for the generation of certain data supporting the site proposals. These guidelines were completed and distributed to the site proposal teams in early 2005 and are designed to reinforce and augment the siting RFP. Copies of the guidelines can be obtained upon request from the ISPO.

In the near future, the activities of the SimWG will revolve around an analysis of the proposed site configurations and the generation of possible evaluation criteria, which will be considered by the ISSAC convened by the ISSC to assess the site proposals following the submission deadline in December 2005. These possible evaluation criteria will be under discussion during the SimWG session at SKA2005 in Pune.

Also during the Pune meeting, the SimWG will hold a joint discussion with the Science Working Group (SWG) to explore how science simulations (i.e. simulations of the radio emission from the sky) and simulations of the instrumental performance of the SKA can come together over the next few years.

In addition to the Pune meeting, several other meetings of interest for SKA simulation work are taking place over the next few months. In late June, the workshop on wide-field imaging and the SKA will take place at ASTRON (1). In early July, the regular Australian SKA simulations meeting will be held at ATNF Headquarters in Sydney (2).

Steven Tingay,
Chair, Simulation Working Group

(1) http://www.skatelescope.org/pages/news/Wrksp20220605.htm
(2) http://www.skatelescope.org/PDF/news/4thAustrlianSKASimulationWorkshop.pdf

---

SWG - SCIENCE WORKING GROUP

Following the publication of the revised SKA science case in New Astronomy Reviews, the SKA Science Working Group (SWG) is getting down to the `nitty-gritty' of the trade-offs between the science achievable with the SKA and site and design choice.

Much SWG activity in 2005 is focussing on the Key Science Projects (KSPs) described in the first few chapters of the book. Over the summer a number of reports are being prepared which will be presented and discussed at the SKA2005 meeting in Pune.

Followers of the work of the SWG (formally known as the ISAC) will be delighted to read that one of the reports will contain a `matrix' summarising the trade-offs between the scientific desires of the KSPs and the harsh realities of real SKA designs. A second report will discuss the impact on the KSPs of site properties such as ionospheric stability. A third report will address detailed questions concerning the scientific necessity of things like specific frequency bands and wide field of view. A fourth report will analyse the new parts of `parameter space' opened up by the SKA.

It is great to see the entire SWG getting involved in producing these reports. They are certain to stimulate much debate at Pune and many members of the SWG will be there to join in.

Additionally, members of the SWG have, or will be, `flying the flag' for the SKA at many international conferences in 2005. Several of these, organized by the `KSP shepherds', will feature the unique capabilities of the SKA to answer fundamental questions in physics.

Steve Rawlings
Chair, Science Working Group

MEETINGS

ISSC 13 MEETING, CHINA

The 13th meeting of the International SKA Steering Committee, hosted by the Chinese SKA group, was held in Guizhou Province during 16 to 20 March 2005. About 30 participants from 12 countries attended the ISSC-13 meeting and site visits.

A pre-meeting in Beijing with Prof. Chunli Bai, executive President of Chinese Academy of Sciences, took place in the afternoon on March 15. Minister Bai showed strong interest and support for the international efforts on the SKA project, on behalf of the Chinese science and technology community. A small group of the ISSC Executive and members met with the directors of the Bureau of Comprehensive Planning, Bureau of International Cooperation, Bureau of Basic Research and National Astronomical Observatories of CAS at CAS headquarters during this meeting.

On March 16, most of the participants arrived at ShengFeng Hotel of Guiyang city, capital of Guizhou province, and enjoyed the reception dinner with poster shows on the SKA site survey in China. The SEWG and ISSC Executive Committee meetings were held on March 17. On March 18 participants visited the Shangjiachong depression of Anshun city, one of the best potential SKA sites in China. The CAS executive President, Minister Bai, and other high officials from the CAS, Department of Science and Technology of Guizhou Province and Anshun city accompanied international SKA colleagues for the whole day site visit.

After a warm welcome speech given by Minister Bai on March 19, the ISSC meeting, chaired by Phil Diamond, then carried on for two full days at ShengFeng Hotel. The Governor of Guizhou hosted a banquet for ISSC-13 participants and top provincial leaders at the Guizhou Hotel in the evening of March 19.

ISPO Director making a presentation to the ISSC at ShengFeng Hotel in Guiyang City.

After the completion of the ISSC-13 meeting on March 20, Jill Tarter presented a public lecture entitled “SETI—Science fact, not fiction”, for nearly a thousand students in the University of Guizhou, as an astronomical gift to the local people.

Local Organizing Committee for the ISSC-13
National Astronomical Observatories, China

NEXT SKA MEETINGS

The next SKA meetings are to be held:

- 16- 18 August 2005, Pulsar astronomy with the SKA, ATNF, EPPING, Sydney, Australia
http://www.skatelescope.org/PDF/news/Pulsars_Sydney_081605_2ndA.pdf

- 29 August – 2 September 2005, The origin and evolution of cosmic magnetism, INAF, Bologna, Italy
http://www.ira.cnr.it/%7Emagnetic/

- 31 October - 5 November 2005: SKA2005 and ISSC-14 meetings, Pune, India
http://www.ncra.tifr.res.in/%7Eska_pune/http://www.ncra.tifr.res.in/%7Eska_pune

- 7 - 10 December 2005 : Low frequency Radio Astronomy, Hobart, Australia
http://www.phys.utas.edu.au/reber/

- 15 - 17 March 2006: ISSC-15 Meeting in Socorro, New Mexico, USA

NEWS FROM THE CONSORTIA AND INSTITUTES

ARGENTINA

Between July 31st and August 5th, the ISPO Director, Richard Schilizzi, visited the Argentine-Brazilian SKA Team. In Sao Paulo, Brazil, he participated in the Annual Meeting of the Astronomical Society of Brazil as an invited speaker and presented the SKA project to the Brazilian astronomical community. There were discussions with radioastronomers from Argentina and Brazil about the progress the South-American team is making in preparing the site proposal.

Prof. Schilizzi (right) received by the National Secretary of Science and

On August 2nd, Prof. Schilizzi flew to Buenos Aires, Argentina, where he followed a tight schedule including different appointments, a scientific talk and a visit to the SKA site in the province of San Juan, 1,100 km West of Buenos Aires. In Buenos Aires, he was first received by the president of CONICET (National Council of Scientific and Technological Research), Dr. Eduardo Charreau, and members of the Board of Directors, and later by Eng. Tulio Del Bono, National Secretary of Science and Technology. In all cases, the national authorities showed an earnest interest in supporting the participation of Argentina in the SKA, either as candidate for the site or in future technological developments.

During a brief visit to San Juan, the SKA delegation was received by the governor of the province, Dr. José Luis Gioja, who offered all his support for the siting of the central stations in this territory. Afterwards, there was a visit to the potential core site, a 3 hours drive from the capital city San Juan. Passing through nearby cities and villages and providing a flavor of the landscape in which the closest baselines of the array would be placed. Upon arrival at the CASLEO observatory, a Land Rover drove through the location in which the core and central station would be installed, at a plain next to CASLEO, shielded by the Andes. There, the trailer in which the equipment provided by the Instituto Argentino de Radioastronomía (Argentine Radio Astronomy Institute) is monitoring the RFI in the region, could be seen. During this visit, Prof. Schilizzi had the opportunity of enjoying the facilities at CASLEO where he met the astronomers, engineers and supporting staff.

At the proposed core site with the beautiful background of the Andes.

Back in Buenos Aires, Prof. Schilizzi was first interviewed by one of the most important national newspapers and then gave a talk to the astronomical community at the Instituto de Astronomía y Física del Espacio (Institute of Astronomy and Space Physics), after which he met the team from the Militar Geographical Institute (MGI) and from a Geographical Research Institute who are gathering the geographical information required for each SKA station. In addition, Lt. Col. Julio Benedetti, one of the leaders of this team, showed the tools they are using to generate maps with different levels of information. and displayed an interactive three-dimensional flight over the site and its surroundings.

Gloria Dubner
Instituto de Astronomia y Fisica del Espacio
Ciudad Universitaria, Buenos Aires

AUSTRALIA

Australian industry group endorses SKA project

The SKA project has been endorsed by the Australian Electronics Industry Action Agenda Implementation Group. Industry Action Agendas are an Australian Government mechanism for enhancing industry engagement in key activities.

The Australian Electrical and Electronic Manufacturers' Association (AEEMA) is the leading industry body representing Australia's information and communication technology (ICT), electronics and electrical manufacturing industries. With the endorsement of the Electronic Industry Action Agenda Implementation Group, AAEMA and the Australian SKA Planning Office (ASPO) within ATNF are initiating the formation of an SKA cluster mapping project. This will build up a network of Australian companies with expertise in SKA electronics technologies, create a database of contacts and capabilities, foster R&D of critical SKA technologies with industry, and explore commercial applications of SKA R&D. The key contact for this project is Dr Carole Jackson, Industry Liaison Office of the ASPO.

Antennas for New Technology Demonstrator

The ATNF's SKA New Technology Demonstrator project was described in January's newsletter. In the first phase of the project, two 13.7-m antennas will be installed at the ATNF's headquarters in Sydney, to be used as a test-bed for focal-plane array development. These antennas are being 'recycled' from a site in Western Sydney formerly used for radio astronomy, called Fleurs. The dishes were removed from the Fleurs site in May, and are currently being refurbished for installation at the ATNF's Sydney site in August.

One of the antennas for the New Technology Demonstrator, before relocation. Photo: Tony Sweetnam.

WA briefing 2 May

An information briefing about the SKA was held on 2 May in Perth, the State capital of Western Australia for about 100 State and Federal politicians, State bureaucrats, and media. The session was organised by the WA Government's Office of Science and Innovation. The audience viewed a short audiovisual presentation about the SKA and was addressed by the WA Minster for Science, Dr Judy Edwards; WA's Chief Scientist, Dr Bruce Hobbs; and the ATNF Director, Professor Brian Boyle. There continues to be strong Government and public interest in the SKA in Western Australia, where Australia's candidate SKA site is located.

WA State funding for radio astronomy in the Mid West of WA

The WA State Government has allocated $4 million in further support for Australian efforts on the SKA. The money, earmarked in the State Budget for 2005/06, will fund infrastructure such as fibre optic cable, buildings, power supplies and local road upgrades for radio astronomy projects at Mileura, including ATNF's 20-dish extended New Technology Demonstrator, the CoRE experiment (see below), and the Low Frequency Demonstrator project being led by MIT Haystack Observatory in the US.

CSIRO, the ATNF's host organisation, has already committed $15m over three years for developing the NTD technology into the extended New Technology Demonstrator telescope.

Science meetings

On 6 April the ATNF held a one-day meeting to canvass the science possible with the 'extended New Technology Demonstrator' – the second phase of the NTD project. The current specifications for the xNTD are for 20 dishes, each of 15-m diameter and with a focal plane array consisting of 100 elements operating over a frequency range of 800-1700 MHz, yielding a field-of-view on the sky of about 40 square degrees at 1.4 GHz.

On 7 June the ATNF hosted a symposium to review science and technology results arising from Major National Research Facilities funding granted by the Australian Government in 2001. About half of this funding has been directed to SKA technology development. The meeting reviewed progress in SKA simulations, RFI testing of the Mileura site in Western Australia, the SKA Molonglo Prototype (SKAMP) project, configurations for the Australian SKA site bid, and development of the Compact Array Broadband Backend, MMICs (monolithic microwave integrated circuits), and focal-plane arrays.

Visit by South African SKA Consortium members

The South African SKA consortium is developing an SKA demonstrator, the Karoo Array Telescope (KAT), which has much in common with the Australian New Technology Demonstrator (NTD). Representatives of SASKA visited the ATNF on 10 May to discuss ways in which the South African and Australian groups might collaborate. Software, digital electronics and focal-plane arrays were identified as the most promising areas for joint effort, and technical discussions have begun.

First light approaching for CoRE (Cosmological Reionization Experiment)

The ATNF has a project in train to develop a telescope to detect the signatures of re-ionization in the early universe. The experiment aims to exploit the extremely low RFI environment at the Mileura site in Western Australia. The execution of this difficult objective would be a strategic development of low-frequency astronomy techniques and a pathfinder to doing useful astronomy from Mileura. Our 'Mark-I' antenna was erected recently at the ATNF's Sydney site for testing.

Hydrogen gas is potentially detectable in absorption or emission (depending on the neutral fraction in the hydrogen and its spin temperature) in the redshift window $z \approx 200$ to $z \approx 6$. Many low-frequency radio telescopes have been proposed and are being built with the aim of detecting the spectrum of spatial-frequency fluctuations in this redshift window as a probe of structure formation, re-ionization process and thermal history of the gas during these epochs. The ATNF project is to develop a capability for sensitive wide-band measurements of the mean spectrum of the sky at VHF frequencies, to be able to detect any features in the all-sky spectrum that might arise from the cosmological evolution in the gas. The project is a developmental effort towards a telescope and receiver that would view the sky with steradian angular resolution, and would be capable of detecting the spectral features of a few milliKelvin that might be present in the background sky, which has a brightness exceeding 1000 K.

The Mark-1 antenna is a two-arm pyramidal log-spiral to operating 100–228 MHz. It is designed to have a structural bandwidth of 20:1 so that the beam pattern is frequency independent, at the 1% level, over the octave operating band. The analogue chains have separate couplers for adding calibration noise into the signal path, low-noise amplifiers, filters that limit the band to the range 114 – 228 MHz for the Mark-1 system, attenuators and further amplifier stages. The 8-bit samplers lead to poly-phase filter banks and cross multipliers implemented on a Berkeley S5 spectrometer board (kindly supplied by Dan Werthimer and his group at Berkeley).

Australian SKA Consortium Committee

CHINA

In the past 6 months, there has been some progress in constructing the FAST demonstrator at Miyun radio astronomical station of the National Astronomical Observatories, and RFI monitoring at the potential SKA core region in China.

Progress on the Miyun FAST model

In early 2005, the FAST project team began to construct the FAST demonstrator in Miyun observatory, i.e., Miyun FAST scaled model, hereafter MyFAST. A cable-mesh structure has been adopted for the reflector of MyFAST, rather than a traditional structure. The total weight of the reflector will be much lighter and the construction cost of the telescope will be reduced by making use of such a structure. Furthermore, any future upgrade of the telescope will benefit as well.

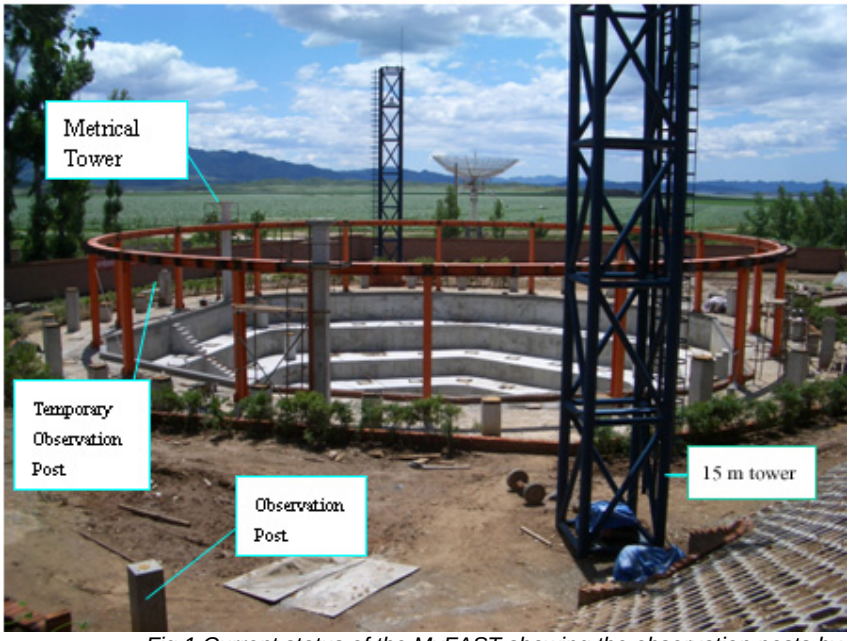


Fig.1 Current status of the MyFAST showing the observation posts by June 2005

The construction of the MyFAST involves following items:

1. Four towers with a height of 15 m and a span of 50 m for supporting feed.
2. A pit (with water pump) with a diameter of 30 m and a depth of 7.5 m to simulate a KARST depression in Guizhou.
3. A spherical reflector constituted of cable-mesh structure (see Fig.2) to be hung on the steel ring beam (transom) 5 m high. The reflector will be adjustable to form an instantaneous paraboloid of 18 m in diameter during observations.
4. The downward actuators (see Fig.3) to pull the cable-mesh structure, and reshape the sphere to a parabola due to elastic deformation caused by the tensions;
5. Four observation posts for the basic control network, two assistant observation posts and three metrical towers for the measuring system for the MyFAST, as shown in Fig.1 (see the following section).
6. Feed platform and receiver.
7. Control room

At present items 1, 2 and 5 have been completed as shown in Fig.1, and the others are in progress. The construction of the whole model will be completed by the end of this year, and pulsar observations are expected to be tested by MyFAST in 2006Q2.

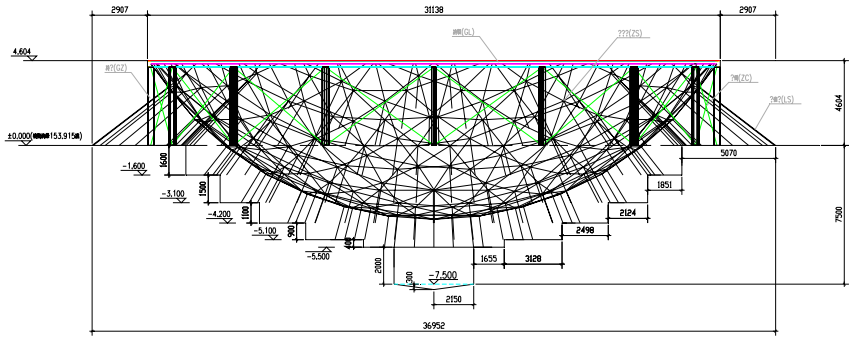


Fig.2 Design charter of the cable-mesh reflector of the FAST demonstrator

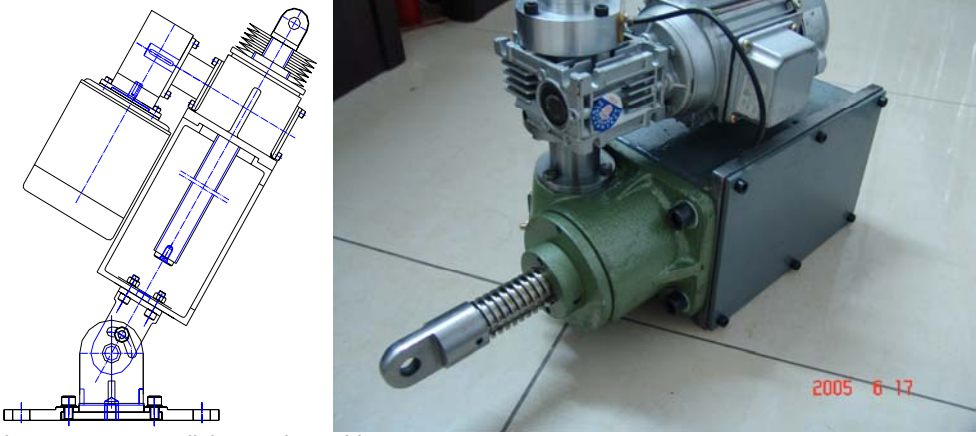


Fig.3 Actuator to pull the tension cable

Measurement of FAST demonstrator

A sophisticated measurement system has been established for the MyFAST, involving four observation posts of 1.5 m height, located in the corners of the test field in Miyun, and three reference towers of 5 m height, located next to the man-made depression (see figure 1).

The astronomical north direction was determined with a precision of ±0.38″ by observing Sun and Polaris separately with a theodolite Leica TM 5100A, a navigation type of GPS and a calculagraph. A basic control network for the measurements was set up, using a Leica TCRA2003 with associated spherical prisms and other instruments in which a relative positional accuracy between every two observation posts reached 0.7 mm. The final multiplex accuracy reached about 0.5 mm.

The standard deviation of the steel ring beam (transom), erected with the 16 steel supports, reached ±6.4 mm, which is within the tolerance of ±1cm.

Ongoing RFI monitoring at candidate SKA core of one year period

RFI monitoring at the Dawodang Depression, the candidate central region for setting the SKA in China, has been carried out since January 2005. The Dawodang Depression is about 170 km in road distance from Guiyang, capital city of Guizhou province. A brick house of 4 rooms has been constructed near Dawodang for better observing and living conditions.

A 4 room brick house near the Dawodang KARST depression

Monitoring sessions were performed in January, March and May 2005 by the local RFI measuring team from Guizhou Radio Monitoring Center. The local team will accompany the international RFI calibration group from ASTRON in late June 2005. Electric power was provided in this remote mountain area earlier last year, and internet accessibility established recently, so that the RFI measurements can be (quasi-) automatically operational. Measures have been taken at the site to prevent RFI generation from the equipment itself, such as a shielded copper mesh room and small boxes to cover RFI measuring equipment completely, etc.

From August 2005 onwards, the RFI monitoring session will be made daily to get denser and more complete data sampling by remote control. We expect to complete this one year RFI monitoring period at the potential SKA core site in China on time, to meet the deadline for submitting the final site proposal set by the International SKA Project Office.

Other activities

The FAST Laboratory of the National Astronomical Observatories hosted the 13th meeting of the International SKA Steering Committee during March 16 to 20 in Guizhou China in 2005. All participants visited Shangjiachong depression in Puding county of Anshun city on March 18. The executive President of the Chinese Academy of Sciences, Minister ChunliBai, joined the site visit with all international SKA colleagues. The top leaders of Guizhou Province welcomed all participants in Guizhou Hotel before a Banquet on March 19. A meeting summary for the ISSC-13 can be found in this SKA Newsletter.

National Astronomical Observatories, China
FAST Group in China

INDIA

For better coordination of the different SKA activities in India, a formal consortium has been formed titled " Square Kilometer Array Consortium of India (SKACI) ". The initial members of the consortium are the National Centre for Radio Astrophysics of the Tata Institute of Fundamental Research, Pune and the Raman Research Institute, Bangalore.

A committee consisting of

J.N. Chengalur (NCRA)
K.S. Dwarakanath (RRI)
A. Pramesh Rao (NCRA)
N. Udaya Shankar (RRI)

will look into and form guidelines for the activities of the SKACI including expanding the membership. The first SKACI meeting was held at NCRA, Pune on 22 April 2005.

The study to optimise the cost of low frequency (< 5GHz) 12 meter dishes (See SKA Newsletter Vol 7) has been adopted as a formal SKACI activity. The Tata Consulting Engineers, India, (M. K. Lokhande and M.K.S. Yogi), have been commissioned to examine various designs of 12 meter dishes, including PPD and advise on a range of parameters including costs, ease of fabrication and long term maintenance, surface accuracy under various wind conditions etc. The study is fairly well advanced and preliminary results are expected by mid-July.

The installation of the 12m PPD at Gauribidnur has been slowed down by delays in the delivery of the mount system. The civil works are complete as is the shifting of the dish from Bangalore. The final integration of the dish will commence by mid to late July when the mount system is expected to be delivered at the site.

N. Udaya Shankar (RRI)
A. Pramesh Rao (NCRA-TIFR)

EUROPE

The European SKA Design Study (SKADS)

The breadth of the European SKA Design Study (SKADS) was outlined in the last newsletter. Since then the SKADS partners, coordinated by Arnold van Ardenne, have had more face-to-face meetings to finalise the details of the multi-national work programme. Thanks to a major effort on all sides, but in particular by Arnold, we now have a fully costed “Description of Work” running to 114 pages. We hoped that funds would begin to flow from mid-2005 but the start has been delayed by some months. Nevertheless SKADS stands ready to be the key cohering organisation for the international scientific and technology R&D effort for the next four years.

A brief reminder of what SKADS involves. Over 30 organisations (national institutes, universities and industry) drawn from EC member states (the main contributors being Netherlands, UK, France, Italy, Spain and Germany) and non-EC countries (Australia, South Africa, Canada and Russia) are contributing. While SKADS was most certainly catalysed by the EC Framework 6 (FP6) proposal and much of the planning and timescales are being driven by the FP6 requirements, the EC’s financial contribution will be only a little over a quarter of the project total of ~€38M. This is unusual for an EC-funded project and has led to a range of new administrative problems to be overcome by the Commission and the national funding agencies.

SKADS is ambitious since it aims to develop a costed design for the entire SKA based on one or more collector concepts involving phased arrays. In view of the ISSC telecon following the meeting of the funding agencies at Heathrow in June, this is likely to be aperture arrays and small dishes with focal plane arrays. The design trade-offs require a range of sophisticated sky-to-astronomer simulations and everyone agrees that the development of low-noise, low-cost, broad-band phased arrays is very challenging and *will require the cooperative efforts of all partners.* It could be that the phased array technology will be implemented on the South African (KAT) and Australian (xNTD) demonstrator instruments.

The EC and the SKADS partners will sign a contract on 1 October 2005. The EC remains very enthusiastic about SKADS and it was included in an EC press event in Dwingeloo on July 7.

Astronomical Politics in Europe

As has often been stressed within the ISSC, a critical next step towards SKA is to establish a set of governance principles and then a legal entity to manage funding. To develop this model a strong link must be forged between the funding agencies and the ISSC. Informal discussions are starting in Europe and I have no doubt that there will be developments to report at the Pune meeting. On a more public front I have just attended a Joint European and National Astronomy Meeting (JENAM) session on "European Cooperation and Projects in Astronomy" and gained the following snapshot picture of the developing scene in Europe, which clearly has relevance to SKA.

There are five main groupings who wish to steer the future direction of European space- and ground-based astronomy: i) the astronomers; ii) the European Commission; iii) the national funding agencies; iv) ESA; v) ESO. The astronomers have organised themselves in wavelength or topic-related groupings (i.e. optical, radio, astro-particle, planetary science) but have not developed a combined vision, along the lines of the US decadal review, to take to our political and financial masters. Since nature abhors a vacuum, others are taking the lead. ESA is proceeding on its own to develop its Cosmic Visions programme for the next two decades and will continue to negotiate directly with its adhering states up to ministerial level. The EC is aiming to develop a European Research Area and, for prioritising big science projects, will be advised by the European Strategy Forum on Research Infrastructures (ESFRI) - a body of senior scientists representing the views of the member states. Now the national funding agencies are getting in on the act directly via ASTRONET, an EC-funded exercise due to get underway in late 2005, coordinated by Anne-Marie Lagrange of CNRS. Within 18 months of kick-off ASTRONET aims to develop a science vision and within 3 years it plans to have a roadmap for infrastructures. While ASTRONET will specifically link with other EC groupings including RadioNet, it is clear that for SKA to cement its place in the European road map an unremitting, coordinated, political effort is required, in parallel with the technologically-driven effort in SKADS.

Peter Wilkinson
Chair ESKAC

New Zealand Development towards VLBI and SKA

New Zealand is a most beautiful country, located in a very dynamic and active region between two colliding tectonic plates. It is also very dynamic and active in mathematics and science, including geoscience and astronomy. There are radio astronomers in New Zealand, but until recently there was no radio astronomy in the country.

The SKA movement all over the world, and especially in Australia, became a catalyst for New Zealand to start developing RA. The year that has passed since September 2004 has been full of important events. In September 2004 the Centre for Radiophysics and Space Research (CRSR) was founded in Auckland University of Technology (AUT) under the patronage of Sir Ian Axford, a scientist with a huge international reputation in the fields of Astrophysics and Geoscience.

The Centre started with a very ambitious goal: to establish VLBI with New Zealand's West Island (Australia). We could not have wished for greater support and enthusiasm than we have received from our Australian colleagues from several universities (especially Swinburne and Tasmania) and research institutions such as ATNF and Geoscience Australia. International bodies, such as IVS and ISPO heartily welcomed New Zealand's entrance into the RA community. Soon New Zealand became a member of the IVS, and (through ASKAC) became the seventeenth member country of the global SKA.

In different countries RA has developed in different ways. Initially in New Zealand political aspects were dominant over the "material" side of development. Our hopes to acquire a "good" instrument from Telecom NZ – a 30m antenna (the twin of a very successful antenna in Ceduna).- were dashed before Christmas. We were about to sign official documents when a powerful solar flare "killed" one of the IntelSat satellites. So Telecom had to dramatically restructure its communication scheme with the Pacific Islands, and as a consequence – to re-commission the de-commissioned antenna!

Against this background, we received several top SKA people in December. Richard Schillizzi and Brian Boyle had a number of meetings with New Zealand Government officials, greatly helping us in the promotion of RA and the SKA. This is when a New Zealand SKA committee (SKANZ) was formed with the objectives to participate in the SKA development, to create the background for New Zealand, together with Australia, to host the SKA, and with an initial membership of Sir Ian Axford (Napier), John Hearnshaw (Univ. Canterbury), Geoff Austin (Univ. Auckland), Robin McNeill (Venture Southland, Invercargill), and the author of this article.

In terms of "material" development, we were extremely lucky to jump on board of the e-VLBI "explosion" in Australia. Driven by very dynamic young researchers from Swinburne, ATNF and Tasmania, e-VLBI quickly became a reality in Australia. Huge advantages, such as software correlator, immediate fringe-check in the first minutes of observations, potentially real-time imaging, make e-VLBI the basic technique for the future SKA.

We should pay homage to the NZ Ministry of Economic Development and the Ministry of Research Science and Technology, for promptly understanding that RA and e-VLBI can be major drivers of the "Digital Strategy" program and major consumers of the "Advanced Research Network" envisaged by the New Zealand Government last year. As a result, the CRSR was granted a substantial fund for the

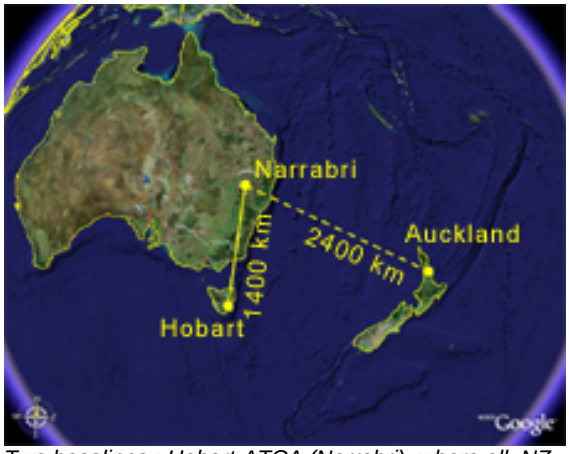
development of Trans-Tasman (NZ-Australia) VLBI. Not enough to build or buy a radio telescope, or a Hydrogen maser, but still a good injection to develop the technique and the software to demonstrate that it can be done.

After the 30m antenna dream had failed, we looked around and found a fully-steerable 6m antenna built by radio amateur Mr. Brent Addis in the backyard of his estate some 50 km out of Auckland. Biologists say "Ontogeny recapitulates phylogeny". Certainly, we had to start from the stage RA was in its dawn, more than half a century ago. A lounge in Brent Addis house became the control room and his wife Brenda made us good coffee. So we enjoyed a homely atmosphere while at work with the first NZ radio telescope.

Many people in New Zealand and Australia now know the name of this RT: BART-6 (Brent Addis RT). Routine RA work (pointing, tracking, calibration of all sorts) was combined with development of the time-keeping system, data recording and sampling technique, working out the receiver and LNA suitable for Trans-Tasman VLBI – the goal that would be trivial with a 30 m antenna, but which is a very difficult, almost marginal task with a low efficiency small antenna. It is a challenge, which added a lot of emotion and enthusiasm to the work of the whole Trans-Tasman e-VLBI team. We are hugely grateful to Australian radio astronomers for their understanding, patience and great support.

In March 2005 the ASKAC meeting was hosted by AUT. A constellation of brilliant radio astronomers gathers in NZ, which had never happened before. It attracted the attention of leading astronomers and astrophysicists in NZ and overseas.NZ International Forum in Astronomy and Astrophysics, Mini-School in Radioastronomy and the VLBI Workshop became important events for both NZ and the international astronomical community.

In April 2005 the first prototype of the full NZ receiving system was tested at Mt Pleasant Observatory, Hobart, Tasmania with the use of two middle-size (14-m and 26-m) radio telescopes. The baseline was relatively short (100 m). The 14m PT was equipped with the principal components of the NZ system (feed, L-band receiver, sampler, etc.). The multibeam correlator was used then to cross-correlate the signals from 14m and 26m radio telescopes on a short baseline of about 100m. Fringes were found for a number of radio sources, including 5Jy QSO. However, in the April test neither clock nor data recorder were tested properly.



Two baselines : Hobart-ATCA (Narrabri), where all NZ VLBI equipment was tested in August), and Auckland (New Zealand) - Narrabri, the baseline for the first Trans-Tasman VLBI. ©Google

Since April 2005 the NZ and Australian e-VLBI team has been trying to do VLBI between NZ and Australia. There were two VLBI sessions between NZ and Australia in May and July, however no fringes were found. All was checked, double-checked and analyzed, and we came to the conclusion that the most probable reason for the lack of success was the low sensitivity of the 6m RT that we use in NZ.

It was suggested we use a combination of the NZ system with a bigger antenna (14m) again, this time in the VLBI test with the Australian Telescope Compact Array. The test was conducted in Hobart at the end of August. For a second time we brought to Hobart all of our equipment. Every element of the system we use was brought from NZ (except the 14m dish) and assembled in to the complete system.

The test was successful. The 5 Jy source (0537-441) gave a very strong fringe (14 sigma with just 1 s integration time). Signals were cross-correlated with the software correlator developed in Swinburne. The test has proved that the NZ system does work in the conditions of real VLBI. It is clear now that the 6m RT is marginal in terms of sensitivity. With much better understanding of the parameters of the NZ system (such as instrumental time delay, system temperature, etc.) there is the probability that we will get fringes in the next Trans-Tasman test, provided we use longer integration time. It is also possible that fringes can be found in the data stored from our previous VLBI sessions.

We started 6 months ago. We learned a lot about the telescope and the system we use. Some innovative approaches have been developed. For example it was demonstrated that two inexpensive Rubidium clocks combined and disciplined with GPS can serve as a reliable VLBI time standard. Due to the great help and support from our Australian colleagues and friends we have evolved to the stage where a single-dish radio astronomy has become fact in NZ, and real-time Trans-Tasman VLBI is just a matter of a greater collecting area. There is no doubt that NZ will soon become a part of the international VLBI network.

Important SKA activity was connected with the visit of Brett Biddington (CISCO, ASKAC Industry WG representative) to NZ in July 2005. Brett initiated very encouraging meetings with NZ industry representatives in 3 major NZ cities: Auckland, Wellington and Christchurch.

Currently, the search for suitable SKA sites in NZ is underway. The Ministry for Economic Development has granted a postgraduate scholarship worth $30k for monitoring the RFI for the SKA sites and for the development of the methodology for monitoring of the background noise floor. This project will be supervised jointly by the University of Auckland and AUT. The future is looking very promising.

Sergei Gulyaev
Director Centre for Radiophysics and Space Research
Auckland University of Technology

SOUTH AFRICA

Project office

The South African SKA project team now has a dedicated office in Johannesburg. This office is the hub for all projects that the team is currently engaged in, including the SKA site proposal and the KAT. Productivity of the project team has improved markedly now that they are all collocated in a centralized location. A key facility in the office is a GIS workstation that has been loaded with extensive spatial datasets for the Southern Africa region. This facility, together with skilled operators, is proving to be invaluable in the preparation of the SKA site proposal.

The office is also an extension of HartRAO, and as such it has become a home base for astronomy related meetings in the greater Johannesburg area. Many colleagues who attended the EVN CBD at HartRAO in May visited the offices during the chaos period while we were moving in.

The postal and physical address for the office is:
SKA project office
First floor
17 Baker Street
Rosebank 2196
South Africa

The office telephone/fax number is: +27 (0)11 442 2434

Proposal preparation
With the 31 December deadline in sight, the project team is tackling the preparation of the SKA site proposal in earnest. Various aspects of the proposal have been contracted out to expert groups. For instance, the section on the ionosphere is being handled by the Hermanus Magnetic Observatory and Rhodes University, while the analysis of the troposphere is being done by Andre Erasmus.

Much of the activity has centred on the choice of a reference array configuration, and this has resulted in iterative consultation with the Simulation Working Group (SimWG). Because some of the remote stations will fall in other countries we have been interacting closely with the relevant authorities in these countries, and conducting site visits.

Visit to Maputo (Mozambique).B. Fanaroff (SKA Project Manager), F. Adam (SKA Project Office), Dr F. Mausse (Mozambique Ministry of Science and Technology), G. Petrick (SKA Project Office), A. Morgan (South African Dept of Science and Technology).

Members of the SA SKA project team during their remote site visit to Kenya. (K.de Boer, K. Sishuba and J. Jonas)

RFI measurements

RFI measurements continue at the proposed SKA core site in the Karoo region. We now have some infrastructure at the site which improves the working conditions at this isolated location, and improves the reliability of the equipment.

Rob Millenaar and Bou Schipper pose with the SSSM antennas and the container office at the proposed South African SKA site.

During April and May the SSSM team from Astron made their scheduled visit to conduct standardized RFI measurements at the site. Rob Millenaar and Bou Schipper, together with SA SKA project team members and ICASA (Independent Communications Authority of South Africa) officers, spent long hours and days in the Karoo wilderness getting the measurement systems operational, and making successful RFI observations.

One of their first results echoed Karl Jansky's serendipitous discovery: they detected the Milky Way at low frequencies! Rob and Bou were hosted by the farm owners, Ronelle and Jan Louw, and had ample opportunity to sample the local culinary speciality: Karoo lamb.

We will eventually have three independent sets of measurement equipment, all of which will be housed in mobile trailers. A programme of mode 1 measurements at selected remote sites and within the central region will soon begin.

Karoo Array Telescope (KAT)

A project team has now been appointed to manage the development and eventual construction of the KAT. The areas of expertise covered by this team include electromagnetic modeling of reflector antennas and feeds, large precision mechanical structures, digital signal processing, fast configurable logic, high performance computing, and software engineering. The project team is employing a formal systems engineering approach to KAT in order to mitigate the risks associated with the development and integration of such a complex system.

A project plan and timeline have been developed for KAT, and this plan includes the construction of a single dish prototype ("Kittie") at HartRAO over the next two years. This prototype will employ a primary reflector that will have its optical configuration decided by numerical electromagnetic modeling. The dish optics will be optimized for use with a focal plane array feed.

Collaboration with other SKA demonstrator programmes is seen as an essential component of the KAT project, and various team members have visited their counterparts at institutions including Manchester University, Astron, CSIRO, MPIfR and UC Berkeley.

Justin Jonas
South African SKA Project Team

USA

Current status of the NSF TDP proposal

The Technology Development Program (TDP) is a proposal submitted to the U.S. National Science Foundation by the NAIC for development work related to the SKA in general and the US concept of a LNSD in particular. Most of the member institutions in the U.S. SKA Consortium have proposed work under the TDP. Given the large number of institutions involved in the TDP, it was reviewed in a "reverse site visit" approach, in which the P.I. (J. Cordes) and various sub-project task leaders presented to a review panel at the NSF. At approximately the same time, the NSF Astronomy Division has decided to undertake a "senior review" of the facilities and operations supported by that division. A final decision on funding of the TDP awaits the outcome of the senior review.

Nonetheless, the broad outlines of the report of the TDP review panel have been made available. Generally, the review was positive. Some concerns were raised as follows: The panel noted that, at least in the U.S, the non-radio astronomy community is not sufficiently aware of the SKA yet, and the science goals do not seem to have been ranked in terms of their priority. The panel also raised several technical issues, including the generally demanding nature of the goals for the SKA and that data transport and processing should be better articulated.

U.S. demonstrator arrays

ATA

The Allen Telescope Array (ATA) is currently under construction at the Hat Creek Radio Observatory in northern California, with 42 antennas expected to be emplaced by this fall. A team of three technicians can emplace 2–3 antennas per week. The feeds (which comprise the entire RF package at the antenna) are then installed in the antenna, which takes just a few minutes. By the end of calendar year 2005, these antennas should be fully functional with multiple tunings, phased array beams, and a correlator. This joint SETI Institute/University of California Radio Astronomy Laboratory project is progressing in phases, beginning with this on-going 42-element tranche. Fundraising is in progress for the next phase of approximately 200 antennas, to be followed by efforts to build towards 350, then 500 antennas.

An ATA antenna being emplaced. The pedestals with the underground infrastructure are installed first; then the remainder of the antenna is assembled in the construction tent and emplaced as a unit. The antennas and mounts arrive on-site as "kits, "which may be assembled and installed in just a few days by a small staff.

tEVLA

The EVLA Project is currently working on four antennas: The original EVLA prototype antenna (Antenna 13) has been withdrawn from operation so that its equipment can be upgraded to the current EVLA design, the second EVLA antenna (Antenna 14) is being used as the Test Antenna with two IFs, installation of one IF's worth of EVLA electronic systems is nearing completion on the third EVLA antenna (Antenna 16), and the fourth EVLA antenna (Antenna 18) has just entered the Antenna Assembly Building. The VLA operators are being trained in the new Monitor & Control system in preparation for returning EVLA antennas to scientific observations. Finally, the

WIDAR EVLA correlator is making good progress at the DRAO. A contract for the design and fabrication of the new correlator chip has been let, and prototype boards are being built. An on-the-sky test of a prototype correlator is planned for early 2006, and a large area beside the VLA Control Room has been cleared in preparation for the installation of the 2300 ft^2 shielded chamber that will house the correlator.

LWA

The Long Wavelength Array (LWA) has reached a number of milestones recently. The LWA design calls for approximately 50 "stations," with each station being a 256-dipole phased array. The first station is planned for the VLA site so as to be able to conduct initial observations with the 74 MHz VLA. A design review, with presentations by personnel from the Naval Research Laboratory (NRL), the Applied Research Laboratories of the University of Texas, Austin (ARL:UT), and the University of New Mexico (UNM), was held at NRAO in March. The purpose of the design review was to present the current design and verify that the operation of the first LWA station would have no adverse impact on the VLA. The Design Review went well and negotiations are underway with the NRAO about starting construction of the first Long Wavelength Demonstrator Array (LWDA) station during the summer of 2005. A preliminary site for the second station (~ 50 km from the VLA) has been identified, and work on locating successive sites continues.

MWA-LFD

The Mileura Widefield Array (MWA) low frequency demonstrator project has seen excellent recent progress. This project is led by MIT in collaboration with CfA, University of Melbourne, the Australian National University, Curtin University in Perth, and ATNF. Antennas and digital receivers covering the 80–300 MHz band have been deployed and tested near the SKA candidate site at Mileura Station in Western Australia, and a series of observing campaigns is ongoing. The early results demonstrate nominal performance of the equipment in all respects, and reveal a pristine RFI environment. Deep integrations at four representative frequencies across the band at 1 kHz resolution show rms noise levels more than 30 dB below the Galactic noise. With the exception of two identified satellite downlink bands, interferers are few in number, extremely weak, and of low duty cycle. Observations to date have yielded movies of the Galactic plane passing overhead, high-quality interferometric data on several discrete sources, and detailed information on a series of small Type-III solar bursts. Interferometric imaging tests are currently in progress.

NASA DSN

A 6 m hydroformed antenna has been under test at JPL and is giving system temperatures of 20 K and 40 K at 8.4 and 32 GHz. A 12 m conventional-panel antenna with moderate cost is due to be delivered by Patriot by early summer and will be tested in a 3-element array with two 6 m antennas. The design of electronics for this breadboard array is complete and is in a construction and test phase. Extensive planning and costing of an array with 400 $\times$ 12 m antennas at each of 3 longitudes is underway.

Wideband feed/receiver development

Initial structural analysis of a 12 m hydroformed antenna design by R. Schultz show < 0.1 mm gravitational distortion; a thermal analysis is in process. Kildal & Olsson will report on measurements of a decade bandwidth feed at the 2005 IEEE AP meeting, and this group has begun testing them. Feeds covering 0.125 to 2 GHz and 0.5 to 2 GHz are to be delivered to MIT Lincoln Laboratory for use on the Green Bank 140 ft telescope. Integration of a Kildal feed with a 1.2 to 11 GHz active balun in a cryogenics dewar has started at Caltech.

Science

Epoch of Reionization Science: Outfitting the VLA for Detection of the EoR

Detection of the hydrogen signal from the end of the EoR is recognized as part of the SKA Key Science Project "Probing the Dark Ages." The Smithsonian Astrophysical Observatory (SAO), in collaboration with NRAO, is working to outfit the VLA for operation below 200 MHz for detection of H I emission at redshifts of 6 to 7, where the VLA could have on the order of 5000 m^2 of effective area. The program leverages past investments in the VLA to achieve a large collecting area in short order and at very low cost. Four VLA antennas are equipped with prototype dual polarization receiver-feed systems built by the SAO Submillimeter Receiver Lab. Tests show nighttime system temperatures below 200 K and a well-formed primary beam, about 4 degrees across at half power. The first image of a strong quasar (3C147) is in hand. Interference in the TV broadcast bands is a serious challenge, and a combination of strategies will be attempted, including coordination, notch filtration, and post-correlation subtraction. Intensive system characterization tests will continue until summer, working around other users and Observatory needs. Pending a final review, observations will begin at the start of 2006. The key science program is imaging H I emission from shells of warm neutral material surrounding the Mpc-scale H II bubbles ionized by young quasars; three Sloan object are first-science targets.

Pulsar survey (P-ALFA)

Pulsar surveys designed to find large numbers of pulsars with which to test general relativity are recognized as part of the SKA Key Science Project "Strong-field Tests of Gravity Using Pulsars and Black Holes." With a collecting area of 5% of a square kilometer, the Arecibo telescope can be used to conduct precursor surveys to prepare for the SKA. The Arecibo telescope was outfitted recently with the Arecibo L-band Feed Array (ALFA), modeled on the Parkes multibeam system, which alone nearly doubled the number of known pulsars. A precursor pulsar survey of the portions of the Galactic plane accessible to Arecibo is being carried out. With only a limited amount of observing, already 12 new pulsars, including some potentially quite interesting objects, have been found. Projections for the full survey are that roughly 1000 new pulsars could be discovered, which would increase the known population by about 50%.

Transients

One of the hopes for the SKA is that it will discover new phenomena, as described in "Exploration of the Unknown" (Wilkinson et al.) in the SKA science book, potentially by exploring the dynamic radio sky. Although the SKA will offer larger fields of view and higher sensitivity, existing instruments can conduct path-finding observations by observing at low frequencies (where the fields of view are intrinsically larger) and targeting directions likely to harbor new classes of sources (e.g., the Galactic center). Hyman et al. (2005, *Nature*, 434, 50) reported recently on the discovery of the transient source, GCRT J1745-3009, from an archival VLA observation of the Galactic center at 0.33 GHz. The object exhibited five ~1.5 Jy bursts, each ~10 minutes in duration, every 1.27 hr. Subsequent GMRT observations recovered the source but were too short (~ 10 min.) to probe it in any greater detail. If the source is more than approximately 70 pc distant, its brightness temperature exceeds that expected for an incoherent synchrotron emitter. Hyman et al. considered a number of possible source classes, but were unable to find a satisfactory match with any. They concluded that the source represents a hitherto unknown mode of activity from an object in a known class of sources or that it is a member of a new class of coherently emitting objects.

Joseph Lazio
US SKA Consortium