

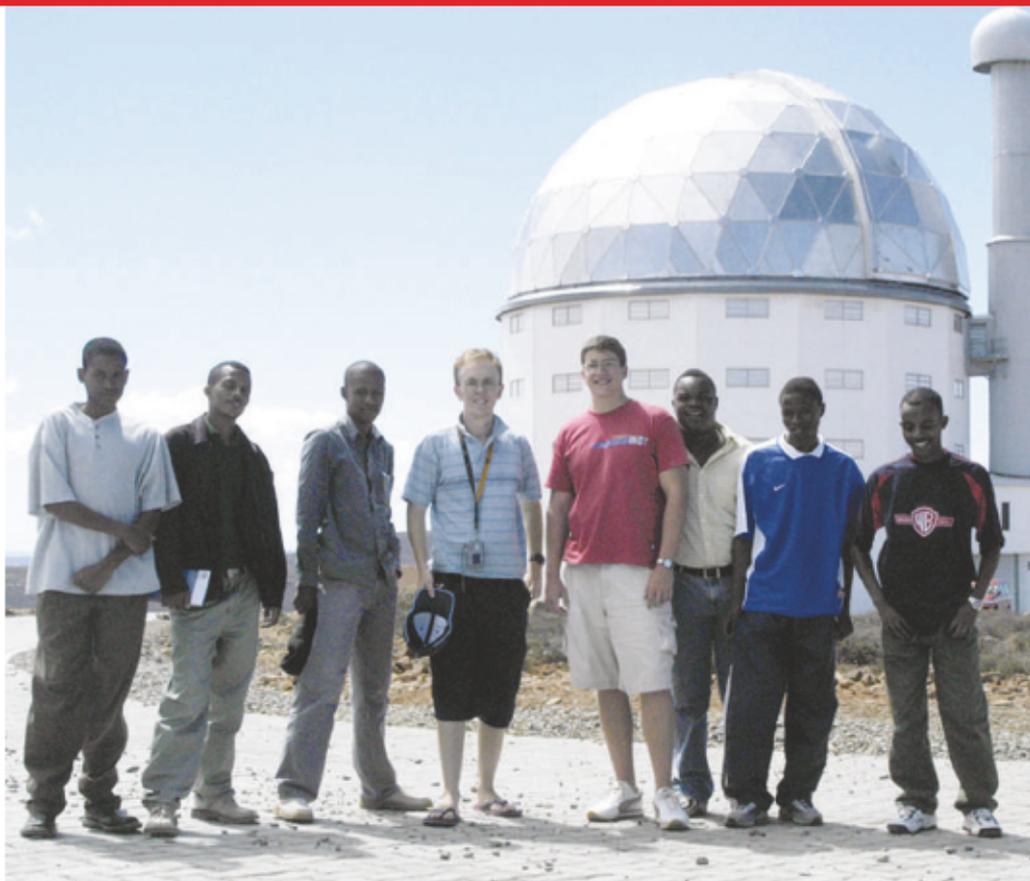
Star of the south

This month South Africa will officially open the largest optical telescope in the Southern Hemisphere. But is the country ready to capitalize on its investment? **Michael Cherry** investigates.

Sutherland has a reputation as the coldest town in South Africa. Sat on a windswept, barren plateau at an altitude of some 1,600 metres, it is home largely to sheep farmers. But on 10 November, it is set to be the focus of a visit by President Thabo Mbeki, when he inaugurates the largest single optical telescope in the Southern Hemisphere at the town's nearby observatory.

When construction began on the \$32-million Southern African Large Telescope (SALT) five years ago, it was accompanied by a sense of excitement. "We are building a gigantic African eye through which we can view the Universe," Mbeki said at the time. For Sutherland, which is in South Africa's poorest province, the Northern Cape, the prospects seemed good. And the government had high hopes that big science projects such as SALT would inspire a future generation of South African scientists.

But even as the telescope saw first light on 1 September, some questions were being raised about South Africa's readiness for the



The Southern African Large Telescope has become the focus for training the country's budding astronomers.

project. "I'm most impressed with the engineering," says Brian Warner, emeritus astronomer at the University of Cape Town (UCT). "The embarrassment is that South Africa does not have the capacity to use the observation time allocated to it."

SALT is a collaboration between South Africa, Germany, New Zealand, Poland, Britain and the United States. Having contributed one-third of SALT's overall costs, South Africa has been given a similar proportion of observation time. But astronomy in South Africa — even more than other scientific disciplines — is still struggling to escape the confines of its colonial legacy.

That legacy has a long history. The plaque

outside the South African Astronomical Observatory (SAAO) in Cape Town declares that it was "established by the Lords Commissioners of the Admiralty in 1820 on the recommendation of the Board of Longitude". Yet administration of the SAAO, which has run Sutherland's observatory for the past 33 years, was transferred to South Africa as recently as 1971.

Since then, just one of its directors has been South African: Richard Woolley, who held the post from its inception until 1976. Even when South Africa's two top jobs in astronomy came up for grabs this year, they were taken by non-nationals. In July, astronomer Phil Charles at the University of Southampton, UK, became

SHARP SHOOTER

With its 11-metre hexagonal mirror, the Southern African Large Telescope (SALT) is both a copy and an upgrade of the Hobby-Eberly Telescope in Fort Davis, Texas. And it will complement its sibling by surveying stars and galaxies visible from the Southern Hemisphere.

One of the biggest advances on SALT is a system that aims to improve image quality over the Texas telescope. SALT features a spherical aberration corrector, which should provide sharper

images, a larger field of view, and it uses its entire mirror area for capturing starlight.

If the images taken by SALT when it saw first light in September are anything to go by (see right), the corrector seems to be a major success. Its designer, Darragh O'Donoghue, an astronomer at the South African Astronomical Observatory, says he couldn't have done it without help from the Texas team, who explained the problems with Hobby-Eberly. "When you start off on the first landing, to



This image of a galaxy some 30 million light years away was one of the first taken by SALT.

climb one more storey is that much easier," O'Donoghue says.

SALT will excel in studying astronomical objects that vary

over time, says its director Phil Charles. It will also make its mark in the ultraviolet spectrum, he adds, where the capabilities of its imaging spectrograph are unrivalled. This instrument, installed

in mid-October, will observe very faint objects, such as distant supernovae explosions that took place in the early Universe.

the new director of the SAAO and therefore of SALT. And earlier this year, Renée Kraan-Korteweg, a Dutch national, succeeded Warner in the chair at UCT — the only department in the country dedicated to astronomy.

Charles admits that the SAAO is run largely the same way it was a century ago. "It is outrageous that until recently there has been nothing in place to create an indigenous astronomy community," he says.

The observatory's track record in training graduate students has been particularly dismal, says Clifford Nxomani. For the past three years, Nxomani has run the SALT Science Foundation, an arm of the SAAO that aims to promote astronomy in the wider community. The approach of the astronomers at the observatory, he says, has been one of "focusing on their work, and regarding everything else, including student training, as an imposition". Nxomani left the foundation last month to take up a senior post in South Africa's Medical Research Council.

"The ten senior astronomers employed by the SAAO have only five doctoral students between them," Nxomani notes. "As a national facility, one of its functions should be to train postgraduate students." At UCT, it is a similar story. With three academic staff, its astronomy department, has produced just 15 PhDs since its inception in 1972. But Nxomani is optimistic that things will improve. "Everything is changing with the advent of SALT," he says.

Scope for improvement

There have been some recent attempts to address the lack of indigenous astronomers. In 2003, the SAAO, under the leadership of astronomer Patricia Whitelock, helped to launch the National Astrophysics and Space Science Programme. Based at UCT, this master's programme enlists the help of 46 scientists nationally who are active in astronomy, cosmology and space science to teach the classes. Students also go on field trips to SALT and other local observatories, before choosing a dissertation topic and supervisor for their thesis.

To date, 15 South Africans and 6 students from other African countries have graduated from the course. Another 19 South Africans and 5 students from the rest of Africa are currently enrolled. Peter Dunsby, a cosmologist at UCT who coordinates the programme, hopes that the students from other African countries will return home and form "nodes of expertise across the continent that would be linked through using SALT".

The government's Department of Science and Technology is currently considering a proposal to expand the programme to produce 76 doctoral graduates and fund 30 postdoctoral fellowships over the next five years. By providing training across many astronomy and space-



School children attend a science fair held at Sutherland's observatory.

science topics, Dunsby hopes to generate graduates not only for SALT, but also for other fields of space science, such as radio astronomy. That strategy could pay off as South Africa is trying to expand its role in space science. It is currently bidding against China, Australia and Argentina to be the main site of the US\$1.2-billion Square Kilometre Array radio telescope, which will be decided in mid-2007.

The success of that bid may depend on how SALT is perceived — especially at home. Local investment in SALT has been justified on several grounds. South Africa has a tradition in

"One of the South African Astronomical Observatory's functions should be to train postgraduate students."
— Clifford Nxomani



optical astronomy that dates back to the early nineteenth century — the British astronomer John Herschel, for instance, came to Cape Town in the 1830s to map the southern skies, and while there documented the return of comet Halley in 1835. And 60% of SALT's construction and development budget has been spent in South Africa — resulting in a net inflow of capital — although only a fraction of this was spent in the poor Northern Cape.

Like its sister telescope in Texas (see 'Sharp shooter', opposite), SALT will be run more like a space telescope than one based on the ground. Astronomers will submit requests for observations over the Internet, and once these have been prioritized and completed by operations staff at SALT, they will receive their data over the net too. Warner quips that in his retirement he will be able to do his

observations in bed. Although this system is more flexible than traditional scheduling, some worry that it might perpetuate astronomy's colonial legacy as it will severely limit the number of scientists visiting the observatory.

In addition, four of SALT's team of six dedicated astronomers have so far been appointed, and none of them is South African. "The problem," says Nxomani, "is that the job requires experience in working on large telescopes. Only now that we have SALT, can South Africa begin to develop this capacity." Whitelock confirms that there have been no South African applicants with the necessary experience.

Seeing how slowly things change at the top, Nxomani chose to focus his efforts at ground level, working with local schools in Sutherland. He got pupils to take part in educational camps in Cape Town and at SALT. Schools from all over the country are also encouraged to visit both sites. There has been a similar push to improve the skills of teachers, many of whom have attended an 18-month part-time course to upgrade their teaching abilities in maths, science and technology.

Teething troubles

The problem with astronomy in South Africa, as in so many other areas, originates in the education system. The post-apartheid government has been fairly unsuccessful at improving the maths and science education of black Africans since it took office in 1994. In 2002, for example, the number of black school-leavers who had maths grades good enough to study science at university was the same as it was in 1991, according to a report published last year by the Johannesburg-based Centre for Development and Enterprise.

So far, the country as a whole has produced only three black and two mixed race PhD astronomers. But retention rates have been high: four of them are now at the SAAO; the other is at the University of Chicago.

Nxomani agrees that the problem starts at grassroots level. He recalls his shock at the low standard of facilities at Sutherland High School, especially as during the apartheid era it was a white school. "In the Northern Cape, everyone is poor — whether you are black or white," he says.

Despite these problems, the advent of SALT has given a new lease of life to astronomy in South Africa. "The future is bright, because if we use our observation time wisely, we should be able to make a significant impact in astrophysics and cosmology," says Dunsby. "The challenge is to ensure that sufficient local astronomers are trained to take advantage of this opportunity."

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