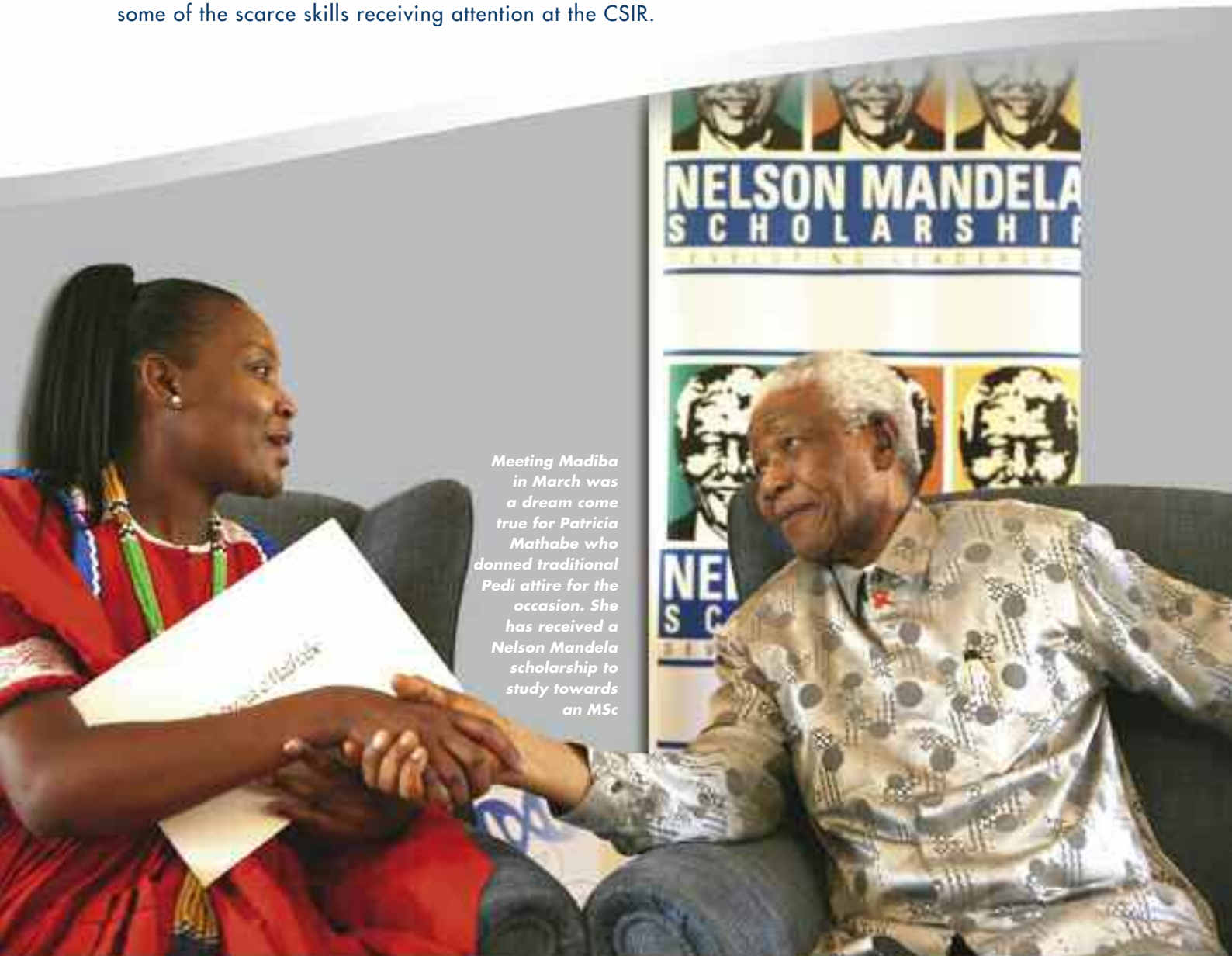


# Scarce skills

ACCORDING TO A STUDY by the Human Sciences Research Council, *Forecasting the Demand for Scarce Skills, 2001-2006* (Woolard et al), there exists a double imbalance in the country's labour market with an oversupply of some skills and undersupply of others.

At the time of compiling this edition of *ScienceScope*, the issue of scarce skills was once again on the national agenda during a ministerial skills indaba held in KwaZulu-Natal. Delegates at that meeting were reminded of the importance of improving the skills base in South Africa to compete in a global economy. The Joint Initiative of Priority Skills Acquisition (Jipsa), a component of the Accelerated and Shared Growth Initiative for South Africa (AsgiSA), gives impetus to this objective. *ScienceScope* features some of the scarce skills receiving attention at the CSIR.



*Meeting Madiba in March was a dream come true for Patricia Mathabe who donned traditional Pedi attire for the occasion. She has received a Nelson Mandela scholarship to study towards an MSc*

# Patricia Mathabe

## Mandela scholarship paves the road for Patricia

**Former South African President Nelson Mandela is quoted as once saying, education is the most powerful weapon that you can use to change the world. Armed with a prestigious Nelson Mandela scholarship to further her qualifications, this is exactly what the CSIR's Patricia Mathabe will do when she leaves for England in September to further her studies in proteomics.**

PROTEOMICS – the large-scale study of proteins, particularly their structures and functions - is a highly specialised technique, regarded as a scarce skill within the CSIR. At CSIR Biosciences, Patricia is part of a relatively new and small research group focusing on this area of science.

"I feel I need to learn as much as possible about this field of study and bring the knowledge back home," says the young researcher, who in March this year received her award at a ceremony

attended by Mr Mandela. Patricia has a passion for biotechnology and will study towards an MSc in the United Kingdom during the 2007/2008 academic year.

"This biotechnology tool is used to identify major alterations that might have resulted during genetic modification of crops; to assist with the production of vaccines using transgenic plants. It is also used for the production and design of biomarkers that are used for the diagnosis of diseases," she explains.

### On winning the Mandela scholarship

"At my initial interview, they had 1 500 applicants, from which they had to choose 80 people. The interviewers then short-listed 40 people. From 40 candidates, 21 people were shortlisted again and the figure was whittled down to 14 candidates," says Patricia, still not quite believing that she had pulled it off. She is the only scientist among the group of scholars. Making the final cut was a surprise to Patricia who saw a call for applications in the *Sunday Times* last year. "The interviewer asked me why they should choose me, to which I responded that I'm highly ambitious, take initiative and I'm a leader. They were looking for a certain personality and that is what I could give them," she says.

Meeting Madiba was a dream come true for her. "I was really looking forward to it and thought it would just be a quick 'hello'. I was touched even just by his presence in the room," she says of the meeting. "Emotions were running high. I can't explain it – it was the highlight of my life so far – not even my wedding day will be able to match that!"

Patricia will study at Durham University where she has already made contact with key individuals. "Durham University is one of the best institutions in the area of proteomics," she says.



**Patricia studies a tobacco plant used by the plant biotechnology group for research into the production of vaccines from transgenic plants. Proteomics can be applied to identify alterations in protein structure**

The scholarship covers tuition, airfare and an allowance for living expenses. In turn, scholars are expected to submit three progress reports during the year and their final results to the Canon Collins Educational Trust for Southern Africa. They must also maintain contact with the Unilever Foundation and with the Nelson Mandela scholarship alumni on completion of their degree. CSIR Biosciences has also contributed some financial resources to boost the scholarship grant.

### **Humble beginnings of a success story**

Born in Mamelodi, Patricia completed her primary school education there and her matric at Settlers Agricultural High School in Limpopo. After that, she embarked on a year-long programme offered by Denel to strengthen maths, science, communication and life skills in black matriculants. She arrived at the CSIR as an in-service trainee about four years ago. "I was standing in for someone on maternity leave, in the food microbiology group," she remembers. "When the six months were up, I found myself begging for a job just to complete my degree: there were vacancies, but not in food science and microbiology." She worked extra hours to prove her mettle, was employed and also graduated with a BTech in 2006.

As a child, Patricia dreamed of becoming a medical doctor, but raised in a single-parent home, there was not enough money

to pursue this. Today Patricia credits her mother as the greatest influence in her life. "She encountered big challenges and always ended up a winner. Her favourite saying is that beautiful things are always surrounded by thorns. The minute you get pricked you should know that what you want is within reach," says Patricia, who has also planted that seed of hope in several learners she has been mentoring on an *ad hoc* basis over the past three years. She hopes to one day collect enough funding to establish a science centre where disadvantaged learners can find academic assistance with maths and science and laboratories to practice experiments at no cost.

"Patricia's story is really heartwarming. When I arrived here in 2003, she was an in-service trainee who applied to work for free because there were no positions available - which we obviously would not do. To see her rising through the ranks and now being afforded an opportunity to study abroad, is proof that she is one of the success stories of our human capital development strategy," says Dr Gatsha Mazithulela, Executive Director of CSIR Biosciences.

True to her ambitious nature Patricia hopes to make headlines again in future. "I'm a sucker for science and can see myself one day published in science works as 'Dr Patricia Mthabe' looking as old as Albert Einstein and Sir Isaac Newton."

**- Asha Speckman**

## **PROTEOMICS IN SOUTH AFRICA**

Proteomics is a new field in molecular biology research. According to Dr Dalu Mancama, leader of the CSIR's systems biology research group, the shortage of these skills impacts significantly on a number of related CSIR activities.

"This technology is used in the areas of drug development research to expedite the development of novel therapeutics against malaria, in plant biotechnology to improve processes in plant-based therapeutic peptide production, and in food safety to critically evaluate the consequences of developing nutritionally enhanced crops. In the near future, proteomics is expected to precipitate significant advances throughout the biosciences sector."

Without proteomics and the skills base this entails, such advances would not be readily possible. South African tertiary education institutions have started incorporating this tool in their research. Significant investments in proteomics have been made at the Centre for Proteomics and Genomics research at the University of the Western Cape and at CSIR Biosciences. The unit has embarked on a programme to recruit young scientists for MSc and PhD programmes that develop these skills.



Marelie Davel

**Unique skills  
make her 'one  
in a million'**

***Human language technologies (HLT) are not merely an abstract interest or an intellectual pursuit for Dr Marelie Davel. She has a keen understanding of the potential for HLT in a developmental context and a strong interest in realising this potential through technology adaptation and innovation.***

MARELIE'S EXPERTISE IN HLT results in part from her excellent academic training in computer science, mathematics and electronic engineering from a number of tertiary education institutions locally and abroad, notably Stellenbosch University, the University of London and the University of Pretoria. She spent a year at Carnegie-Mellon University in the USA as part of her doctoral studies. The year was "a career highlight", says Marelie, during which she was part of a group that ranks as one of the best speech research groups in the world. She has retained contact with her American peers.

### **In short supply**

Scarce skills are exactly that: expertise that is currently lacking in sufficient volumes in South Africa. They are also essential to address national priorities and to promote economic progress and competitiveness. "Innovation requires skills and skills are resident in people," Marelie points out. The question is: why is HLT a scarce skill? Marelie explains, "Essentially it is a multi-disciplinary skill, which builds on skills in a variety of domains. These are as broad as computer science, mathematics, signal processing, electronic engineering and linguistics. A limited pool of HLT experts – fewer than 50 – exists in South Africa.

HLT experts are at our universities, in small specialist companies and in industry."

HLT has a unique role in South Africa in promoting access to information via the telephone for people with limited literacy, and limited proficiency in English or limited access to computing infrastructure. HLT makes such information provision affordable.

"We are currently engaged in a large, multi-year project funded by the Department of Arts and Culture to develop a telephone-based information system in all 11 official languages," she reveals. "The aim of the project, which will run to March 2009, is to provide information critical for day-to-day needs to the South African public. For this to materialise, research is required."

Marelie's tools of her trade: her expertise in HLT combined with the requisite software to produce information accessible via speech-driven telephone-based systems.

## HLT as a career option

"I didn't choose HLT; it chose me." Marelie explains that she happened upon HLT as she was preparing to embark on her PhD studies. HLT was identified by the CSIR as an area of research relevant to the future. Hers proved to be a significant decision, "I was the first member of the group, which now numbers 27."

Marelie has two roles within the HLT group: as a principal researcher, she contributes to the research agenda. She also provides co-supervision and mentorship to students actively pursuing their studies. The calibre of the HLT group is clear from the fact that it contributes 4% of the CSIR's peer-reviewed publications.

As a research group leader, she is responsible for the operations within the research group. A combination of formidable efficiency and a likeable and friendly demeanour make her highly effective in this role. It entails looking after project delivery, operational systems, funding and the human capital development component. Her particular research interest is optimising the process by which HLT is developed for local languages with limited resources.

## HLT at work

HLT cannot and does not remain an intellectual exercise – the research results in technical building blocks for various application partners locally and abroad. Specific initiatives in the Meraka Institute's applications innovations programme that have benefited from HLT are Intelligent Environments for Independent Living (IE4IL), which uses information and communications technology to empower people with disabilities to live independently; one of its sub-initiatives, the National Accessibility Portal; and the MobilEd project, which uses cell phone technology to promote learning.

The HLT research group has active links with its peers locally and internationally. Local links are strengthened through the National HLT network, in which role players from the universities of Stellenbosch, North-West, Limpopo, the Witwatersrand, Pretoria and Unisa participate. Industrial partners include De Beers, Grintek ewation and Intellecta.

## Into the future

More HLT researchers are coming to the fore now that North-West University offers a degree in HLT. The student pipeline remains an important mechanism and the HLT research group has found innovative ways to engage with its target market. "We become involved with engineering students during the choice of their 4th year projects," explains Marelie. "Many of them opt to remain at the CSIR to pursue their Master's degree or even a PhD." The group also has a vacation work programme.

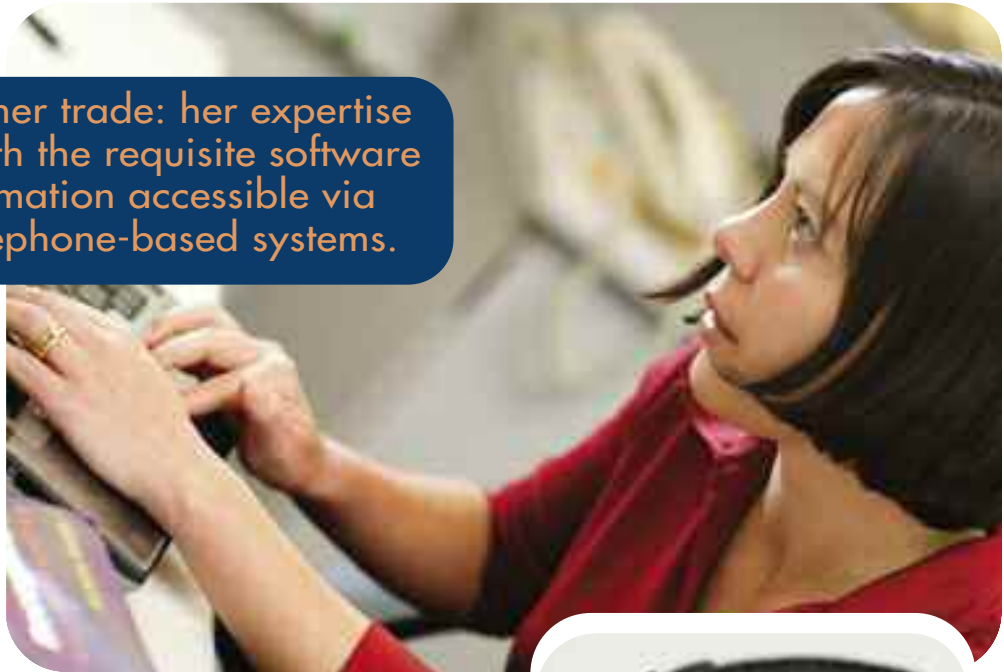
HLT needs to be promoted. "Within two years, the phenomenon of speech processing will become more visible in South Africa," she says. "I am convinced this will generate interest among learners and undergraduate students in a variety of fields, such as mathematics, computer science, statistical pattern recognition and linguistics. "No single profile is a prerequisite for a career in HLT.

"I didn't choose HLT; it chose me."

To become an HLT researcher requires many skills, which can only be acquired during a so-called apprenticeship. "Becoming a researcher is a 10-year learning curve," Marelie warns. "I believe our group provides an environment conducive to such acquisition and learning."

"And this learning should remain fun. We try to ensure our young researchers both enjoy and are challenged by the research problems they tackle."

– Biffy van Rooyen



# Placing passenger transport on the research agenda

***Improving the safety and security of South Africa's public transport system should be an investment priority for decision-makers, and could make a meaningful impact on the lives of ordinary South Africans who have to use the transport system. This is the view of senior CSIR researcher, Mathetha Mokonyama.***

Mathetha Mokonyama

A TRANSPORTATION ENGINEER who specialises in passenger transport, Mathetha's skills are much in demand at research institutions throughout the country.

"National transport policy states that transport service delivery must shift from a historically supply-driven system to a demand or needs-driven system in a manner that is responsive to the needs of its users," Mathetha explains.

The research group led by him supports this process by exploring ways of incorporating lessons from service research into the design and delivery of passenger transport services.

"When asked in the 2003 national household travel survey to identify the most important aspect of transport, 43% of South African transport users indicated that safety was at the top of the list," Mathetha points out. "Transport safety is indeed reflected as an important aspect in South Africa's transport policy, but the same 2003 survey indicated that a significant number of transport users were dissatisfied with the level of safety and security in the transport system, further showing that it is practice as opposed to policy that ultimately makes the necessary impact." Mathetha believes that the country's preparations for the 2010 Soccer World Cup will provide the opportunity to address aspects such as safety and security in a meaningful way.

According to Mathetha, the state of passenger transport in the country is increasingly shaped by customer service. "Our research agenda is founded on the premise that we need to focus on research that is an integral part of the implementation process," he explains. Key aspects include defining the concept of service failure, designing incentive packages to effect certain travel behavioural changes, translating service design and delivery requirements into operational specifications, and investigating the use of service performance as a lever in inter and intra-modal competition.

Mathetha's association with the CSIR dates back to his undergraduate days as a CSIR bursar at the University of Witwatersrand, where he studied civil engineering. Having completed his Master's in transportation engineering at the University of Pretoria (UP), he has registered to do a PhD at the same university. His thesis will focus on modelling choice of travel modes over time, as influenced by customer satisfaction, and how to relate it back to service design and delivery.



**“We need to focus on research that is an integral part of the implementation process.”**

Asked for an opinion on the reasons why the field of transportation engineering attracts insufficient numbers of students at undergraduate level, Mathetha points out that South African universities generally offer few undergraduate courses in this particular field, resulting in limited exposure to the discipline. He also believes there are certain challenges in teaching undergraduates a discipline that intimately combines science and art. “I became interested in transportation engineering only after being exposed to challenging research opportunities at the CSIR. Working with internationally-recognised experts in the field, such as Dr Christo Venter, now at the UP, and Bob Stanway, executive director of transportation planning and management at the City of Johannesburg, also influenced my choice of discipline.”

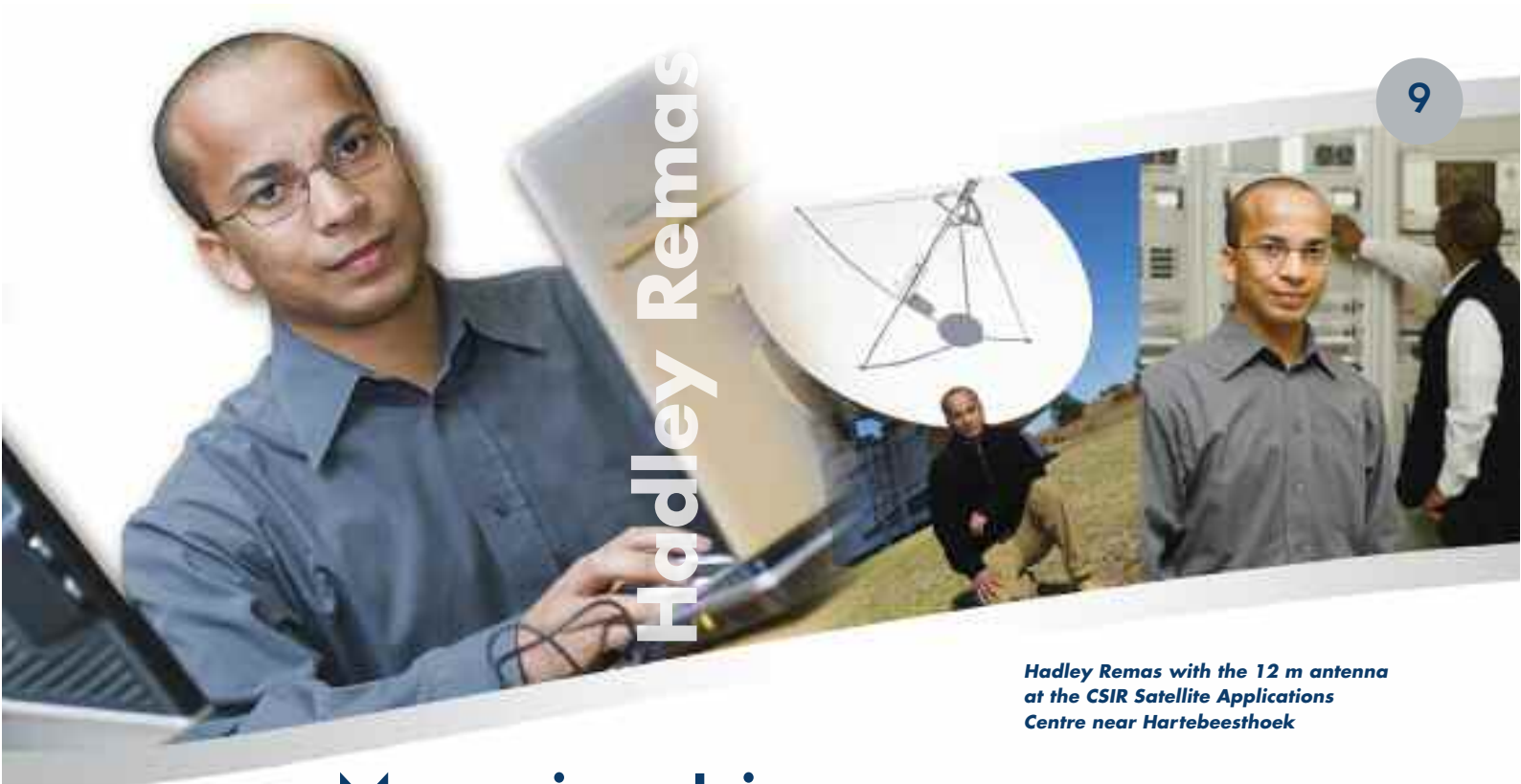
During the past year, Mathetha and his team had the opportunity to make recommendations on national transport subsidy policy, and participated in a project to formulate a mobility management framework for the Department of Transport. The group also participated in a study carried out on behalf of the

Development Bank of Southern Africa, which pieced together numerous cross-sectional travel survey datasets to create, for the first time, a time-series profile of changes in the state of passenger transport across all the government spheres.

One of Mathetha's career highlights is his recent appointment as the South African transport national contact point (NCP) for the European Union's Seventh Framework Programme (FP7). As the transport NCP, Mathetha acts as a conduit between South Africa and the European research community in matters relating to transport research. His responsibilities include raising awareness of the FP7 transport research opportunities, enabling South African participation in FP7 transport research and liaising with European counterparts on relevant transnational transport research related activities.

“The transport research priorities in FP7 are largely similar to our own, and include aspects such as the greening of transport, encouraging and increasing modal shift to more efficient modes, ensuring accessible urban mobility, improving safety and security and strengthening competitiveness,” says Mathetha. “Nevertheless, we need to start experimenting extensively in our transport research. It may sound basic, but the ultimate aim of our research must be to support the design and implementation of customer-centric passenger transport services, while at the same time ensuring the optimal allocation and utilisation of available resources,” he concludes.

**– Deidre Lotter**



**Hadley Remas with the 12 m antenna at the CSIR Satellite Applications Centre near Hartebeesthoek**

## Mapping his way to a bright future

RAISING A CHILD in Kuilsrivier, Cape Town – where young boys are reportedly exposed to gangsterism, drugs and violence – has been a worrying factor for many mothers over the years. Hadley Remas's mother was spared this agony. Hadley chose his books.

And it has paid off handsomely. Today he works for the CSIR Satellite Applications Centre at Hartebeesthoek and he is studying towards a Master's degree in geographic information systems (GIS). "I have learnt a lot from my CSIR colleagues and this knowledge is contributing to my thesis," he says. "I could not have gained this experience anywhere else."

Hadley, just like many young South Africans from former disadvantaged backgrounds, fell victim to not having proper career guidance at school. "I was not aware of GIS until one month before my final matric exams in 2000," he says, adding that he was interviewed by a representative from Stellenbosch University who assisted him in making his decision to study GIS. "There was a very long list of courses I could have selected, but I chose GIS, as I have always been interested in maps, computers and geography."

Remote sensing, the acquisition of information of an object or phenomenon through the use of a variety of devices, is a rela-

tively new discipline in South African space technology. Hadley is part of the team who is currently completing South Africa's first natural colour, seamless mosaic dataset of South Africa, with a 2,5 m resolution. This is made possible through an agreement with Spot Image, the commercial operator of the SPOT earth observation satellites. The CSIR has negotiated an open access model that allows access to data from the SPOT 2, 4 and 5 sensors for government departments, research institutions and academia in South Africa. The new acquisition facility was launched by Mr Derek Hanekom, Deputy Minister of Science and Technology, on 20 April this year.

"Our hard work and team effort culminated in the launch of the SPOT 5 acquisition system and will be valuable in various applications, including agriculture, town planning and environmental monitoring," he says.

Hadley's father, a geography teacher, named him after Hadley-Cell, a geographic term that refers to the circulation pattern that dominates the tropical atmosphere, with rising motion near the equator, poleward flow 10-15 km above the surface, descending motion in the subtropics, and equator-ward flow near the surface. Hadley loves space science and anything that has to do with space.

The young Capetonian started his junior degree with eight other students. Came graduation time, only two students obtained their degrees – "The course was tough," he recalls. Despite the complexity of the course, Hadley was named the recipient of the Golden Key International Award in his second year. This academic honour society recognises and encourages scholastic achievement and excellence among college and university students from all academic disciplines. The society awards its members annually through 15 different scholarship and award programmes.

Hadley passed his Honours degree *cum laude* and is working extremely hard at achieving the next level. "I want to become a world-respected researcher in this discipline," he says.

Hadley works under the supervision of technical manager Wolfgang Lück, who coincidentally was also his remote sensing lecturer at Stellenbosch University.

Wolfgang says there are very few people who have programming and remote sensing skills and who specialise in object-oriented image analysis, hence Hadley's skills qualify as being scarce. According to Wolfgang, Hadley is a hard worker who tends to underestimate his capabilities. "Young talent is very important in the South African context. Hadley can grow into one of the leading remote sensing experts in the future South African Space Agency," he says.

– Mzimasi Gcukumana