Annual Report 2005/2006

CSIR

our future through science

CSIR Mandate

The CSIR's mandate is as stipulated in the Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990), section 3: Objects of CSIR:

"The objects of the CSIR are, through directed and particularly multi-disciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

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CSIR Chairperson's Review

At the heart of the CSIR's operation lies the obligation to adhere to its founding purpose as iterated in its mandate, yet over the years there has been a perceived shift away from the core science component. Starting out with a vision for the future, the Beyond 60 process set out to strengthen and transform the CSIR's science and technology (S&T) base, and create an appropriate structure and environment where researchers can flourish and grow into the future generation of innovators. I believe the CSIR has been appropriately positioned to harness its resources to respond appropriately to national needs for purposes of sustainable socio-economic development.

Building and maintaining world-class S&T capacity in critical areas and growing the national science pool – especially among young historically disadvantaged South Africans – is a key CSIR priority. In support of this imperative. The organisation must continue to forge strategic alliances with local and international tertiary education institutions, research and technology institutes, as well as public and private enterprises.

I am particularly interested in the impact of the Young Researchers Establishment Fund, a fund created by the CSIR to assist young researchers in following their own research ideas, developing their own areas of expertise and building their own reputations as credible researchers.

The frontiers of S&T are continually evolving; new developments within both basic science and applied technologies are opening new opportunities and providing new solutions to global and national priorities. The CSIR needs to be fully aware of the emerging technologies and how these could be applied within the needs of its research portfolio. However, the establishment of national capacity in emerging research areas often requires substantial investment.

The CSIR's annual expenditure on scientific equipment is less than half of the desired target (4% of turnover versus the target of 10%). It is imperative that the organisation works toward reaching the 10% target within the next three years. Through the recently formed Regional Expensive Equipment Forum (REEF), the CSIR should be able to coordinate the purchase of capital items through funding from the Department of Science and Technology (DST) and achieve more effective utilisation. In addition, the CSIR will implement its own programme of capital equipment renewal based on a proportion of the Parliamentary Grant (PG).

The CSIR has always maintained a sound commercial basis. The new focus on intellectual property is important and the success of this aspect bodes well for South Africa's industrial competitiveness. Knowledge generation and application are both components of the CSIR. The organisational structure has evolved to take cognisance of the desired ratio of work between knowledge generation and application. The knowledge generation aspect of the innovation value chain will be at the core of scientific and technological growth, while knowledge application will be structured on a commercial basis.

It has been a privilege for me to be part of the CSIR Board over the past five years as a participant in and witness to the profound leadership changes that have led to the repositioning of the CSIR to serve its clients and stakeholders within a more effective framework.

I would like to thank my fellow Board members and the CSIR Executive, and wish them well as they continue to strengthen the CSIR as the premier scientific institution in South Africa. I have great confidence that Nobusi Shikwane, the new Chairperson of the Board, will take the organisation into its next growth phase with strong direction and great vision, steering the CSIR to iconic status.

Roger Jardine
CSIR Board Chairperson: 2000–2005

Views of the new CSIR Board Chairperson

Change certainly tests an organisation's resilience and the Beyond 60 restructuring process did indeed penetrate the CSIR to the core, but I believe the benefits will be immense. The organisation is agile and innovative enough to emerge as a global role model of a successful research and technology institute that has relevance and impact in our country and throughout the African continent.

As a new Board coming in to serve its first term, we share the CSIR's vision of transforming its S&T base to ensure that it can make a meaningful contribution to the national agenda. Our conversations have changed from science for gain to science with impact – not to say that finance becomes irrelevant, but we're more balanced now. We do business, but differently.

Our greatest challenges are, without a doubt, human capital development, transformation and expanding our research capability. Current areas of concern are the proportion of experienced researchers approaching retirement and a shortage of middle career researchers. This means that we need to recruit promising young graduates as a matter of urgency. A set of key strategic initiatives has been proposed that will strengthen the science, engineering and technology (SET) human capital base of the CSIR while simultaneously contributing to building the national resource pool of scientists, engineers and technologists.

Another area which needs to be approached with care is R&D investment. Limited funds are a reality, therefore prudence is required to ensure optimum benefit in terms of impact. With a view to creating a global niche for itself, the CSIR must consider emerging research areas if it is to create a reputation for excellence and innovation coming out of Africa. However, we need to determine the needs in our own country before we embark on a new area of research.

As a Board, we shall continue to support the CSIR in developing strong collaborative relationships with local institutions, science councils, tertiary education institutions and the like so as to achieve common national goals. We cannot lose sight of the global perspective, but we need to play to one another's strengths and use our limited resources effectively. The NEPAD goals will always remain in sight, while we need to work together as a nation to create a ripple effect across the continent – we need to do it better and differently.

When an organisation goes through a change of great magnitude, as the CSIR has done, the focus is on the progression of change and often standards fall by the wayside. In the case of the CSIR, not only did it comply, but it exceeded the corporate governance standards throughout the restructuring process. I attribute this feat to excellent teamwork. I must compliment the communication and transparency of management during the reconfiguration of the organisation, while the excellence and foresight of the staff were admirable.

I would like to thank the Board members for their time and energy spent on deliberating the CSIR's reconfiguration, as well as the CSIR Executive and management for their unwavering commitment to the Beyond 60 process, with Sibusiso Sibisi at the helm as the master architect. It is with great pleasure that I commend the CSIR's staff for their role in embracing change and proactively making it work. I look forward to continue serving the CSIR in my new role as Chair of the Board.

Nobusi Shikwane
New CSIR Board Chairperson: 2006

Overview by the

CSIR President and CEO

Faced with an overwhelming need to recreate an environment within the CSIR that is conducive to scientific research and innovation, without compromising its commercial integrity, the Beyond 60 reconfiguration process came into being as the CSIR approached its 60th anniversary. We took a critical look at our key functions and how these resonate with our mandate to enable the organisation to respond appropriately to national needs. Consequently, an operations model was adopted with a renewed focus on strengthening science and engineering competences, as well as human capital development in these domains. Organisational structures have been reshaped to reflect the renewed priorities and comprise an exclusive focus on the research and innovation value chain. I am pleased to say that the process of refreshing the organisational culture and values has also achieved good progress.

In tandem with the revitalisation of the organisation, the CSIR's new corporate identity made its debut in February 2006. With a positioning statement that reads, "our future through science", we plan to develop a strong brand in support of our reconfiguration with a renewed focus on science and research. The CSIR brand essence is captured in a few key concepts: scientific excellence; innovation and quality; skills development; leadership in science; working through partnerships; ensuring transformation and making a real difference through science to build a better South Africa.

However, the CSIR brand can only realise its potential if we build a core of exceptional scientists – living legends who are serious about making a difference through science.

As leaders in innovation, we must become a catalyst for change so as to deliver on our promise to contribute to the upliftment of our people. Another milestone was the first CSIR Research and Innovation Conference held in February 2006; a multi-disciplinary scientific conference that portrayed the full diversity of the CSIR. As we succeed in strengthening our S&T base, events such as this conference are important in conveying the outcomes of our R&D to a broader public. However, the ultimate success of this conference will be measured by the extent to which it ignites our enthusiasm for research and innovation.

In order to continue developing our people, major achievements were made towards the strengthening of the CSIR's human capital base during 2005/6. A research career ladder based on criteria reflecting generally-accepted standards for advancement in a research career was adopted for organisation-wide implementation. The stricter system will influence the number of staff categorised as researchers in future. Communication of the CSIR's refreshed values reinforced by initiatives such as the introduction of the research career ladder, has acted as a catalyst for a total of 160 staff members to register for degrees at Masters or Doctoral level. This far exceeds expectations and I am pleased that we have set a new standard for the organisation. With a view to guiding the CSIR in its efforts to revitalise the S&T base and to ensure longer-term investment in emerging research areas that will ensure delivery against its mandate, an S&T strategy has been developed based on the development agenda of South Africa and an understanding of the role that the CSIR is required to play within the National System of Innovation (NSI).

The way forward is not to discard the business culture in pursuit of a renewed scientific culture, but to recognise that a single organisational model for the CSIR is simply no longer appropriate. Synergy must be encouraged between a business culture and a scientific culture in pursuit of virtuous developmental outcomes. The CSIR mantra must be one of "sustainable development; sustainable knowledge base; sustainable business". Having put in place a balanced culture that earnestly attributes value to scientific research and business alertness, the knowledge generation layer must be kept intact as the core of the CSIR. Yet, knowledge application specifically aimed at improving the quality of life of South Africans (and increasingly, Africans) and the sustainable use of their environment must be taken very seriously indeed.

I would like to express my appreciation to the Board members who have come to the end of their term and to our outgoing Chairperson of the Board, Roger Jardine. Roger has proved to be an inspiring leader who has shown the utmost dedication to the CSIR at all times. I look forward to working with Nobusi Shikwane, our new Board Chair.

It is with great satisfaction that I can report that the CSIR performance has met all expectations, and in certain instances, we have exceeded our targets. This would not have been possible without the commitment of all our staff members and I would like to thank them for having made a successful transition to the new set of organisational values and renewed culture.

Dr Sibusiso Sibisi
CSIR President and CEO

Research and Development

Highlights

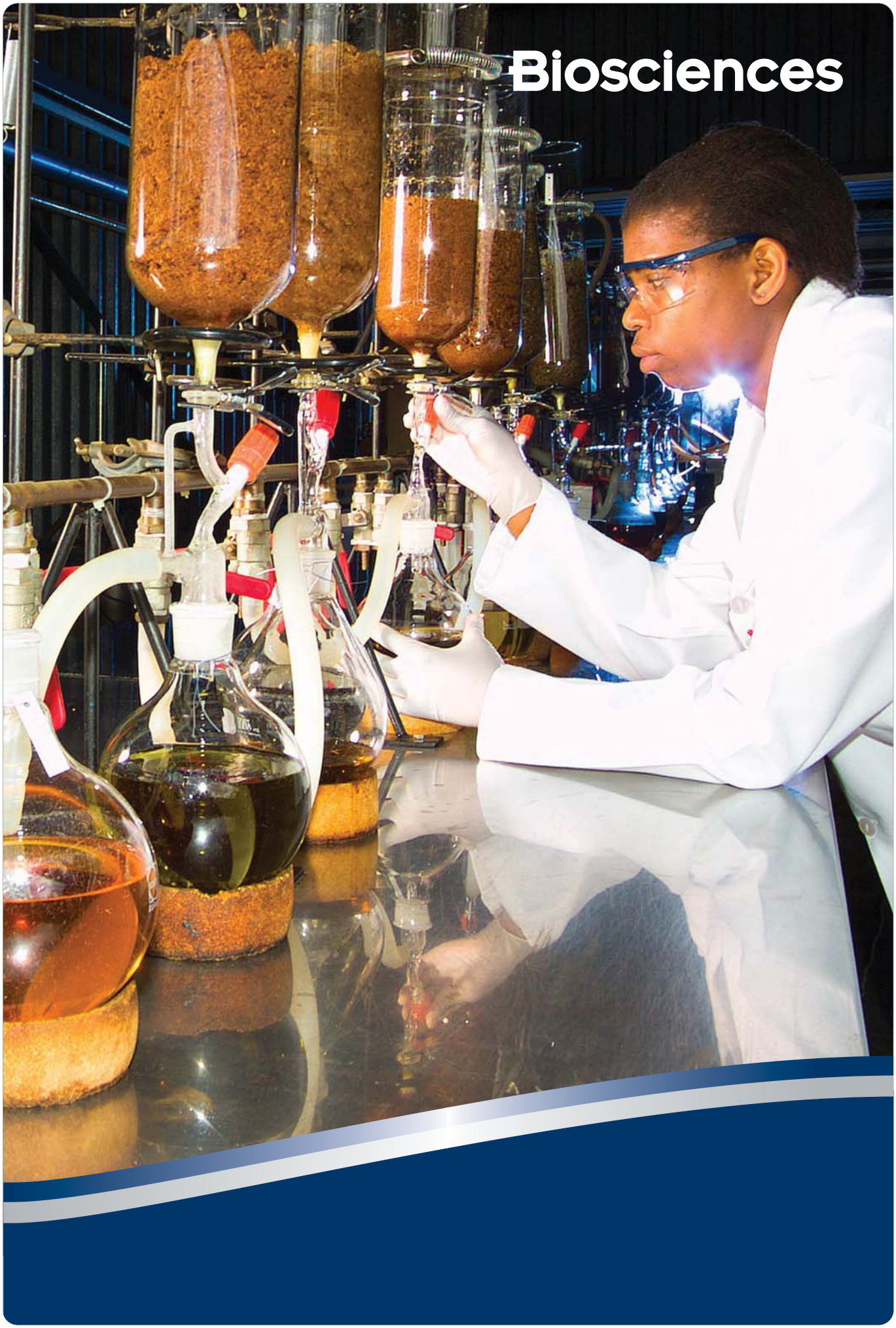
The CSIR's core research and development (R&D) base consists of key competency areas, which include biosciences; the built environment: defence, peace, safety and security; materials science and manufacturing; and natural resources and the environment. These areas draw together research fields and scientific disciplines assembled to align with the needs of specific government departments, primary, secondary and tertiary industry sectors and society in key areas of socio-economic impact. Each area takes into account strategic stakeholder requirements and focuses on managing a portfolio of science and technology (S&T) competencies and research directions that contributes most meaningfully to the attainment of scientific objectives within the sectors addressed. R&D and its outcomes are handled as an integral part of the research and innovation value chain.

Over and above the core research areas, the CSIR houses facilities of strategic importance for African science, which currently include the Meraka Institute (the African Advanced Institute for Information and Communications Technology), the CSIR National Laser Centre, the CSIR National Metrology Laboratory and the CSIR Satellite Applications Centre.

Management of services based on the routine application of existing knowledge, encompassing specialised and differentiated services have been grouped under CSIR Knowledge Services. Since a different operating culture is required to sustain these commercially-driven operations, CSIR Knowledge Services resides outside the core CSIR R&D operations, with management control exercised through an Executive Director.

This section of the Annual Report offers a brief overview of the CSIR's activities during the year under review by highlighting a number of innovative projects and initiatives in these areas.

Biosciences



Strategic overview

The vision of CSIR Biosciences is to provide bioscience solutions that improve health and fight disease, and that support the private and public sector industries in a manner that is sensitive to the economic realities and the natural environment of the societies we live in. The strategic objectives that will underpin achievement of this goal include engagement and partnership with key stakeholders in the national R&D system and the National System of Innovation in order to find alignment with national imperatives.

The biosciences research core has been structured into seven platforms, which incorporate multi-disciplinary expertise required to deliver on key elements of a research value chain that is focused on addressing economic development and health-based socio-economic challenges: discovery biology, discovery chemistry, bioprospecting and analytical platforms focus on the identification and development of new molecules and biological targets that find application to provide novel solutions for HIV, tuberculosis and malaria. The plant biotechnology, bioprocess technologies and product and process development platforms focus on the identification and development of novel technologies that enhance the competitiveness of the emerging South African biosciences industry.

Close interaction with the International Cooperation and Resources and the Frontier Science and Technology programmes of the Department of Science and Technology (DST) has enabled the organisation to align with strategies at national level. In this respect, several strategic initiatives are being developed. Strong partnerships and collaborations with local universities and research councils have been formed, as well as with top institutions in Africa, Europe and the US. These partnerships have facilitated access to world-class laboratories and technologies. In line with the emphasis on scientific research, the unit has lodged eight Patent Cooperation Treaty (PCT) patents during the year that protect multi-application technologies and will eventually lead to high-impact publications. Human capacity to increase the CSIR skills profile is being developed through studentship and postdoctoral programmes.

Mosquito repellent candle factory launched in Limpopo

CSIR researchers and traditional healers who collaborated in studies on indigenous plants with mosquito repellent properties, celebrated the discovery in the mid-1990s of a novel mosquito repellent that proved to be more effective than similar or comparable commercial products on the market.

In August 2005, this discovery resulted in another celebration when the Deputy Minister of Science and Technology, Derek Hanekom, officially launched a community-owned mosquito repellent candle factory in Limpopo, where this plant is being cultivated and distilled, and its essential oils used in the manufacturing of candles.

Hi-Hanyile is the result of a project aimed at transferring CSIR essential oil production technology and skills to the Giyani community in Limpopo, with the DST providing the funding. The first stages of the project involved the establishment of a 30 ha cultivation site where lemon grass and the mosquito repellent essential oil crop, BP1, are grown and then processed in an essential oil distillation factory.

The 650 m^2 factory contains equipment required to formulate the active ingredients of the candles, as well as to undertake manufacturing and packaging of 400 000 candles per year.

The project currently provides employment for 67 people from rural communities around Giyani.

Exploiting proteins to build molecular motors

Proteins provide the functional scaffolding constituting all organisms, and enable complex chemical reactions (using enzymes) that can convert thousands of substrate molecules per second.

Proteins are highly organised, forming efficient and stable nano- to micro-sized protein complexes. Determining the stability of the complexes gives insight into how these proteins are able to fold and interact in the cell, performing reactions that are not possible in a chemistry laboratory. CSIR researchers, Dr Neeresh Rohitlall (CSIR Biosciences) and Dr Raymond Sparrow (CSIR National Laser Centre), are exploiting these protein characteristics to build nanomotors – molecular devices which convert energy into movement and forces in the order of picoNewtons.

Light has the potential to activate and control nano-machines that can kill cancer cells, or even help break up clots in blood vessels and the brain. Scientists hope to create nanomotors with applications that can target disease and repair damaged cells in the body. The CSIR's molecular motor project is aimed at engineering a light-activated controllable power source that can be coupled to a variety of nanodevices. The proposed nanoscopic energy source is probably the smallest and most efficient known energy source. It is the only such power supply to introduce on/off controllability as fundamental to its design. The nanodevice can be developed for specific applications such as drug delivery, nano-engineering or minimally invasive nano-surgery, particularly for delicate tissues such as the retina.

Enzymes put to work to produce pectin from citrus waste

CSIR biochemists are collaborating with the University of KwaZulu-Natal in Durban, the Chemin Incubator and Kat River Citrus Co-op Ltd to establish a pectin production plant that uses enzymes to produce pectins from citrus waste.

South Africa's citrus industry, one of the biggest exporters worldwide, produces large volumes of citrus peel waste. Pectin, a polysaccharide, is found abundantly in the primary walls and intercellular layers of plant cells. It is obtained from a variety of sources including many fruit pulps like orange and apple pulp.

In citrus fruit, pectin constitutes the white spongy inner part of the peel. Pectin is traditionally produced by chemical hydrolysis, with significant yield losses and the production of substantial waste streams.

The aim of the three-year project is to extract and convert high-methodoxyl (HM) pectin from the citrus peel, to value-added low-methodoxyl (LM) pectin using an enzyme-based process.

There has recently been significant growth in the uses of LM pectin. LM pectins are used as thickening or gelling agents in a broad range of formulated foods such as yoghurt, milk desserts and jellies. The CSIR will apply its skills in process chemistry, biotechnology, chemical engineering and food science to develop the technology required for the extraction, hydrolysis, purification and formulation of LM pectin.

The birth of the "safe egg"

Food safety coupled with rising consumer concerns inspired the establishment of an R&D consortium led by the CSIR. The consortium successfully developed a new system to pasteurise shell eggs, significantly reducing the risk of *Salmonella enteritidis*, a disease-causing micro-organism carried by infected chicks. Uncooked and semi-cooked eggs and products containing raw eggs – many types of desserts, mayonnaise and salad dressings – can contain the pathogen resulting in salmonella poisoning.

The consortium, supported financially by South Africa's Innovation Fund, draws together the expertise of food scientists and microbiologists at the CSIR, sensory evaluation experts at the University of Pretoria, design engineering expertise from Delphius Technologies and commercial experts at Eggbert Eggs, South Africa's second largest egg producer.

The new system involves a specially designed oven and phased process – which is a combination of microwave and hot air technology. The challenge is to keep the eggs at an optimal temperature to destroy the micro-organism without changing the composition or taste of the egg.

Preliminary results show that the new technology also destroys the avian influenza pathogen. The consortium is in discussion with local retailers, caterers and restaurants to consider using and selling pasteurised eggs.

Partnership to develop "super sorghum" for Africa

The CSIR has joined forces with eight other globally-respected organisations to develop more nutritious, easily digestible sorghum with increased levels of pro-vitamin A and E, iron, zinc, essential amino acids and protein prototype with increased lysine.

An African-led consortium under the leadership of Kenya-based Africa Harvest Biotech Foundation International is presently conducting research into fortifying one of Africa's important staple foods. While the grain is uniquely adapted to the semi-arid and sub-tropical climatic conditions of the continent, its nutritional imbalance can, however result in a form of hunger known as micronutrient malnutrition.

The African Biofortified Sorghum Project, a Grand Challenges in Global Health initiative, is funded by the Bill and Melinda Gates Foundation to the tune of US $17.6m. CSIR biotechnologists, Drs Luke Mehlo and Andile Grootboom, have temporarily relocated to the US to assist in producing improved sorghum seeds. Dr Blessed Okole is project leader on behalf of the CSIR.

Consortium partners are:

- Africa Harvest
- African Agricultural Technology Forum
- Forum for Agricultural Research in Africa
- International Crops Research Institute for Semi-arid Tropics
- University of Pretoria, South Africa
- Agricultural Research Council's Grain Crops Institute, South Africa
- University of California, Berkeley, USA
- Pioneer Hi-Bred International, Inc, a DuPont Company, USA.

Built Environment

Strategic overview

The built environment can be defined as a complex, techno-socio-economic system comprising physical components (e.g. bridges, roads, ports, rail, schools, healthcare facilities), and the institutional, management and operational relationships among these components and the society they serve.

As a catalyst for sustained economic growth and social development, support to the built environment is high on South Africa's national agenda. This is illustrated by government's R372 billion infrastructure investment programme announced towards the end of 2005.

The CSIR's research activities in the built environment address a number of key national objectives, including provision of housing and improved human habitats; increased access and mobility; rural development of infrastructure (with a specific focus on poverty reduction and job creation); human resource development of professionals in the built environment; safety and personal security; environmental sustainability; better public buildings (including health facilities and schools); and improved service delivery in the public sector.

During the year under review, the CSIR merged its strategic activities relating to the built environment into a single unit to drive the organisation's research activities in support of this critical sector. This is in line with the international trend in R&D organisations to create integrated, multi-disciplinary units to address economic, social and environmental sustainability issues inherent to the built environment.

The snapshots included in this section of the Annual Report illustrate the CSIR's continued contribution to South Africa's competitive performance and the welfare and quality of life of its people through cutting-edge R&D capability and SET excellence in the built environment.

Projects featured range from decision-making support on housing investment, the planning of functional community health centres and support for the development and operation of South Africa's ports, to the development of a design guideline for architects, the second annual State of Logistics survey and research into integrated and sustainable rural access systems.

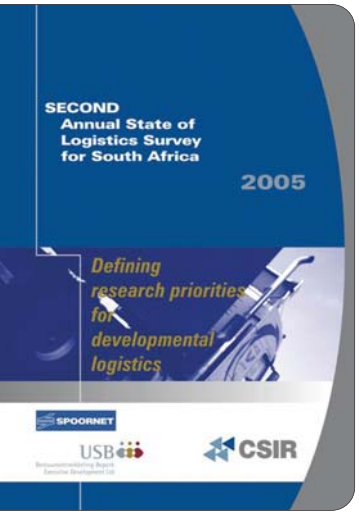
Assessing the suitability of land for low-income housing

The CSIR has developed and applied a sustainable housing locality cost-benefit assessment model in eight subsidised housing locations (Alexandra and Diepsloot in Johannesburg, and six localities in Ethekwini, KwaZulu-Natal). The model aims to test the assumption that peripheral localities are more costly and less beneficial in terms of transportation costs, accessibility to employment opportunities and greater energy consumption and greenhouse gas emissions.

The model has been developed to guide decision-makers to direct low-income housing delivery to localities which are least costly to develop, maintain and operate over the longer term, but which at the same time yield the greatest benefit. Multi-disciplinary in nature, the model incorporates engineering services, transportation, social amenities, retail goods and services, environmental resources, land and house top structure costs and benefits, including capital and recurrent costs, to both government and households.

This model enables the critical sustainability factor of affordability to be measured, not only for the different spheres of government but also for households, in both the shorter and longer term.

Second annual State of Logistics survey



The second annual national State of Logistics survey, published in November 2005 by the CSIR, re-emphasised the importance of logistics and supply chain management for the South African economy. The survey once again identified the biggest logistics cost driver in South Africa as transportation costs.

The research for the survey was conducted by the CSIR and Stellenbosch University Business School.

In addition to macro-economic issues, the 2005 State of Logistics survey addressed supply chain challenges and innovations of the chemicals, processed foods and logistics service provider industries. The results of the survey furthermore provide an overview of the national health care system, where the need for inventory management is identified as the key challenge.

The survey highlighted the need for expanding small business support initiatives to include all the aspects involved in establishing channels to market and developing supply chains. Another key requirement identified by the survey is the need for a national transport and logistics database to measure delivery and its impact, and direct investment.

It is envisaged that the State of Logistics survey will become the premier reference for logistics in South Africa.

APT technology leads to better roads world wide

Accelerated pavement testing (APT), although a relatively mature technology in South Africa, is increasingly being used around the world to gain a better understanding of pavement behaviour, test designs prior to construction and predict pavement performance. The heavy vehicle simulator (HVS), a research tool designed by the CSIR, is the most widely-used APT equipment internationally. Seven HVS APT facilities are currently operating around the world.

In recent years, the South African machine, owned by the Gauteng Department of Public Transport, Roads and Works (Gautrans) and operated by the CSIR, has been used to assess various rehabilitation strategies.

These include deep in-situ recycling of existing pavements with foamed bitumen and bitumen emulsion, and to study the influences of the environment and traffic on the behaviour and performance of both conventional and innovative concrete pavements.

The following international initiatives are in place to optimise the use of ATP facilities:

- The HVST-International Alliance was established in 2003 as a forum for HVS operators to discuss research plans, identify opportunities for joint projects and share experiences and data.
- As part of the joint collaboration between the CSIR and the University of California Pavement Research Center, a CSIR researcher has been seconded to California to assist with the establishment of a new research facility at the University of Davis.
- The Consortium of APT and Technical Exchange Partnership (CAPT), established in the USA in 2005, aims to establish a programme that identifies and produces key technical deliverables. CAPT was formulated as part of a larger study undertaken by a CSIR researcher during a twelve-month assignment with the Transportation Research Board in Washington.

Supporting development and operation of South Africa's ports

The CSIR is playing a key role in supporting the development and operation of South Africa's ports, as illustrated by its involvement in the extension of the Cape Town container terminal, and the development of the Future Ports programme.

The National Ports Authority (NPA) is planning to widen the container terminal at the Port of Cape Town by extending the stacking area towards the north-east seaward side. To optimise the design for these extensions, the NPA has contracted the CSIR to carry out a number of studies, including:

- determining the local wave conditions for design by numerical wave refraction
- investigating and numerically modelling the harbour basin resonance and wave diffraction resulting from the proposed new layout and depth of the Ben Schoeman dock
- physically modelling the wave protection structures at the seaward extension of the container terminal.

The CSIR has conceptualised the multi-year Future Ports programme to enhance the sustainable planning and development of South Africa's ports, and support efficient, safe and environmentally sound port operations.

Specific objectives of the programme include identifying and developing integrative systems to support port operations; developing operational risk management solutions and systems to improve safety; and ensuring sustainability of ports through more efficient maintenance planning and management.

Research in support of labour-based construction

Thin concrete pavements are an ideal medium for labour-based construction and can be effectively applied in the development of low-volume rural roads and streets, as well as community access roads.

The CSIR performed initial research into continuously reinforced thin concrete pavements (100 mm, 75 mm and 50 mm thick respectively) on an access road to a quarry at Roodekrans, near Krugersdorp. The 50 mm section was included to establish the limits of failure/thickness that could be considered.

Following the satisfactory performance of the 50 mm-thick concrete section, the CSIR, in collaboration with the Department of Roads and Public Works of the Eastern Cape, constructed a 2.9 km-long road with a thin concrete paving, to serve a quarry and a local community near Mthatha.

The CSIR is working with the University of Pretoria to establish the theory behind the successful performance of thin concrete pavements. The research is aimed at developing a procedure to design concrete roads to a limit state, where the failure mechanism of the pavement is taken into account when the thickness and steel content of the concrete is determined.

The project is set to provide additional labour-based pavement options in support of the principles of government's Expanded Public Works Programme, a comprehensive, people-centred initiative aimed at creating work opportunities and improving skills levels.

Architect's guide to designing for sustainability

Approximately 40 000 architects in the Commonwealth are set to benefit from sustainable development guidelines developed by the CSIR at the request of the Commonwealth Association of Architects (CAA). In preparing these guidelines, significant research went into establishing a suitable framework, especially in light of the importance of infrastructure in supporting economic growth, human development and poverty alleviation.

Due recognition was given to the role of the architect in influencing the relationship between the economic and social systems and the carrying capacity of the environment in which they operate. Accordingly, the CAA framework largely followed the work done by the United Nations Commission on Sustainable Development, more specifically its construction of sustainable development indicators, as these indicators are more responsive to issues in developing economies.

Even though a significant number of Commonwealth architects practise in developed economies, the additional indicators introduced are becoming increasingly relevant in developed economies as a result of the pressures associated with the emerging corporate social responsibility agenda.

The guidelines will be accessible to all Commonwealth architects through a dedicated page on the CAA website. Architects will be able to construct a guideline sheet based on the phase of the project and/or the appropriate sub-themes.

Planning functional community health centres

The CSIR, in cooperation with collaborative partners such as the Centres for Disease Control (CDC) in the USA, and South Africa's Medical Research Council (MRC), is playing an important role in guiding and advising architects and engineers involved in the planning of healthcare facilities.

At the invitation of the CDC, the CSIR recently co-presented a four-day lecture on the functional design of healthcare centres to architects and engineers in Lima, Peru. Locally, the Department of Health has been approached to fund a joint project involving the CSIR, CDC and the MRC to publish a guide for tuberculosis (TB) infection control in South Africa.

Globally, nine million new cases of TB are reported annually, causing more than 25% of preventable adult deaths. To add to the medical and epidemiological challenge in South Africa, 55% of TB patients are also HIV-positive, with TB being the leading cause of mortality for people living with HIV/Aids.

Research has shown that TB infection control practices in southern Africa are often lacking or insufficient. A possible effective intervention is dilution ventilation with pressure differentials to prevent the spread and reduce the concentration of infectious droplet nuclei. The essential requirement for ventilation is to dilute contaminated air with fresh, uncontaminated outdoor air. This can be achieved through controlled (mechanical) or natural ventilation. The latter relies on air moving through a building under the natural forces of gravity, due to density differences and wind.

Self-regulation in heavy vehicle transport industry

The Load Accreditation Programme (LAP), an initiative to introduce self-regulation in the heavy vehicle transport industry, has shown promising results from a pilot project in the timber industry.

The LAP was pioneered by the Institute for Commercial Forestry Research, together with the CSIR, the National Productivity Institute and Crickmay & Associates.

The programme offers incentives to assist consignees, consignors and transport operators in implementing systems that result in improved road safety, protection of infrastructure and increased transport productivity by curbing overloading, improving vehicle maintenance and promoting driver wellness.

Since the start of a pilot project in the timber industry in August 2003, overloading in that industry has declined from 18% to 12%. Currently there are initiatives to roll out the programme in the coal, bitumen, sugar and pulp, paper and board industries. The aim is to expand the programme to include other industry sectors, such as mining, construction, chemicals and refrigerated transport, and eventually the whole of the heavy vehicle transport industry.

Key stakeholders in the programme include the Road Freight Association, the Department of Transport, the South African National Roads Agency Ltd, the KwaZulu-Natal Department of Transport, industry associations such as Forestry South Africa, and organised labour.

Support for decision-making on housing investment

The CSIR has published the second Housing Atlas in a planned series, prepared in response to housing trends and changing policy direction. The overall aim of the series is to provide a spatial interpretation of current policy as it relates to human settlement and housing locality at a national scale. The Housing Atlas 2005 provides organised spatial information concerning factors, criteria and indices that impact on decisions regarding the most suitable locations and priorities for housing investment in the country, in the prevailing delivery and policy context.

The study introduces information updates on the basis of the 2001 Census and other newly released data. It replaces the concept of location suitability, on which the Housing Atlas 2002 was based, with the concepts of economic development potential and sustainable livelihoods potential. This is in line with the principles and objectives of national guiding documents, such as the National Spatial Development Perspective and the Department of Housing's Comprehensive Housing Plan of 2004.

Part of the challenge addressed by the Housing Atlas 2005 is to ensure that housing intervention (including different types of housing) occurs in appropriate locations as a contributing factor in addressing residents' basic needs and improving their livelihoods potential.

Atlases are produced in both printed copy and electronic format, and can be obtained from www.housing.gov.za

Logistics strategy to improve agriculture's competitiveness

An assessment of South Africa's agro-logistics system has identified critical areas of investment for the agricultural industry. The study comprised a survey of the views of industry and logistics service providers, an assessment of the status of emerging farmer logistics issues, case studies of initiatives undertaken in development nodes and scenario development and modelling.

Commissioned by the Department of Agriculture as part of its efforts to improve the competitiveness of the agricultural sector as a whole, the study was carried out by a consortium comprising the CSIR, Agri-Africa Consultants and the University of Stellenbosch Business School.

Critical areas of investment for the agricultural industry, as identified by the study, include the exploration of economically sustainable models for infrastructure ownership, the establishment of ongoing intra- and cross-industry initiatives to develop innovative solutions to infrastructure congestion, and support for information initiatives to facilitate improved decision-making.

With reference to emerging farmers, the study identifies the need to create a means of reporting on development initiatives in specific development nodes, with the long-term aim of enabling integration of agriculture-specific and other development initiatives relating to logistics infrastructure. Other critical areas of investment specific to emerging farmers include piloting innovative solutions for deep-rural freight transport, and improving market access by making value-adding logistics services available.

Enhancing the CSIR's spatial analysis platform

The CSIR has initiated the Collaborative Spatial and Modelling Platform (CoSAMP) aimed at the establishment of an enhanced spatial analysis platform in support of advanced scientific enquiry and high-level decision-making. The emphasis is on those components that will strengthen the CSIR's competencies and cost-effectiveness in spatial-statistical data mining and indicator development, and scientific and participatory value addition.

The effective development and deployment of CoSAMP should enable the CSIR to respond more effectively to national socio-economic development and environmental priorities by, in particular, helping to co-produce sufficiently contextualised spatial indicators and knowledge about sustainable development issues, "hot spots" or intervention targets, and likely intervention impacts.

In terms of applications, one of the key challenges is to move beyond relatively static spatial profiling to the integrated monitoring and modelling of dynamic behaviour. Other application challenges are to make GIS more accessible to decision-makers and poor, vulnerable local-level users, and improve its integration into policy environments, governance institutions and management systems.

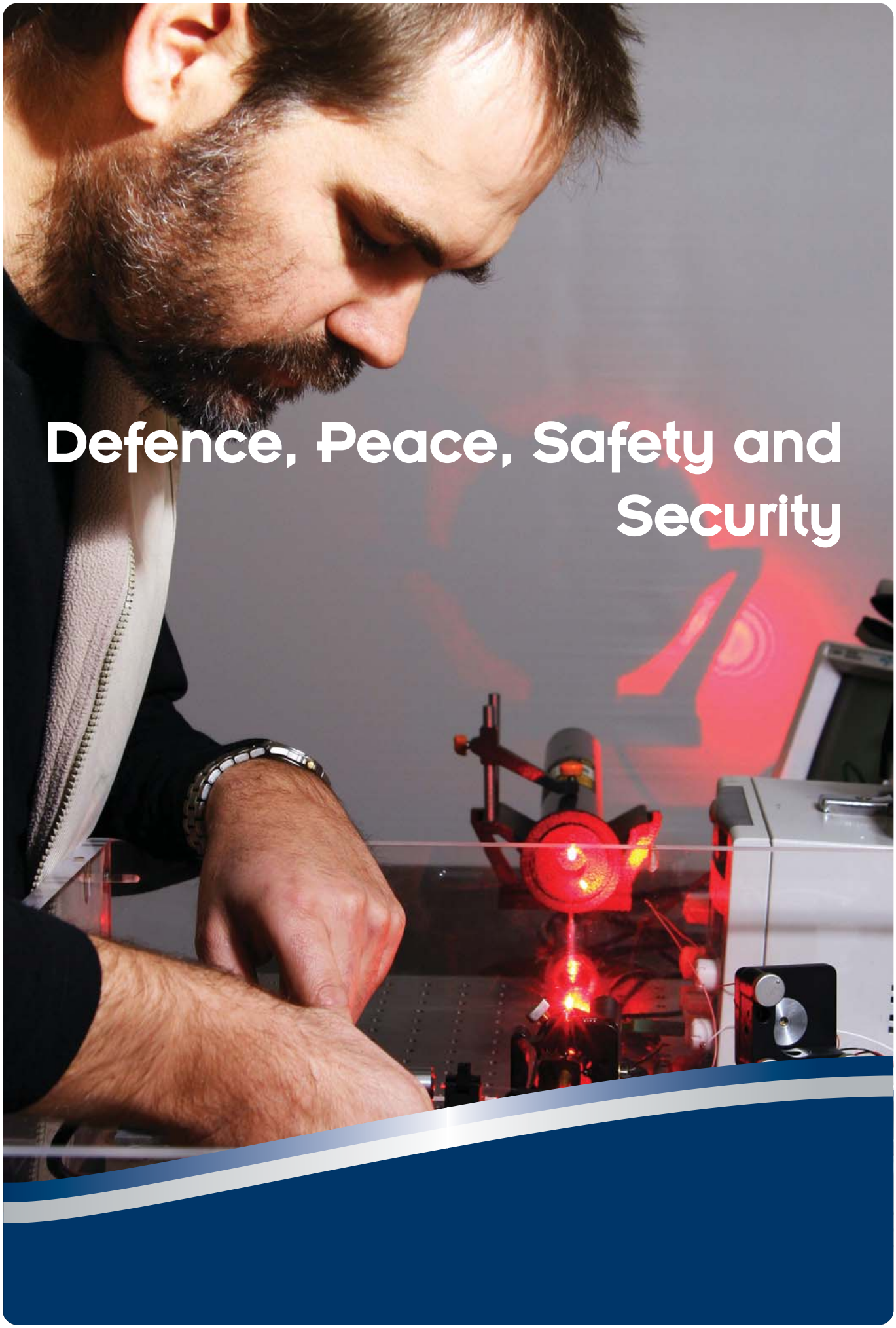
Towards improved rural access systems

A study co-authored by researchers from the CSIR and the Department of Transport examines approaches to integrated, intelligent and sustainable rural access systems, and sets an agenda for further action and research.

The study also explores issues around greater connectivity, broadening the focus to include the harnessing of information and communications technology (ICT) for all the core rural access networks, shared spatial intelligence, and transport exchange networks as high-leverage interventions.

The study suggests that ICT, tailored to address rural accessibility issues, has the ability to coordinate, synchronise or simply improve the general scheduling of rural infrastructure and service delivery operations. It emphasises that the potential value of enhanced spatial intelligence will only be realised if there are mutually supporting investments and good maintenance of all the core infrastructures comprising an integrated rural access system.

A brokering service is conceptualised as a centralised information, booking, scheduling and coordination service for all public transport, including non-motorised transport, and can include both passenger and freight services where appropriate.

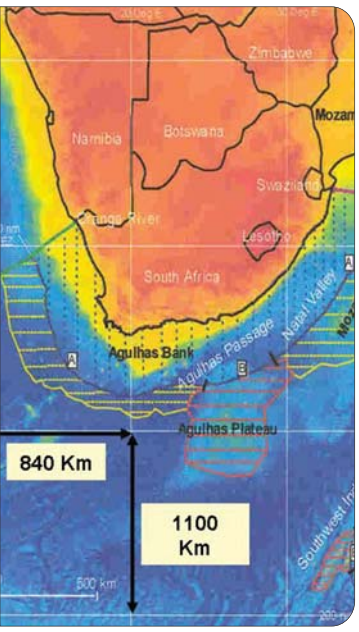


Defence, Peace, Safety and Security

Strategic overview

The vision for CSIR Defence, Peace, Safety and Security is to contribute, through scientific and technological excellence, to the achievement of a peaceful and safe South Africa and continent. The unit does this by operating as a strategic science, engineering and technology (SET) capability of state departments and agencies in defence, peace, safety and security as well as the aerospace-related industry. SET capabilities are developed that are regarded as of national strategic importance by stakeholders and these capabilities are applied in generating new insights, innovative solutions, new technologies and providing scientific advice.

Persistent maritime area surveillance



South Africa and its surrounding maritime areas are continuously being threatened by activities such as illegal fishing, illegal immigration, smuggling and oil pollution, and in most cases these activities are difficult to observe.

AwareNet is a new programme with the objective to develop an S&T capability that provides wide-area, real-time situational awareness to those agencies of the state tasked to ensure peace, safety and security in South African territory. The proposal is to have seven unmanned airships in constant flight at strategic points along the South African coastline transmitting sensed data as real-time information to a ground control station.

The first phase of the project involves gathering information on the user requirements for the system and identifying the main technological needs. The subsequent phases will address the main research questions, develop the required technologies and develop partnerships with local and international organisations required to build technology demonstrators. It is envisaged that work will be conducted with universities and the local aerospace industries on the R&D of the airships, their avionic subsystems and sensors. Some of the potential users of the system would be the South African Air Force and Navy, the Department of Environmental Affairs and Tourism, and the South African Police Service.

An important proposed technology demonstrator will be the Mountaintop Sensor and Data Fusion Advanced Concept Technology Demonstrator. Constantia Berg in the Cape Peninsula is currently being investigated as a potential deployment site.

South Africa designs and develops top cash-in-transit vehicle

As the number of cash-in-transit (CIT) heists in South Africa increases and the weapons and tactics that the perpetrators use become more sophisticated, CIT companies have been searching for vehicles designed to withstand the growing risks of transporting cash.

For this purpose, the CSIR, Nissan Diesel SA and TFM Industries formed a consortium to design a new CIT vehicle in conjunction with one of South Africa's leading CIT companies. Together they have created a new armoured multipurpose vehicle (MPV). It is a modular, upgradeable, protected vehicle, developed for the local and international CIT market.

When the consortium was formed in 2004, the CSIR began designing the new vehicle by creating a data pack of CAD drawings for TFM. Using this data pack and with engineering support from the CSIR, TFM produced a prototype vehicle, built on a Nissan Diesel UD40 chassis and driveline, which was unveiled in July 2005. This specialist truck body builder has since begun manufacturing these armoured vehicles on a dedicated production line at its Olifantsfontein plant.

The CSIR will provide design back-up and modifications as needed. Nissan Diesel will provide primary support on the automotive components, and TFM will supply any components related to the armour to Nissan Diesel's nationwide network of branches.

Curbing cyber crime

The use of ICT in perpetrating crimes is growing world wide. Internationally and in South Africa, new laws have been formulated to combat this problem, such as the Electronic Communications and Transactions (ECT) Act. The laws aim to curb the rising trend of cyber crime, but investigating these crimes requires high-quality technical, investigative and legal knowledge. This has given rise to the discipline of cyber forensics.

Cyber describes the virtual space of electronic communications and information sharing, and forensics is the use of S&T to investigate and establish facts for legal evidence. Cyber forensics therefore describes all the actions and measures taken by investigating authorities in the use of electronic and communications artefacts as evidence in court.

The Cyber Security Science Centre (CSSC) laboratory was established at the CSIR to perform world-class research into cyber forensic questions. The CSSC has formed strategic partnerships with South African law enforcement agencies and role-players in the financial services industry to deliver practical solutions to existing problems. The CSSC has therefore become involved with the establishment of cyber forensic capabilities at various levels in a variety of organisations, assisting with cyber forensic responses to crimes and the advanced analysis of a range of incidents.

The CSSC has established research areas in evidence mining, network forensics and the cyber forensic investigation of mobile technology. It is also actively involved in the establishment of good practice processes, providing training and knowledge transfer to the industry in general.

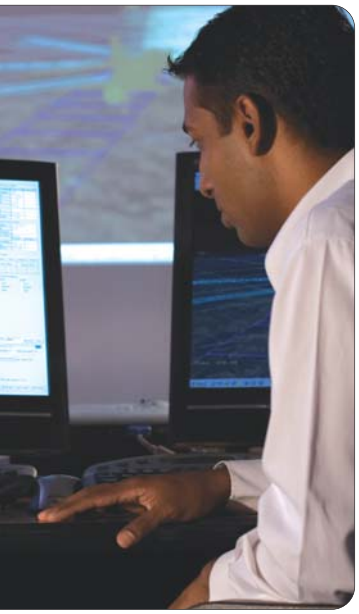
Flutter flight testing for safer civil aircraft

The CSIR has provided flutter clearance of military aircraft as a measure of structural integrity for the South African Air Force since 1978. Flutter occurs in an aircraft when the frequency of an aerodynamically-induced vibration coincides with an un-damped, natural frequency of a component such as a wing.

A number of years ago the CSIR identified the need for similar capability specifically aimed at civil aircraft and developed a dedicated civil flutter exciter. Following the design of a number of new light aircraft in South Africa, the CSIR has offered a flutter clearance service to civil aircraft manufacturers. For this flutter flight testing, civil aircraft flutter exciters are mounted on the wingtips of the aircraft to induce vibration during flight. The resultant response or vibration of the airframe in flight is measured by accelerometers placed on various points on the structure over a range of flying speeds. The response is analysed using CSIR-developed flutter flight testing software to predict flutter in flight. A recommendation is made on a safe maximum speed for the aircraft based on the data gathered during flight tests.

Civil aircraft flutter flight testing has been successfully done on two locally-manufactured aircraft, the Ravin 500 utility aircraft and the Slick 360 aerobatic aircraft. This follows the flutter flight testing on the DA43 Twinstar in Austria two years ago. The CSIR has also secured a contract for flutter flight testing of the SPn, a passenger jet aircraft from Grob Aerospace, a German company.

Modelling and simulation used as part of SANDF field exercises



A systems modelling and simulation capability has been established at CSIR Defence, Peace, Safety and Security to provide decision support to the South African National Defence Force (SANDF) on acquisition and upgrade programmes. The Ground Based Air Defence System (GBADS) acquisition programme of the South African Army is successfully using this capability to assist in concept evaluation and doctrine development.

Ground-based air defence is the capability to engage and destroy enemy air targets. The Virtual GBADS Demonstrator (VGD) allows dynamic "deployment" of GBAD entities in a defined scenario to observe the behaviour, interactions between systems and estimated performances of systems and sub-systems. Evaluation tools allow various aspects of the system to be observed in real time and off-line.

In 2005, the VGD was integrated into an SANDF operational exercise, which provided an opportunity to apply modelling and simulation as an integral part of a surface-based exercise including land, air and naval assets of the SANDF.

The VGD is currently being transformed into a Mobile Virtual Ground Based Air Defence Demonstrator (MVGD). It is planned that GBAD personnel from the Air Defence Artillery Formation will operate the virtual GBADS, interacting with the bigger operational systems in a realistic way. The MVGD is easy to set up and integrate with an SANDF field exercise, and will be used in many different roles in future.

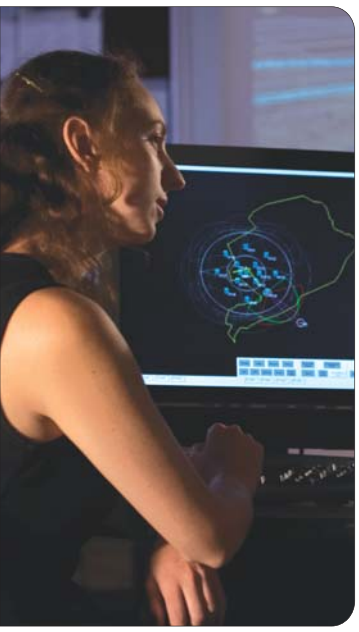
Human response measurement and survivability

Peace-keeping forces and relief/aid workers operating in unrest areas all over the world are exposed to landmines and anti-personnel mines. Mine-protected vehicles are therefore indispensable for peace-keeping and relief operations, and to ensure that the vehicles used are suitable, they must meet the requirements set by the SANDF or other military and police forces. The CSIR's Landwards Sciences unit supports the SANDF in the acquisition of vehicles and technology to counter the landmine threat with its capability of measuring human response and determining survivability when subjected to landmine detonation.

Specialised test methods have been developed for synchronous data capture and analysis to determine the forces encountered during a landmine detonation and to evaluate whether the occupants would have survived and what their level of injury would have been. Basic and applied research is done in cooperation with the Blast, Impact and Survivability Research Unit (BIRU) of the Mechanical Engineering Department of the University of Cape Town. The CSIR is also involved as a Partner for Peace with the NATO scientific task group responsible for developing and maintaining the NATO equivalent specification to RSA-MIL-STD 37 (STANAG 4569).

The CSIR's capability of evaluating landmine protection and crew survivability is being developed through the construction of modelling and simulation programmes. Research and validation are carried out on new landmine protection technologies for the SANDF as well as for international industries and customers, e.g. landmine-protected seats, integrated explosively formed projectiles, mine protection packages and protection against large improvised explosive devices.

Understanding information warfare through simulation



The capability to model and simulate complex netted systems has been established by the CSIR. This capability is being applied in the creation of the Information Warfare Simulator, a unique integrative simulator that operates across the six pillars of information warfare (IW), namely network security, information infrastructure security, command and control, electronic warfare, intelligence-based warfare and psychological operations.

The C4I3RS framework (command and control, communications, computers, information, intelligence, infrastructure, reconnaissance and surveillance) is used by the SANDF to manage IW operations. The IW Simulator will facilitate understanding of IW concepts and assist in testing theories in a virtual representation of realistic scenarios. It enables cost-effective testing of IW equipment and tactics in a simulation environment rather than as part of field exercises.

Current capabilities include modelling of network topology, message routing, message transfer time and latency, services, vulnerabilities, patches and exploits, viruses, worms and backdoors, and modelling of the generation, distribution and consumption of electricity and resources. Progress has also been made in the complex modelling of human agents and their influence on the IW system. A secondary area of research revolves around the visualisation of extensive networks of systems, each containing thousands of entities.

The future will see extended research in the other pillars of IW as well as the concurrent expansion of the IW Simulator.

Toolkit to be used in crime prevention

The Local Crime Prevention Toolkit (LCPT) was developed in response to a need for greater understanding, more skilled capacity and enabling tools for local crime prevention strategies and interventions. Over the past three years, the LCPT has grown and been adapted to incorporate the needs and learning of many different communities and circumstances. National and even provincial crime prevention and safety strategies are sound, but crime and violence are experienced at local level and must be addressed there. Designed originally as a process tool, the toolkit is supported by capacity-building programmes and technical support provided by the CSIR team.

Partners in the initiative include UN Habitat through their Safer Cities programme. The SAPS is an essential partner and learning achieved through the toolkit has been used in a workshop programme for station management and Area Crime Prevention Component Heads in four provinces.

The toolkit is internationally recognised as contributing to the body of knowledge and to making crime prevention more practical and sustainable at local level. The toolkit has been featured on the website of the International Centre for the Prevention of Crime and is a key contributor to the development of a safety audit tool being developed by the National Centre for Crime Prevention in Canada. Cooperation is envisaged with the Australian Attorney General's office on a project aimed at better crime prevention for indigenous communities.

MECORT installed on CSIR Pretoria site

The world-class R45 million MECORT radar and electro-optical research facility was delivered to the CSIR in October 2005. It represents one of the largest investments by the Department of Defence in the research infrastructure of the CSIR. The system has been installed to provide a clear line of sight to the test target generator on the Telkom tower, as well as air traffic associated with Waterkloof Air Force Base and some of the local commercial airports.

MECORT was developed in close cooperation with Reutech Radar Systems (Stellenbosch) and other South African defence industry companies. The CSIR developed the antenna, radar signal processor and the data capture and analysis system. The modular design of this research facility allows new technologies and processing algorithms to be researched in conjunction with the instrumented and operational building blocks.

The radar research programmes that will be supported by this facility include: radar angle tracking accuracy; tracking of low-flying objects in severe multi-path conditions often experienced in naval environments; advanced detection and tracking techniques of small objects in sea clutter, e.g. small rubber boats used in illegal fishing; identification of aircraft types; and advanced electronic protection.

The facility will also be used to support the SANDF with force preparation, doctrine development, training and optimisation of existing systems, and is expected to play an important role in the drive to increase the local industry's international competitiveness.

Power management for electronic devices

Electronic devices are firmly established in the modern world. They are powered by many different types of battery, which either need to be replaced or recharged regularly, and the number of battery chargers is growing. This is an inconvenience for many users, but it is a problem for soldiers in the field who do not have access to electricity and have to carry all the equipment around.

This CSIR project conducted research on power management which includes generation and distribution. The system that was designed can currently charge up to three laptops, radios, satellite phones, cell phones and rechargeable AA and AAA battery packs. Using a special cable, the system automatically supplies the correct charging for each device. The system can be charged from a car battery (12 V or 24 V), 110/220 V mains power and solar panels. The control unit has a display to inform the user of remaining battery time to empty or how much it still needs to charge to reach its capacity. Further research will focus on finding other generation methods such as salt batteries and fuel cells.

This product will make the life of soldiers easier, particularly when they are away from power infrastructure. Many organisations around the world have the same problem and as far as it can be established, this is the first military quality product in the world to solve this serious problem.

Information, Communications and Space

Strategic overview

The Meraka Institute, the African Advanced Institute for Information and Communications Technology (ICT), was launched on World Telecommunications Day (17 May 2005). Meraka is a word used in Sesotho, Sesotho sa Leboa and Setswana to refer to an area of shared land most commonly used for cattle grazing. In the institute's sense, it refers to shared resources and associated communities. The institute is hosted by the CSIR, drawing on its organisational and management functions, supplemented by a distinct governance structure to ensure implementation of the institute's strategy.

The Meraka Institute will contribute to government's drive to enhance both the scale and scope of R&D in the ICT sector and the impact of R&D interventions through focused, needs-driven research in a number of key areas, such as human language technologies and high performance computing. These efforts will be closely aligned with current initiatives and strategies such as the ICT Roadmap, the Advanced Manufacturing Technology Strategy and the DST's Frontier Science Programme. In addition, the institute envisages close partnering with international R&D players.

The institute derives its mandate as a national strategic initiative from President Thabo Mbeki's 2002 State of the Nation Address, in which he announced the concept of a university for ICT.

In her keynote address at the launch, Dr Ivy Matsepe-Casaburri, Minister of Communications, emphasised that the establishment of the institute would contribute to a vibrant local industry and reinforce the view of South Africa as an innovator and leader in ICT. "Most importantly, the institute will form collaborative relationships with government, industry, academia and civil society in achieving its objectives."

Dr Ivy Matsepe-Casaburri, Minister of Communications with Dr Sibusiso Sibisi, CSIR President and CEO, at the launch of the Meraka Institute.

- **Wireless Africa** entails research into sustainable ICT for developing countries in order to close the digital divide that exists within and between these countries. Its components include social research (focusing on community projects in South Africa, Angola and Mozambique in order to create sustainable, community-owned wireless infrastructure for applications in health, education and related service delivery) and the removal of technology barriers to enable bottom-up creation of wireless access infrastructure.

- **The National Accessibility Portal (NAP)** uses ICT to help empower persons with disabilities to live independently. Of the four million South Africans who have severe or moderate disabilities, less than 1% are employed gainfully and are financially independent. The NAP enables people with different disabilities to access information and services, to interact and communicate irrespective of age, gender, language and level of literacy. The prototype demonstrator is based on internet technologies and uses open source software (OSS) to provide affordable alternatives.

- **Human Language Technologies (HLT)** enable people to get information and services, and to interact with technology, through language. The aim is to overcome barriers related to language, illiteracy or disability. A major long-term goal of the group's advanced research is the creation of automatic translation services. A current research project is OpenPhone, a fully open source telephony platform that will provide multilingual voice services in all South Africa's local languages.

- **The Digital Doorway**, an initiative between the DST and the Meraka Institute, uses minimally invasive education to promote large-scale computer literacy. During 2005, more than 100 terminals were installed in a mix of rural, peri-urban and urban areas. The Digital Doorway is cost-effective, requires low maintenance and makes remote management and administration possible through the use of OSS.

- **The Open Source Centre (OSC)** promotes understanding and the use of free/libre and open source software (FLOSS) in the public, private and civil sectors. The OSC's flagship research project is FLOSSWorld, a European Union 6th Framework project with collaborators from Europe, Brazil and Asia.

- **The Centre for High Performance Computing** is currently being formed in collaboration with TEIs. The aim is to provide high-end computing and expertise for research, including natural science, medicine, engineering and social science.

Cantenna connects rural home to the world

The Meraka Institute's first "Cantenna" (an antenna made from a metal can, such as a coffee tin, and a section of bicycle spoke soldered into a special connector) was installed in a rural setting. It was mounted on the house of Agnes Mdluli, a health worker in Peebles Valley, near White River in Mpumalanga.

These small, self-constructed antennas, which are made from locally-available material, are connected to a low-cost WiFi card plugged into a computer. A small wireless router is placed in a weatherproof casing on a pole to which several community members can connect and form a community mesh network. This mesh networking technology allows the wireless installations to configure themselves automatically to find the optimal routes through the network, and very little configuration is needed to set them up.

This technology has also enabled the local high school, which uses the more costly omni-direction antenna, to gain internet access through its computer centre. Community members will be trained to construct their own Cantennas, set up a wireless router and connect it to a computer. The project in Peebles Valley is one of 10 sub-projects in the First Mile First Inch project being funded by the International Development Research Centre, a Canadian public corporation. The Meraka Institute is responsible for the technical development as part of its Community Owned Information Network (COIN) initiative under the Wireless Africa project banner.

Accessible telephony services now a reality with DialogPalette

DialogPalette, a user interface based on OSS developed by the Meraka Institute, is helping to make affordable and easy-to-use telephony-based systems a reality. It is part of the OpenPhone project, which aims to make telephony-based applications accessible to all South Africans.

Existing interactive voice response systems are not satisfactory and the cost of commercial telephony-based systems and related training is often beyond the financial means and skills of communities.

DialogPalette is flexible and therefore easy to use. It allows an information provider to design a telephony-based information service to localised specifications. It is intuitive and focuses on logical intent rather than implementation details. Voice prompts for various phases can be recorded. Templates guide the designer so that the optimum design is achieved with learning acquired through the activity.

The advantages of DialogPalette make it an ideal application in MobilEd, a mobile ICT initiative for education, which uses cell phones. It is also being used in the Meraka Institute's text-to-speech research aimed at providing auditory information.

DialogPalette has been released as OSS on SourceForge (http://dialogpalette.sf.net) and can be freely downloaded. It runs on the Asterisk Open Source PBX, which is also freely available on SourceForge with an installation guide. Asterisk supports Voice Over Internet Protocol, which obviates the need for fixed telephone lines. Both industry and non-governmental organisations have shown a keen interest in DialogPalette.

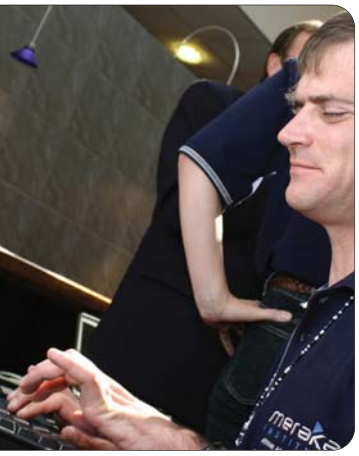
FOSSFA secretariat handed over to CSIR

The Secretariat for the Free Software and Open Source Foundation for Africa (FOSSFA) was officially handed over by Council Chair, Nnenna Nwakanma (Ivory Coast), to the Meraka Institute's Open Source Centre (OSC) at the conclusion of the Idlelo2 conference. OSC Manager, Nhlanhla Mabaso, was accompanied by representatives of the State Information Technology Agency, the DST and the Presidential National Commission on Information Society and Development.

The OSC now also has the task of addressing any amendments to the newly-ratified FOSSFA constitution. FOSSFA brings together individuals and organisations working on free and OSS in Africa and is mandated to pursue the vision of the Foundation. In essence, this covers awareness creation of and capacity-building in OSS, development of knowledge and expertise in Africa, and of national and regional open source portals, and support for technical experts in Africa to participate fully in the development of open source software.

Idlelo2, held in February 2006 in Nairobi, Kenya, focused on the importance of community software in achieving the Millennium Development Goals. The first Idlelo conference was held in January 2004 in Cape Town. The word "idlelo" is isiZulu for a common grazing ground and thus relates to the meaning of the word "meraka".

Meraka releases text-to-speech systems in isiZulu and Afrikaans



The release by the Meraka Institute of software containing new voices accompanied by the requisite software toolkit (in OSS format) is a significant milestone in the development of text-to-speech (TTS) voices in new languages, notably isiZulu and Afrikaans. Research is also being done on South African English, Setswana and Sesotho sa Leboa.

The voices are captured and processed by recording a very specific set of sentences in which the range of sounds, or phonemes, in a language, is captured. Once the speech sounds have been extracted, new sentences can be created from them. This innovative work is being done with existing OSS, notably Festival, which is the standard used for text-to-speech research and to develop voices.

The language data compiled from this phase cannot be used on its own. Together with Festival, Flite (written in the C software language) is required for use of the languages. Free TTS, which is in Java, has been released for applications such as the institute's NAP project for persons with disabilities. This technology is used in screen readers for the blind and for interactive voice response systems.

Creating the Sensor Web alliance

The Sensor Web is a concept that is being investigated by a growing number of organisations across the world – a world-wide Sensor Web will allow users to query vast quantities of data from widely distributed sensors, and to re-use existing data in new ways.

A Sensor Web is a web-centric, open, interconnected, intelligent and dynamic network of sensors. It is an earth and space observation system consisting of many interconnected sensors which can perform as an extensive monitoring and sensing system to provide timely, comprehensive, continuous and multi-mode observations.

The Meraka Institute (ICT4EO Research Group), the University of Muenster (Institute for Geoinformatics), Mississippi State University (GeoResources Institute) and 52North have agreed in principle to establish a global research partnership for Sensor Web Enablement (SWE).

The objectives of the partnership are to stimulate research into various aspects of SWE, promote collaborative/network research, build critical research mass in Sensor Web research, pool resources and funding, encourage scientific exchange programmes, contribute to the GEOSS architectural design, and contribute to the development of Open Geospatial Consortium (OGC) standards and specifications for SWE.

The partnership is open to any institution with a keen interest in any aspect of SWE.

Forty years of excellence in satellite tracking

The 40 ft diameter (12.19 m) parabolic antenna of the CSIR Satellite Applications Centre at Hartebeesthoek has, over a period of 40 years, rescued a $400 million satellite, received data from scientific packages left on the moon by Apollo astronauts and tracked the BIOS capsule with a monkey on board. This high-performance antenna was designed and manufactured by Philco Ford in Los Angeles on behalf of the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Centre (GSFC) to receive wide-band data reliably from complex scientific orbiting observatories.

The antenna was commissioned in August 1964 as one of three such antennae spaced roughly at 120° longitude around the world. It has received more than four million minutes of data during its long and distinguished career from dozens of NASA scientific satellites and was used to support hundreds of NASA launches. It played a crucial role in NASA missions from 1964 to 1975.

After NASA ceased operations in South Africa, the 40 ft feed was modified to receive data from a variety of earth observation satellites, including Meteosat, National Oceanic and Atmospheric Administration (NOAA) and Landsat. In the early 1980s, the system was modified to support the space activities of the French National Space Agency (CNES), as it still does today. In recent years, transmitting capabilities were added. The antenna is still going strong after 40 years, and with proper care and maintenance, it will last another 40 years.

Detecting fires from space

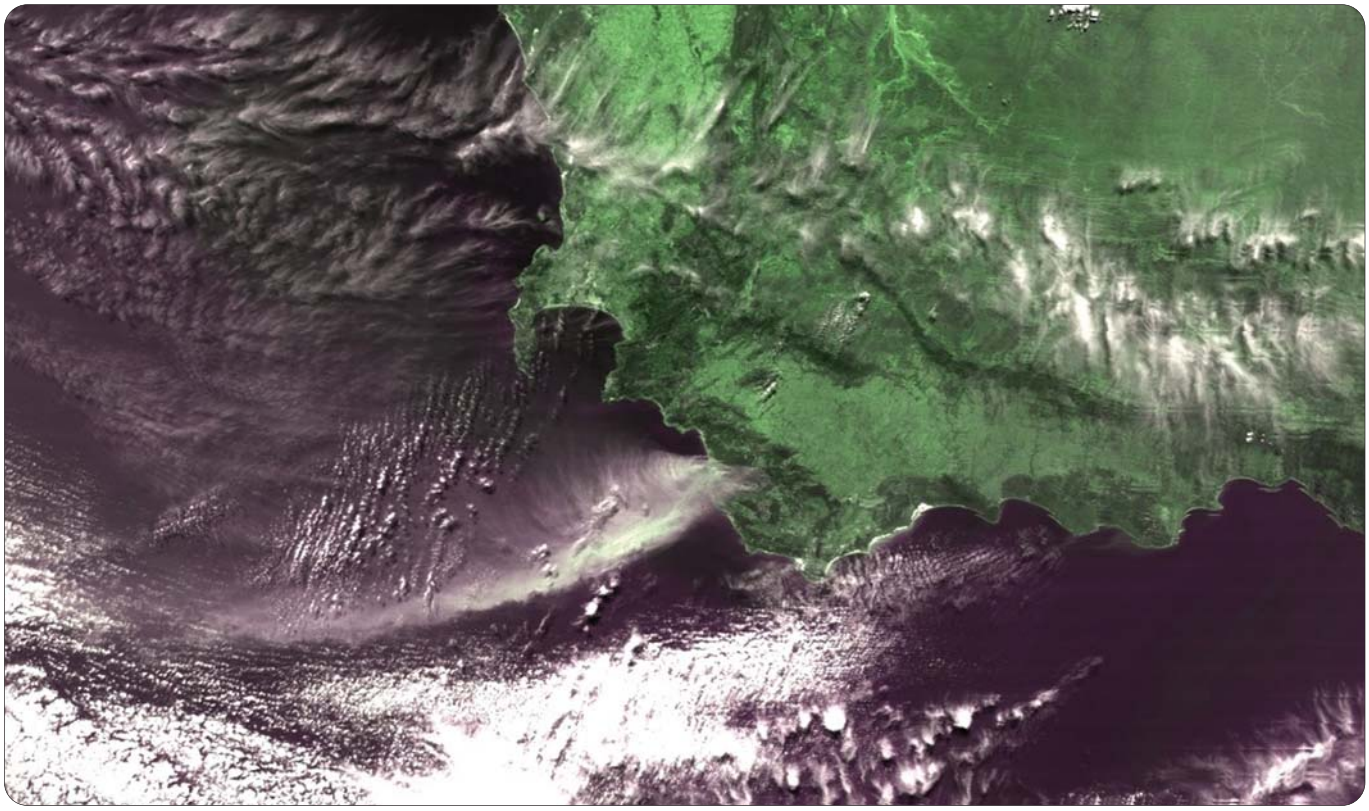
The CSIR is modernising its data centre using state-of-the-art technologies based on OSS. Progress in this regard is the porting of the Advanced Fire Information System (AFIS) from a proprietary to an OSS platform.

Unwanted and uncontrolled bush and grass fires are often disastrous for people, livestock and property. The only means of accurately determining the exact location and extent of a fire is by a global perspective from space.

Recognising the benefits of earth observation information, the National Department of Agriculture made a multi-million rand grant to the CSIR to procure a Moderate Resolution Imaging Spectroradiometer (MODIS) receiving and processing system. Kongsberg Spacetec in Norway was awarded the contract to upgrade the CSIR's Earth Observation Data Centre (EODC) for MODIS and NOAA reception.

The current National Oceanic and Atmospheric Administration NOAA archive at the CSIR Satellite Applications Centre will enable the generation of a 17-year active fire record, which will provide valuable information on fire frequency, distribution and intensity.

In January 2004, the CSIR approached Eskom with a proposal for a satellite-based fire detection system using MODIS data, and a prototype of the system was launched as an Eskom research project. The final fire detection system will include a fully-automated alarm system. It will operate via a mobile telephone text message system and will alert the responsible person if a fire is detected within a specified distance from a power line or within a defined area such as a nature reserve. It appears that South Africa is the first country where such a near real-time approach has been used by an electricity utility.



CSIR supports first Ka-band satellite

When Boeing's Spaceway F1 satellite was launched on 26 April 2005 in Long Beach, California, the CSIR had all systems in place to provide the launch support for the first commercial Ka-band telemetry, tracking and command (TT&C) satellite ever launched in the world.

In terms of a contract awarded to the CSIR, its Satellite Applications Centre will support the launches of all three Spaceway satellites – F1, F2 and F3. The support services provided include telemetry (receiving the satellite's health status and data), tracking (tracking the satellite and sending Boeing the antenna pointing data and ranging data) and command (relaying commands from the Boeing control centre to the satellite).

A team comprising radio frequency engineers, system engineers and technicians from the CSIR was involved in the preliminary design review and technical discussions in the project's initial stages. Other projects undertaken by the CSIR to ensure the project's success included the construction of a new 13 m full-motion Ka-band antenna.

The US-designed Spaceway satellite network will provide high-speed, two-way communications for internet, data, voice, video and multimedia applications. The spacecraft is regarded as the next generation in satellite communications technology, with approximately five to eight times the capacity of current satellites. The satellite will be able to provide services to small terminals, and users of the system will be able to communicate directly with one another without requiring connection through a central hub.

Materials Science and Manufacturing

Strategic overview

The strategic intent of CSIR Materials Science and Manufacturing is to improve industry competitiveness, national human resource development and quality of life for all South Africans through conducting leading research and innovation, with partners and stakeholders, in the fields of materials and manufacturing.

The S&T environment in which the CSIR operates is largely determined by the National Research and Development Strategy (NRDS), Integrated Manufacturing Strategy (IMS) and the Advanced Manufacturing Technology Strategy (AMTS). The Africa Science and Technology Strategy is also an important reference and guide, as are specific strategies such as the National Nanotechnology Strategy.

Advanced manufacturing is one of the four missions identified in the NRDS, with a focus on technological innovation, technology demonstration, new business incubation and enhanced networks. Future competitiveness of the manufacturing sector depends on mastering advanced technologies and moving towards knowledge-intensive goods and services. The AMTS aims to bring together related elements of the NRDS and IMS to improve the competitiveness of the manufacturing industry through encouraging the adoption of advanced technologies.

The CSIR is in a unique position to add value and impact in the materials and manufacturing industries in Africa and to develop human capital through its critical mass of multi-disciplinary researchers, its equipment and infrastructure and its knowledge and networks within these fields. A major competitive advantage is the wide coverage of materials (e.g. fibres, textiles, polymers, ceramics, composites, metals) and manufacturing disciplines within one unit. This enables multi-disciplinary research and solution development.

Sensor technology reaches milestone

CSIR Materials Science and Manufacturing reached a milestone when the 100th unit of the CoroCAM was sold. CoroCAM is a range of imaging tools developed with Eskom for the power distribution industry that provide engineers with the ability to inspect distribution lines and their insulators for damage or deteriorating condition that could lead to power outages. CoroCAM cameras can simultaneously image visible as well as ultra-violet wavelengths to provide an analysis of an electrical installation's condition. Units have been sold worldwide, with many being used by universities and electrical utilities for research into insulator design and maintenance.

Building on the CoroCAM platform, the world's first multi-spectral imaging (MSI) system that simultaneously images across visible, ultra-violet and infrared wavelengths has been developed. The MSI system provides additional information on the temperature profile of a remotely-viewed structure providing further diagnostic information. A broad-band sonar device has also been produced based on the use of composite piezoelectric materials. Broader bandwidths enable higher data rates to be exploited, allowing for significant increases in a device's performance and functionality.

The Sensor Science and Technology competence area of the CSIR conducts R&D work across the cycle of innovation from strategic basic research to technology transfer and industrialisation in the fields of smart structures and materials, electro-optic sensing and imaging and underwater sonar. Within these areas, research is undertaken to introduce and adopt new sensing technologies within South Africa. Novel applications are investigated across a broad range of industries, including energy, defence, medical, process control, security, food and beverage and optical systems.

Body scanner benefits clothing industry

A 3D body scanner that will benefit the South African clothing and textile industry has been acquired by the CSIR as part of the AMTS. Apart from contributing towards countering the global pressures experienced by industry, the scanner will feed into the anthropometric database by providing data for body shape analysis of the general population in the country.

The 3D full-body scanner is an image-capturing piece of equipment used to generate virtual models and extract body measurements for individuals and is to be used in the manufacture of custom-fitting apparel. It reflects body posture of individuals and can be utilised in body-shape analysis, as well as virtual fitting of apparel on body models. The 3D to 2D beta software is currently being used to generate basic patterns based on an individual's body measurements.

Body measurements extracted from the scanner are used to alter key body measurements on parametric models (part of the optitex software package). Computer-generated garments are then simulated on the altered parametric models in order to evaluate garment fit. The aim is to achieve interconnectivity between these systems with a view to taking an e-prototyping manufacturing approach to clothing.

For South Africa, the acquisition of this machine means that retailers will be able to access the database, spend less time measuring people and save costs.

New nano-drug delivery system targets TB sufferers

Tuberculosis (TB) is gaining ground – in 2001, the disease killed more people than any previous year in history. Globally, there is a 3% increase in new TB cases each year, while in Africa the increase is 20% per year, largely due to co-infection with HIV/Aids. Every year, eight million people worldwide develop active TB and three million die from it, while more than 400 000 new cases of multi-drug resistant TB are diagnosed.

A new method of delivering TB drugs to sufferers of the disease using nanotechnology is being developed by the CSIR. The TB nano-drug delivery project seeks to address patient noncompliance in TB control programmes through the development of a system whereby drugs can be administered in a single dose that maintains an active level of the drug for a number of days or weeks. By reducing dose frequency and shortening the duration of the treatment from six months to less than two months, patient compliance will improve substantially.

The project, led by the CSIR in collaboration with the Universities of South Africa, Pretoria and Stellenbosch as well as the Medical Research Council, received a further boost recently with the signing of a memorandum of understanding with Lifecare Innovations in India and also with the National Jewish Medical and Research Centre, and the University of Colorado's Health Sciences Centre.

FabLab introduces concept of personal fabrication

Personal fabrication, a concept that enables users to design and produce their own products with a machine that combines consumer electronics and industrial tools, came to local shores with the launch of South Africa's first FabLab (fabrication laboratory) during 2005.

South Africa's first FabLab, established by the DST under the auspices of its AMTS and managed and established by the CSIR, is based at the Innovation Hub in Pretoria.

The goal of the AMTS FabLab programme is to help people use advanced information technologies to develop products and solutions to address local needs. The FabLab is very different from other rapid product development facilities, with the focus on manufacturing the total product. This includes design, fabrication, testing and debugging.

Working in close partnership with provincial and local governments, NGOs and the private sector, it is planned to establish seven additional FabLabs around the country.

Investigating alternative power resources

Fuel cell technology as an alternative to traditional power resources has the potential to diversify the face of power supply in South Africa. The CSIR will significantly enhance its fuel cell research capability when a custom-designed test system is acquired for furthering this technology. Known as an Evaluator ® C050, the test system is ideally designed for membrane electrode assembly (MEA) developers, fuel cell researchers and stack developers performing single-cell testing. This technology not only promises cleaner, more efficient energy, but provides a unique combination of features and benefits. A current project of the CSIR explores and uses the potential benefit offered by the unique properties of nanostructured materials to improve performance of MEAs and to reduce the amount of platinum used in fuel cells.

Fuel cell research is a multi-disciplinary field and requires expertise in chemistry, engineering and material science. The CSIR will foster cooperation with a number of South African TEIs within the research programmes.

South Africa, as the world's leading producer of platinum (78% of known world reserves), is potentially in a strategic position to take advantage of the new opportunities in the fuel cell domain.

Implementation of first regional AMTS

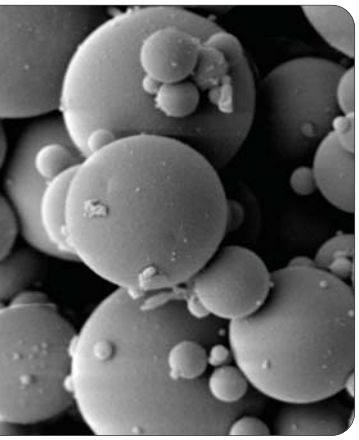
The first regional AMTS, tailored to the needs of local industry and a unique provincial environment, was launched in the Western Cape in November 2005. The AMTS of the DST, managed and implemented by the CSIR, aims to strengthen the competitiveness of the manufacturing sector through the implementation of targeted, high-impact projects in areas such as industry development, world-class manufacturing, innovation and R&D. Implementation of the AMTS takes place on both a national and regional level.

The Provincial AMTS for the Western Cape (WC PAMTS) is the first example of a regional strategy that has been developed to support the objectives of the province, as articulated in the Micro Economic Development Strategy (MEDS), and which is aligned with relevant national strategies and initiatives.

The WC PAMTS will also support the provincial growth and development strategies and objectives by providing a technology component that will enable the sectors to compete globally and thereby support the export drive, manufacturing sector growth and employment creation.

The strategy focuses on five selected sectors, namely craft, electronics, food, metals and engineering, as well as clothing. The scope of the strategy will be expanded to other sectors.

Immobilising enzymes for better adaptability



Enzymes are preferred to normal chemical catalysts in many industries due to their high selectivity, activity and product yields, while reducing waste products, effluent load and energy consumption (due to milder reaction conditions). However, their general application in industrial biocatalysis is hampered by their cost and difficulties in recycling.

The CSIR has developed a novel self-immobilised enzyme by using an emulsion to control size and orientation. Known as SphereZymes™, these self-immobilised enzyme spheres display high enzyme activity per unit volume of reaction. In some cases, activities in excess of 100% compared to the native enzymes can be achieved (whereas immobilisation through cross-linking usually leads to activities of less than 50% of the free enzyme activity). This is achieved by using a proprietary method during manufacture to immobilise the enzyme in its active state.

The technology is currently being patented internationally and there is already international industrial interest in its commercialisation.

Innovative textiles with nanotechnology

R&D efforts in the textile industry are aimed at integrating new functional characteristics into textiles to generate additional benefits and create a competitive advantage. The application of nanotechnology will improve the characteristics and functions of fibres, finishes, dyes, colouration systems and textile composites.

The CSIR's National Fibre, Textile and Clothing Centre heads up a number of projects in this area including the following:

- **The South Africa/Hungary S&T programme:** Research was undertaken under the South African/Hungarian Science and Technology Cooperation Programme involving the CSIR and the Bay Zoltán Institute for Materials Science and Technology. The project comprises the development of nano-composites with polypropylene matrices and surface treatment of bentonite for preparation of fibrous nanocomposites. The products have applications in packaging and automotive parts.
- **Nanofibre-based non-woven formation:** The CSIR has invested in state-of-the-art non-woven technologies and has initiated novel research ideas to develop nano-fibres. This technology will also find application in the medical field.
- **Multi-functional natural fibre:** This project aims to improve the multi-functionality of cotton, specifically by imparting flame retardancy to the cotton using various techniques.

Solar cells — a solution to the energy crisis?

As fuel sources become depleted, there is an increasing search for alternative sources of energy, particularly solar energy, since it is clean, abundant and renewable. Cost, performance and convenience of current systems need to be improved if solar energy is to be integrated successfully into society. A novel system to effect improvement is the use of dye-sensitised solar cells (DSC), in conjunction with several new concepts, such as nanotechnology and molecular devices.

The CSIR is working toward DSC niche applications, which include alternative energy devices to be used in cell phone chargers, laptops and radio batteries. Solar cells produced to date at the CSIR have successfully driven a toy windmill and a kitchen clock.

Energy conversion in a DSC is based on the injection of an electron from a photo-excited state of the sensitiser dye into the conduction band of the nanocrystalline TiO_2 film. These cells also employ a liquid electrolyte (usually an iodide/triiodide redox-active couple dissolved in an organic solvent) to reduce the dye cation, i.e. to regenerate the ground state of the dye.

CSIR contributes to road safety

In a significant contribution towards road safety, the CSIR harnesses modern technology to protect law-abiding people while ensuring a fair judicial process.

Being one of only two institutions in the country accredited to calibrate evidential breath testers, the CSIR National Metrology Laboratory calibrated more than 350 breathalysers in 2005. The CSIR laboratory ensures that these devices are properly adjusted, calibrated and that they meet the legal traceability requirements prescribed by the Measuring Units and Measurement Standards Act (Act 73 of 1976).

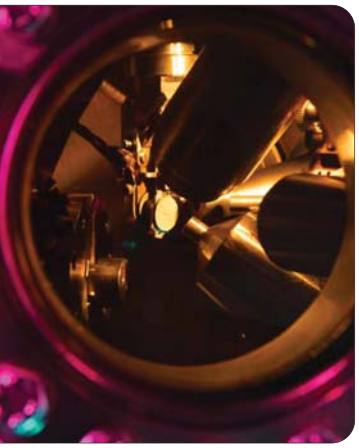
Prosecuting guidelines require breathalysers to be calibrated and adjusted every six months.

The two peak periods for calibration of the breathalysers are immediately prior to the December and April holidays.

The calibration process is semi-automated and takes between 30 and 45 minutes per unit. The CSIR is involved with the work of the Drunken Driving Working Group of the Technical Committee for Standards and Procedures for Traffic Control and Traffic Control Equipment of the Department of Transport.

This committee keeps the specifications for evidential breath testing updated in accordance with the standards prescribed by the International Organisation for Legal Metrology.

Measurement technologies to support nanoscience



The CSIR has developed high-precision measurement techniques and commissioned a comprehensive suite of analytical tools to ensure successful industry participation in local and international markets, while keeping abreast of developments in nanotechnology.

These include a high-resolution scanning electron microscope, scanning electron spectroscopy for chemical analysis microprobe, a scanning auger electron microprobe, x-ray diffraction and glow discharge optical emission spectroscopy.

These will ensure reliable comparable reference measurements with results traceable to an agreed metrology scale and products that are interchangeable.

Proper measurement and testing are key aspects to sectors such as biomolecular technology, aerospace, telecommunications, chemical engineering, electronics, the automotive industry, etc.

New forum set to boost automotive industry competitiveness

The CSIR and the National Association of Automotive Manufacturers of South Africa established the South African Automotive Measurement and Testing Forum.

The aim of the Forum is to strengthen and improve measurement capabilities of the South African automotive industry, both at the motor vehicle manufacturers and their component suppliers.

The Forum is set to raise the standard of metrology in the automotive industry and will play a vital role in coordinating efforts to promote good metrology practice in the industry, thereby improving competitiveness in the global marketplace through improved quality.

Lasers used in cleaning and nuclear decontamination

Laser cleaning involves the laser evaporation of non-metallic coatings from metallic substrates. A number of demonstrators involving this technology have been set up at a CSIR laboratory where the necessary nuclear safety services are available. However, both for industrial laser cleaning and nuclear decontamination, system mobility is a key issue.

The first locally-developed transportable laser-based system intended for the removal of paint from walls in nuclear facilities, developed by the CSIR National Laser Centre, is nearing completion. Potential applications range from paint removal to cleaning of vulcanising moulds, removal of grease layers and de-scaling of weld seams.

The main advantages of the laser-cleaning process include the control that can be exercised with regard to precision and depth of cleaning.

In addition, the process offers an environmentally-friendly option to cleaning technologies that involve the use of toxic chemicals, which pose a hazard to both operators and the environment. Since remote operation is possible, the process can be automated to avoid human contact with hazardous materials being cleaned.

The advantages of waste minimisation and remote operation are key in the application of laser cleaning to nuclear decontamination. By removing from the surface of a component only the contaminated layer, the volume of waste requiring expensive disposal is minimised. Remote application of the laser decontamination technology also effectively reduces operators' exposure to radiation.

Phase calibration of laboratory standard accelerometers

National metrology institutes (NMIs) have the responsibility to uphold the national measurement standards at a level that satisfies industry's requirements. Industry requires higher accuracy phase-response calibration of accelerometers – which are used to measure vibration.

A laser interferometer system to satisfy current requirements for phase shift calibration of vibration transducers has been implemented by the CSIR.

The magnitude and phase performance of the system were validated through bilateral comparison measurements between the CSIR and Physikalisch-Technische Bundesanstalt (PTB) of Germany.

Comparisons between NMIs are performed at various levels in order to validate the participating NMIs' Calibration and Measurement Capabilities (CMCs). After the CSIR National Metrology Laboratory's successful participation in CCAUV.V-K1, a key comparison of accelerometer calibrations, the organisation (in cooperation with the PTB) registered a supplementary comparison, SADCMET.AUV.V-S1, with the Bureau International des Poids et Mésures (BIPM).

In this bilateral comparison between the CSIR National Mertrology Laboratory and the PTB, the complex (magnitude and phase) CMCs of the participating NMIs for accelerometer calibration were examined and compared.

This was the first registered publication of phase calibration results internationally.

System to calibrate scanning electron microscope

A standards system has been developed for the calibration of scanning electron microscopes used for dimensional measuring. The system, developed by the CSIR, was built around projecting a laser, with a known wavelength, onto the line-grating standards and measuring the angle at which the light is diffracted. From the wavelength and the angle, the pitch between the line gratings can be calculated.

Comparison with another national metrology institute proves that the current system can measure down to an uncertainty of ± 0.2 nm. With planned improvements to the detector, an uncertainty of ± 0.05 nm or 50 pm can be achieved. This is more than adequate when compared to the accuracy achieved by current electron microscopes in dimensional measuring.

Obtaining precise measurement of optical frequencies

A femto-second frequency comb will in future ensure precise measurement of optical frequencies in the visible and near-infrared wavelength ranges.

The femto-second frequency comb of the CSIR will be used in precise laser spectroscopy, time and frequency measurements, dimensional measurements and photometry and radiometry measurements.

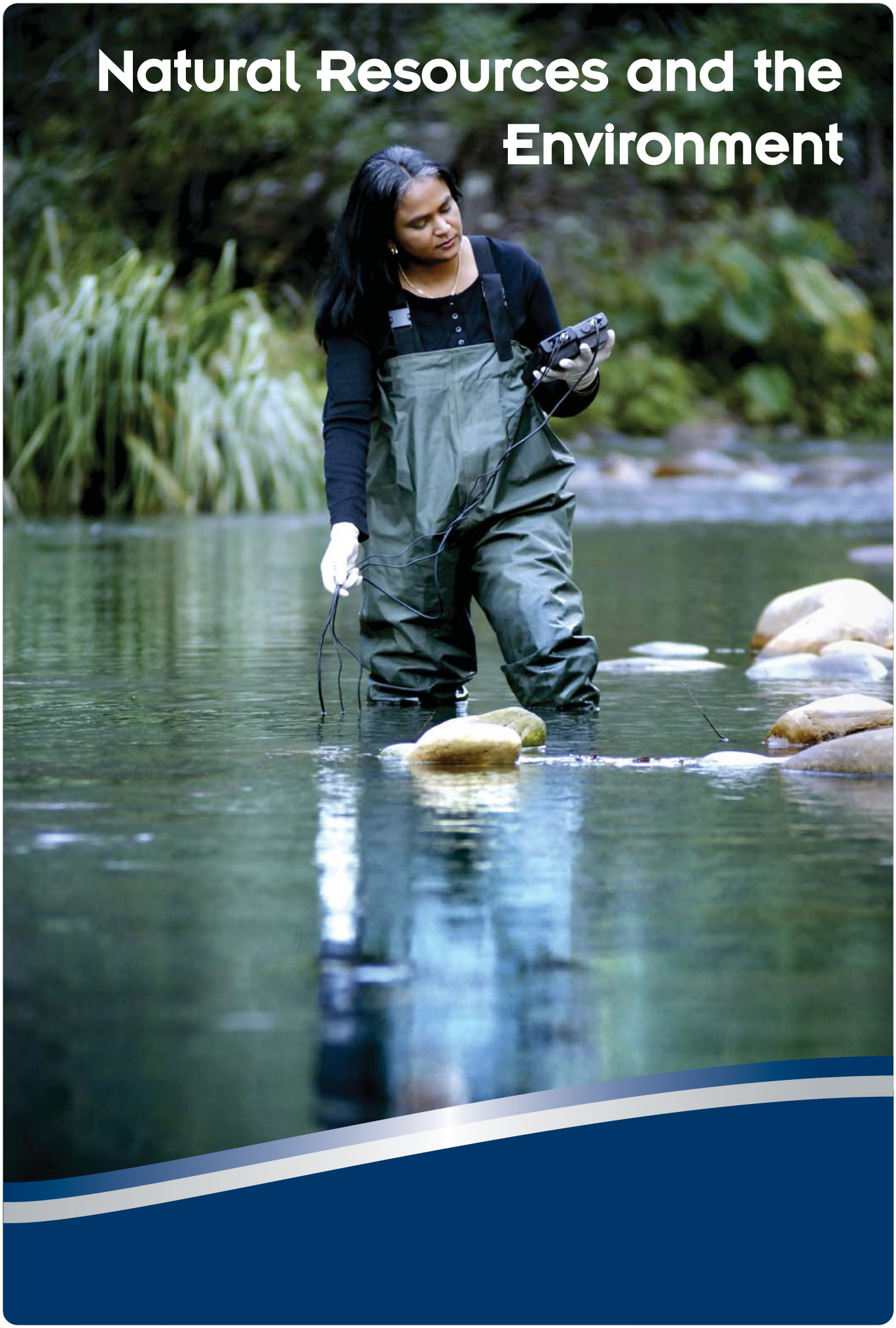
The system will also be available to universities for carefully selected experiments requiring the unique capabilities of the system. It forms the basis of the envisaged new optical clock which will be developed by the CSIR National Metrology Laboratory as the national standard for time for South Africa.

Apart from CSIR metrologists, two lecturers and one doctoral student from the University of Stellenbosch and representatives from the CSIR National Laser Centre have received training in the use of the system.

During the training, a measurement was performed on CSIR4, one of two iodine stabilised He-Ne lasers that is used as the national standard for length in South Africa.

This laser was recently calibrated at the BIPM in France. The value obtained in that measurement agreed with the calibration value within the uncertainty of the measurement, that being about 1.4 parts in 1 011 and required a very short time to complete.

Natural Resources and the Environment



Strategic overview

The CSIR restructuring process provided an opportunity to create an operating unit focused on natural resources and the environment, and designed in line with leading thinking in natural resources and environmental issues. Through relevant and focused research, the CSIR seeks to address the significant challenges regarding sustainable development in South Africa and Africa, with a focus on the optimal utilisation of natural resources in support of economic growth and human wellbeing.

CSIR Natural Resources and the Environment is structured to provide focus in specific sectors (mining and forestry), deal with cross-cutting issues (resource-based sustainable development and pollution and waste) and deal with domain-specific issues in water resources and ecosystems. There is a high level of integration within each of the competence areas, compared with the previous discipline-based approach. Integration across the competence areas is achieved through the design of research programmes aimed at national or regional impact. The CSIR is starting to see an appreciation of this approach in dealing with very complex natural resources and environmental issues.

The strategy for this unit provides for research into sustainability science to develop guiding principles that ensure all research is relevant and applied. The strategy focuses the bulk of research on understanding how resources can be managed to derive optimum benefit and avoid harmful consequences. In addition to understanding the resource base and how to manage it, this requires an understanding of the condition of the resource base, how it is changing, and the likely consequences of future change associated with global change and other drivers of change.

CSIR guides Botswana to develop national SET plan

The Botswana National Research Science and Technology Plan, developed by the CSIR and research consortium members, is set to help that country prioritise its S&T and R&D investments for the period between 2006 and 2011.

It addresses several socio-economic challenges facing Botswana, including economic diversification, poverty, unemployment, HIV/Aids and the sustainable use of natural resources.

The proposed areas of research cover several sectors including health; the service industry; eco and cultural tourism; the software industry; manufacturing; mining; water; energy; agriculture; media; education and human resource development; housing and construction; as well as transport and logistics.

Besides outlining how priority research areas will meet Botswana's national goals, the plan also identifies the human resources and institutional structures required for effective implementation plus an implementation plan with estimated financial costs.

Various reports were produced during the duration of the project. These include the:

- Inception Report
- Inventory and Assessment Report
- Botswana National Research, Science and Technology Plan: Priority Areas for Research – Stakeholder Views and Economic Analysis.

The study revealed that the key features of Botswana's national system of innovation included low gross expenditure on R&D, a reasonable publications record, a significant number of women researchers, and a relatively well-qualified research workforce.

Technology to predict and manage air quality

South Africa's population resides largely in urban areas where the cumulative effects of increased vehicle use, population growth and industrialisation have led to poor air quality. The CSIR is leading a team consisting of the South African Weather Services, Cape Peninsula University of Technology and SRK Consulting, which has designed computer-based technology that can predict concentrations of air pollution in the atmosphere.

This technology – the Dynamic Air Pollution Prediction System (DAPPS) – is used to manage air quality on an urban scale and to give decision-makers an understanding of expected air quality. It will also help to ensure that polluting activities are managed to reduce the predicted impact of air pollution on human health and to ensure that individual behaviour is managed to limit exposure to air pollution.

The technology combines a comprehensive emissions inventory with a meso-scale prognostic meteorological model and a photochemical dispersion model, and communicates air quality forecast information via an Air Pollution Index (API).

DAPPS operates in real time to provide daily forecasts of air quality for metropolitan areas, and evaluates the implications of development scenarios on air quality. The three-year project commenced in August 2002 and was funded by the Innovation Fund.

Water research to influence legislation

In partnership with the European Union, the CSIR undertook the Aquapol research study investigating water contamination trends, ensuring positive changes in current rural water policies. Another research objective was to analyse the cost-effectiveness of current water policy to adequately reflect the impact of water quality deterioration between the sources and point-of-use. Pilot studies involving measurements of microbiological water quality were conducted in poor rural communities in South Africa, Kenya and Zimbabwe. Samples were taken from transport vessels, drinking cups, storage vessels and hands of adults caring for children.

The effect of water quality on health was assessed by taking anthropometric measurements of young children and adults caring for them. Information about diarrhoea among children was also gathered. Results showed that children from households using water filters were at a lower risk of diarrhoea infection compared to homes without filters. Water in rural homes was more contaminated than from the water source due to storage practices.

In another study in rural South Africa and Zimbabwe, more than 60 households were provided with ceramic water filters while 55 homes were not, but served as control households. Diarrhoea in children aged 24-38 months was monitored for six months. The quality of water was determined at the beginning and end of the test period.

Results revealed that, although absolute rates of diarrhoea infections were low, filtration reduced the risk of all types of diarrhoea by about 80%. The reduction was primarily marked for bloody diarrhoea.

Working with communities to rehabilitate degraded catchments

Soil erosion poses a threat to water resources and land productivity. The land in rural Mnweni and Okhombe (in the Drakensberg foothills), is subjected to poor water infiltration, increased runoff and soil erosion, due to loss of grass cover on the steep mountain slopes. A project funded by the Water Research Commission, involving the CSIR, the University of KwaZulu-Natal, the Farmer Support Group, the Department of Agriculture and KwaZulu-Natal Wildlife, is assisting these rural communities to control this erosion.

The project aims to determine the effect of different rehabilitation techniques on runoff and soil loss, and to identify and prioritise rehabilitation interventions for establishing baseline conditions in the study areas. It also tries to establish land users' perceptions on soil erosion and rehabilitation in conserving water, and aims to identify soil conservation measures that are socially acceptable and physically effective in communal areas.

Job creation programmes have been launched, focusing on the rehabilitation of degraded areas. Training is also taking place in the implementation of a number of different erosion control techniques, including physical structures and vegetative structures.

Another objective of the project is to implement participatory monitoring whereby the rural participants record and analyse differences and change. This will contribute positively towards the community's learning, decision-making and local capacity.

Watching over the carbon budget of Africa

International treaties are in place to control rising levels of carbon dioxide, a problem which has been on the global agenda for the past decade. A complication in the global carbon budget is the total emissions of carbon dioxide resulting from human activities. But there is also a rapidly growing market for "carbon credits", i.e. countries that reduce emissions more than they need sell their forests and soil space (carbon sinks) to those who exceed their targets for carbon storage. Global distribution of these "sinks" can be calculated in broad latitudinal bands using inverse modelling.

The CSIR manages two large projects, the Ecosystem Processes and Dynamics Research Group, which provide high-quality measurements to narrow the sinks to small regions. The three-year African Carbon Experiment (funded by NASA) that is now in its second year, will feed into a European Union-funded project call AfriCarbon. The CSIR and its collaborators from the USA are working on an innovative technique to combine flux measurements (up-and-down exchanges between the land and atmosphere) and concentration measurements. This is to approximate the measurements that could come from tall towers. The CSIR-operated flux tower near Skukuza is crucial to this experiment.

Planning a climatic future for Durban

Climate change will affect South Africa's economy, health, livelihoods, social structure, infrastructure, natural systems and sustainable development. It's likely to be extreme in coastal cities where communities and infrastructure will be affected by sea level and extreme weather events.

In 2004, South Africa released a National Climate Change Response Strategy aimed at integrating national and regional climate programmes. The following year, the eThekwini Municipality, with assistance from the CSIR, embarked on a project called "Climatic Future for Durban", to understand the implications of climate change for the city. Its objectives included:

- Synthesising the science of climate change such that it is clear and understandable
- Improving awareness and knowledge dissemination by providing information in a user-friendly format
- Providing a forum for scientific debate to seek clarity on the issue of climate change
- Engaging the public in the climate change discourse
- Preparing a range of potential images and scenarios that depict the implications of climate change for the city
- Assessing the municipality's Integrated Development Plan in terms of its responsiveness to climate change
- Understanding how the city can maximise opportunities presented through climate change adaptation and mitigation
- Developing a response strategy, which could be adopted to address the challenges associated with climate change.

CSIR leads investigation into risks posed by seismic events in gold mining areas

An investigation of the risks posed by large seismic events to miners, mines, and the public, led by CSIR Natural Resources and the Environment Fellow, Dr Ray Durrheim and a team of experts, was completed in March 2006.

The investigation was commissioned by the Chief Inspector of Mines following a magnitude 5.3 seismic event on 9 March 2005 at DRDGOLD's North West Operations in the Klerksdorp district, which damaged several buildings and injured 58 people in nearby Stilfontein. Two mineworkers were killed while 3 200 others had to be evacuated.

Durrheim and the team completed a report, detailing the following:

- Those seismic events which could be ascribed to past mining
- Seismic events will not cease in gold mining districts as long as mining continues
- Seismic monitoring should continue after mine closure, and seismic hazard should be considered when the future use of mining land is being considered
- Seismic events are likely to be triggered by rising water levels in mines that have been closed and allowed to flood
- Disaster management officials in the Klerksdorp and Free State gold mining districts are aware of seismicity risks, and are incorporating these in their disaster management plans
- Training should be provided to members of emergency services, and drills should be practised at public buildings
- Some buildings in gold mining districts are damage-prone and a few could even collapse during large seismic events. Ways to limit damage and reduce injury risks should be explored.

Awards and Accolades

Biosciences

CSIR researcher **Gerda Lombard** recently attended the International Young Scientists Workshop in Prague, Czech Republic. Lombard was the winner of the European South African Science and Technology Advancement Programme (ESASTAP) paper-writing contest, coordinated by the DST. Her entry paper, titled Opportunities for Future South African EU Food Science Collaborations, was selected by ESASTAP, and ensured that she also attended the 2nd International Symposium on Recent Advances in Food Analysis. This allowed Lombard, of CSIR Biosciences, to identify food science collaboration opportunities between South Africa and the EU, under the auspices of the upcoming Seventh Framework Programme (FP7).

Built environment

Dr Sharon Biermann of CSIR Built Environment won the 2005 JD Roberts award for her research contribution to public sector infrastructure investment and development, focusing on integrated land use, infrastructure planning, land suitability assessment, development prioritisation and spatial infrastructure economics. Biermann was also appointed in 2005 to serve as an advisor on the Gauteng Infrastructure Committee of Inquiry and heads up a team developing an Infrastructure Investment Spatial Targeting Framework for the province.

At a joint congress of the Operations Research Society of SA (ORSSA) and the SA Institute of Industrial Engineers in May 2005, **Esbeth van Dyk** was awarded the Tom Rozwadowski medal for the best paper published by an ORSSA member. Van Dyk's paper was titled *An Analysis of the South African Fruit Logistics Infrastructure*. Van Dyk of CSIR Built Environment, also received a recognition award for her role as project manager of the Fruitlog project, a comprehensive investigation into the national fruit logistics infrastructure.

Hans Ittmann of CSIR Built Environment was invited to become a Fellow of ORSSA in recognition of his sustained contribution to operations research over a period of time. It was the first year that the society extended this honour to members; Ittmann is one of four people to become an ORSSA Fellow.

Tinus Kruger of CSIR Built Environment has been elected as a director of the board of the International Crime Prevention through Environmental Design (CPTED) Association. The association aims to promote the use of CPTED principles and strategies to create safer environments and improved quality of life.

CSIR National Laser Centre

Two researchers from the CSIR National Laser Centre, **Dr Andrew Forbes** and **Dr Lourens Botha**, were invited to contribute a chapter on "Isotope separation with Infrared laser beams" to a book with a title *Laser Beam Shaping Applications*. (Forbes A, Botha LR, Isotope separation with infrared laser beams, in *Laser Beam Shaping Applications*, Ch 5, eds FM Dickey, SC Holswade and DL Shealy. CRC Taylor & Francis Group (New York), 2005).

Natural resources and the environment

More than 1 300 experts from 95 nations recently carried out the first international scientific assessment of the planet's ecological health. The 2005 Zayed International Prize for the Environment, awarded for "scientific and or technological achievement in environment" went to scientists for their work on the Millennium Ecosystem Assessment (MEA). Several CSIR scientists played key roles in this study. CSIR fellow, Dr Bob Scholes, co-chaired one of the four global working groups that produced the study.

One of the innovative features of the MEA was the regional studies. The leading study was the Southern African Millennium Assessment published by the CSIR, and involving **Dr Bob Scholes, Dr Belinda Reyers, Oonsie Biggs, Tinyiko Malungani, Gavin Fleming and Jennie Cooper**, as well as 15 other researchers from universities throughout the region.

Dr Lindsay Linzer, senior researcher at CSIR Natural Resources and the Environment, has been appointed as the South African representative on the International Union of Geodesy and Geophysics (IUGG). Established in 1919, the IUGG is an international, non-governmental, non-profit scientific organisation whose objective is to promote and coordinate studies of physical, chemical and mathematical properties of the Earth and its environment in space.

Felicity Blakeway of CSIR Natural Resources and the Environment was recently appointed to the National Forests Advisory Council (NFAC). Blakeway and 18 other members will serve a three-year term on the council. The selection panel consisted of the Minister of Water Affairs and Forestry, Bulelwa Sonjica, the Chief Director Forestry, Linda Mossop-Rousseau, and the chairperson of the NFAC, Dinga Mncube. Blakeway, who is based in Durban, will attend four council meetings per year and participate in the work programme of the council. She has also been appointed vice-chairperson on the Committee for Sustainable Forest Management, one of the committees constituted under the NFAC.

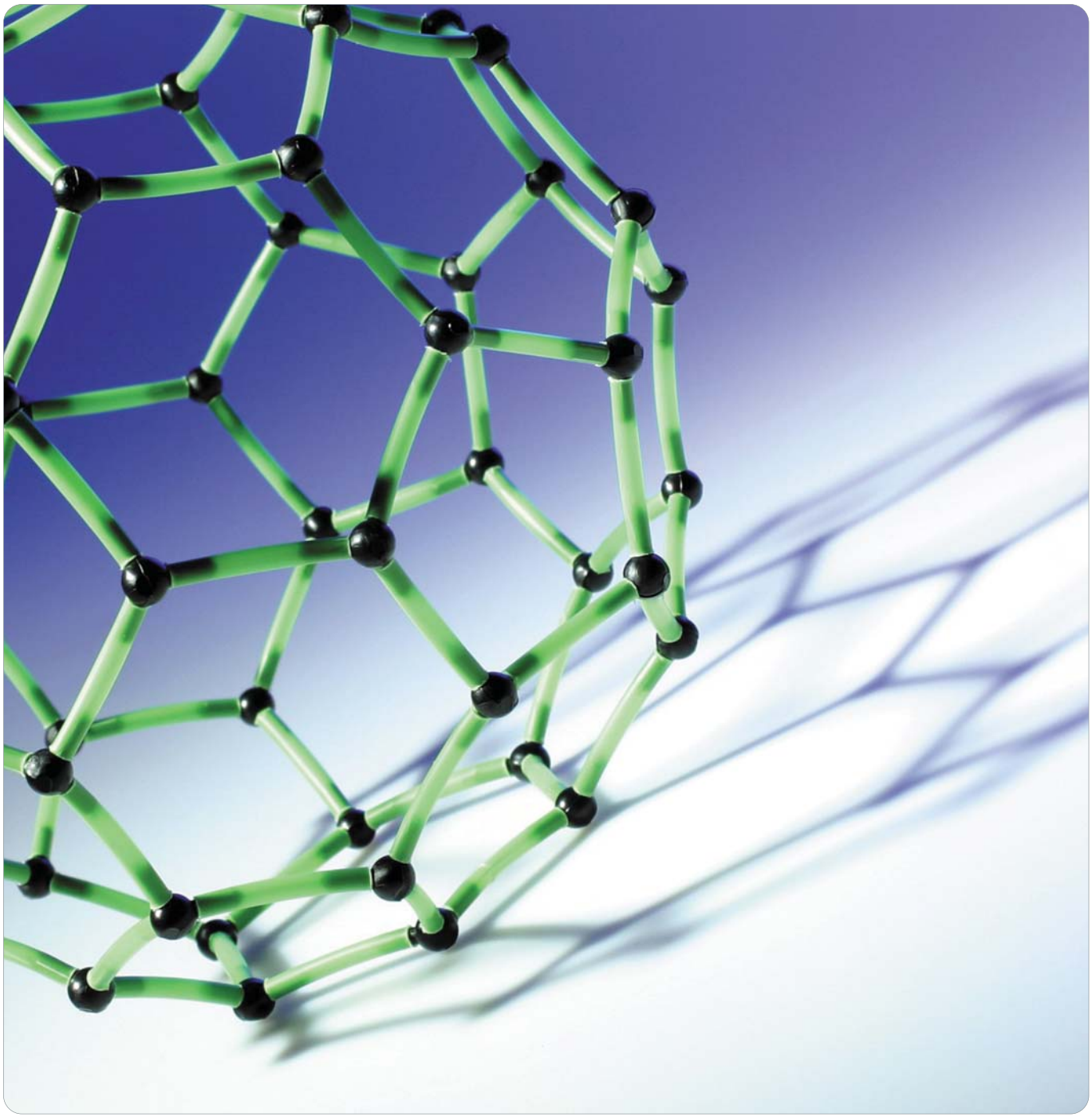
CSIR National Metrology Laboratory

Sara Prins, a researcher from the CSIR National Metrology Laboratory, was among South Africa's top women scientists honoured for their contribution to science by the DST at the Women in Science Awards. The awards were presented by the Minister of Science and Technology, Mosibudi Mangena, in Johannesburg in August 2005. Prins received a Women Scientist Fellowship for her contribution to a field where the participation by women is traditionally low, which in her case is surface and microstructure analysis. In this area, her particular focus is the development of national standards and guidelines in electron microscopy and alloy development of advanced materials for technological applications.

Information and communications technology

The Meraka Institute (a national research centre managed by the CSIR) was invited to join the Wireless World Research Forum (WWRF) by Dr Mikko Uusitalo, WWRF chair and head of international cooperation of the Nokia Research Centre. The WWRF is a prominent forum of researchers in wireless and telecommunications companies and organisations. Its current membership numbers 160. The Meraka Institute is the first member from Africa in this forum.

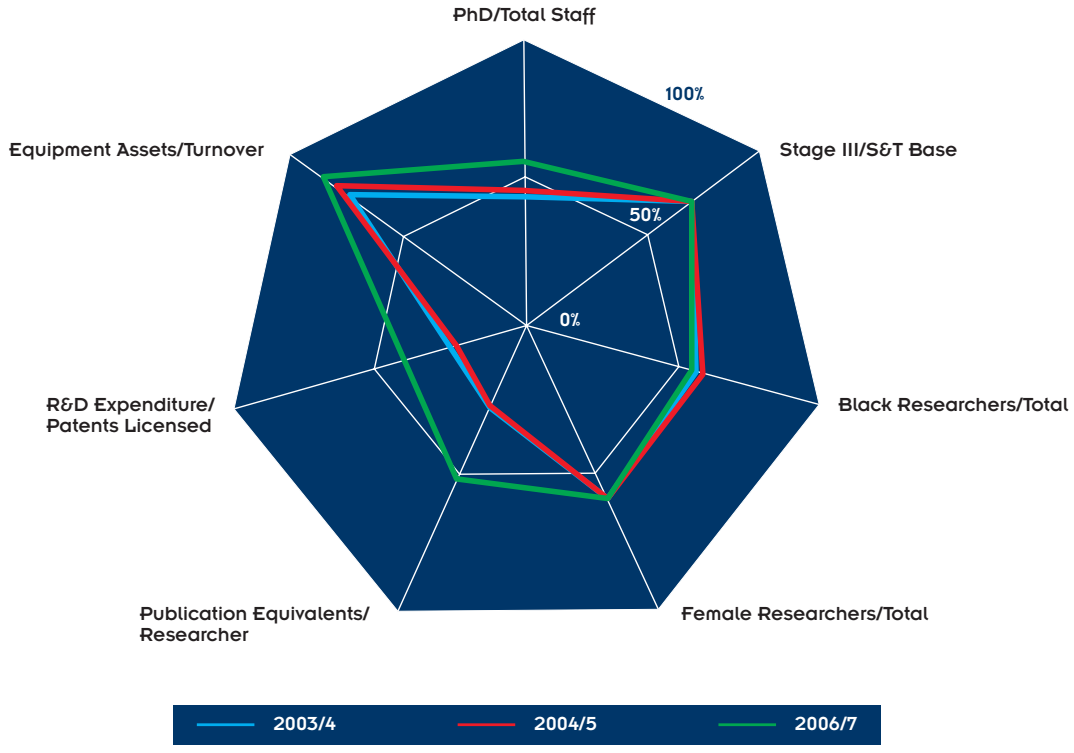
The State of Science and Technology in the CSIR



Introduction

This State of Science and Technology (SoST) report covers the results of an annual evaluation of the CSIR's science and technology (S&T) base. The report was first published in 2002, and has followed a consistent evaluation framework over the period 2002 to 2005. However, the CSIR went through a major reconfiguration in 2005 which has necessitated some revision to the SoST report. The 2006 report covers the same overall headings but there are some changes to the definition of various job categories within the S&T base. As a result, the data within the section on human resources are not strictly comparable to previous years.

The key indicators for the year 2005/6 show further improvement in most respects as compared to the 2004/5 data (see the radar plot below, which shows the main indicators normalised against the desired targets or benchmark values). Further details of the CSIR's performance relative to these indicators are as follows:



The purpose of this section is to consider whether the qualification profile of the CSIR's human capital base is sufficient to enable delivery against its key objectives (as defined in the CSIR mandate and in its strategic plan). The data are taken from the CSIR Human Resources Database, as at 31 March 2006.

The total number of employees as of this date was 2 088, down considerably from 2 379 in 2005, as a direct result of restructuring during the 2005/6 financial year. The major changes have been in the area of knowledge-based services, several of which have been discontinued. Having consolidated its research base, the CSIR is now embarking on a growth path that will strengthen its S&T core and enable it to deliver on the Beyond 60 objectives.

The qualifications and age breakdown are given in the following table. It is noted that for the first time, the information is organised according to degree categories, not years of study; this change in reporting affects mainly those employees who have an Honours degree in engineering and were previously included with the Masters graduates.

Age	Qualification Levels					Totals	Percent
	0-2 year Diploma, Matric or less	3 year BSc, BA, BTech	4 year BEng, BSc (Hons)	Masters	Doctorate		
< 30 Years	190	112	67	43	14	426	20.4%
30 - 39 Years	253	130	77	153	63	676	32.4%
40 - 49 Years	283	57	35	103	58	536	25.7%
> 49 Years	272	46	15	55	62	450	21.6%
All Ages	998	345	194	354	197	2 088	
% of Total Employees	47.8%	16.5%	9.3%	17.0%	9.4%	190	100.0%

The low fraction of employees with advanced post-graduate qualifications has been a matter of concern since the first publication of this report in 2002. It is therefore encouraging to note that as a percentage of total employees, the proportion of PhDs employed has risen for the fifth consecutive year from 7.3% as at March 2002 to 9.4% as at March 2006, in line with the organisation's plans to strengthen its S&T base. However the total number of PhD and Masters-level employees declined over the past year and the demographic profile is virtually unchanged (there is a slight increase in the proportion of younger graduates).

Further improvement will be more evident in future years following the development of a specific human capital development (HCD) strategy, focused on addressing this and other related issues. For instance, the organisation is now directly supporting a total of 233 staff members who are registered for higher degrees (mainly MSc and PhD). Implementation of the HCD strategy will assist the CSIR in reaching its own targets for researchers with an MSc or PhD (39% of total staff) and will begin to approach the international benchmark among similar research organisations in Australia, Europe and North America, which have on average 36% of their staff with PhD-equivalent qualifications.

Profile of the Research Team

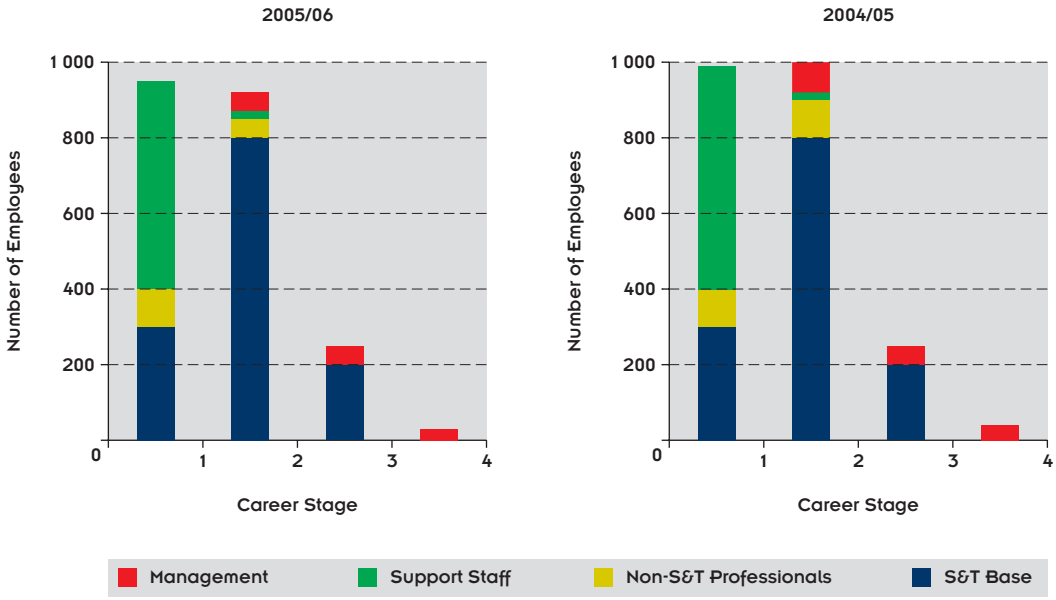
In this section, the distribution of CSIR employees is reviewed according to their role within the organisation as of 31 March 2006. The four categories are:

- **S&T base –** consisting of both research staff, who are defined as staff engaged in research and development, and in possession of a Doctorate, Masters, Honours or equivalent Bachelors (four-year degree), and the technical staff, defined as staff with a relevant diploma or technical qualification who are employed to provide technical support to researchers (including in-service trainees)
- **non-S&T professionals** – defined as staff members who are qualified as professionals, but work in a non-research capacity
- **support staff** – defined as staff who provide administrative, financial, human resource and other non-technical support to the S&T base, and whose role is also essential to the ability of the CSIR to deliver on its mandate
- **management** – defined as staff members whose role is primarily a management role (such as research, human resources, operations and competence area management).

The following diagram shows four functional categories of employees in the CSIR, as per the previous four stage career model and compared to the 2004/5 data. It is noted that 2005/6 is the last year for which such information will be provided. During the course of 2006/7, the CSIR will be implementing a new career path structure, consisting of separate paths for different categories of work and in most cases comprising five stages or layers.

The researcher and technical bases are 30% and 29%, respectively, of the total employees in the CSIR (excluding staff on special leave, bursars and students). The combined total of 59% is unchanged from the previous years, but is projected to grow significantly in the next three-year period.

S&T Profile by Employee Role



During the 2005/6 financial year, there were several initiatives within the CSIR to streamline its management and support services in order to ensure a greater proportion of its financial resources is applied in research. As a result, the support ratio, which is a measure of the number of employees in support roles relative to the S&T base, has declined from 0.55 to 0.52. The ''management ratio", which is a measure of the deployment of CSIR resources into management relative to the S&T base, has remained steady over the past five years at about 0.12.

Transformation

The purpose of these indicators is to measure the CSIR's progress towards gender and race equity across all employment levels. The relevant data, as at 31 March 2006, are shown in the table below.

		Staff with PhD, MSc or Honours Degrees	Other Qualifications	Total
Black	Number of Staff	215	767	982
	% of Category	32.5%	53.7%	47.0%
White	Number of Staff	446	660	1 106
	% of Category	67.5%	46.3%	53.0%
Male	Number of Staff	444	828	1 272
	% of Category	67.2%	58.0%	60.9%
Female	Number of Staff	217	599	816
	% of Category	32.8%	42.0%	39.1%
Total Number of Staff		661	1 427	2 088

Further separation of the data into career stages, as per previous reports, is not possible since this approach to human resource management is now being replaced by formal career paths. Future reports will also be changed as the career paths are implemented within the organisation. At this stage, it is possible only to state that the overall gender balance has remained unchanged at 39% relative to the previous years, but the proportion of black employees has increased from 44% to 47%. However the proportion of black researchers has dropped from 36% to 33% (as a percentage of the total researchers).

Technical Outputs

The purpose of these indicators is to measure the volume of the research outputs of the CSIR (see table below). All the data refer to outputs published in the 2005/6 financial year with the exception of the research papers, which are collected on a calendar year basis (in this case 2005).

CSIR Unit/ Centre	Number of Outputs[1]						
	Research Papers[2]	Conference Papers[3] (Peer Reviewed)	Books	Book Chapters	CSIR Reports[4]	Other Publications	Total Publication Equivalents[5]
Biosciences	11	0	0	0	188	10	11.0
Built Environment	12	28	1	6	41	41	37.0
Defence, Peace, Safety and Security	5	20	0	2	137	24	17.0
Materials Science and Manufacturing	7	3	0	0	84	36	8.5
Natural Resources and the Environment	41	4	4	13	183	49	76.0
Meraka Institute	2	18	0	0	21	10	11.0
National Laser Centre	2	8	0	1	31	18	7.0
National Metrology Laboratory	8	0	0	0	0	0	8.0
R&D Support	1	0	0	0	0	0	1.0
Total	89	81	5	22	685	188	176.5

Notes:

1. *All data were obtained from the CSIR's technical outputs database; the information refers to publications within the 2005/6 financial year with the exception of the "research papers", which are counted on a calendar year basis.*
2. *The category of "research papers" refers to peer-reviewed articles in accredited journals only.*
3. *The category of "peer-reviewed conference proceedings" refer to proceedings that are both peer reviewed and published in a set of proceedings with an ISBN number.*
4. *Mainly internal and client reports, in any medium, provided they are issued a CSIR number. Many of these are peer reviewed, and the majority are available in the public domain.*
5. *All other publications including dissertations, monographs, posters and non-peer reviewed conference proceedings or journal articles.*
6. *In order to increase the comparative value of the data, the CSIR is now reporting its publication output in the form of publication equivalents, measured according to the standard guidelines from the Department of Education. At present, no adjustment is made for co-authorship; as a result publications that are co-authored with external researchers are counted as a single unit, as opposed to a fraction of a unit as recommended by the Department of Education guidelines.*

[1] It is noted that the present output of South African TEIs is about 0.4 publication equivalents per full-time equivalent researcher per year.

In this report, the publication data are reported in more detail due to the increasing emphasis that the CSIR places on publications as a measure of S&T output. For instance, in 2005/6 publication equivalents were for the first time formally included in the key performance indicator (KPI) measures, both for the CSIR as a whole and for the individual units and centres. As a result, the total number of publication equivalents has increased sharply, mostly as a result of the contribution of published and peer-reviewed conference proceedings. On the other hand, the number of publications recorded by ISI Web of Science has remained static and the average citation frequency, taken over a moving 10-year window period, has fallen. While the system has its critics, peer-reviewed publication output remains a widely used approach to the measurement of research output and further improvements in this area, such as reaching the organisation's goal of 0.5 publication equivalents per researcher per year, are anticipated[1].

The citation frequency for CSIR publications is given in the table below; as for 2005, the frequencies are similar to the ISI averages, with the exception of 1999, which was obviously a poor year for the CSIR. As noted, the average citation frequency over the past 10 years has fallen from 5.9 in 2004/5 to 5.5 in 2005/6. This indicator will be monitored in future years to determine if the decrease is part of a longer term trend indicative of a decline in the impact achieved by CSIR publications.

Year	Peer-reviewed Publications (ISI)	Total Citations	Citation Frequency (CSIR)	Citation Frequency (ISI)
1996	64	806	12.6	14.6
1997	73	723	9.9	14.0
1998	73	503	6.9	13.2
1999	68	244	3.6	11.9
2000	65	474	7.3	10.6
2001	77	545	7.1	8.8
2002	61	202	3.3	6.8
2003	85	273	3.2	4.6
2004	72	136	1.9	2.5
2005	73	27	0.4	0.6

The CSIR patent output is shown in the following table; the data have been disaggregated into the categories of local and PCT applications, local and international registrations granted, patents licensed and royalty income, the latter including all forms of income derived from the sale of intellectual property. Although a benchmark of 0.017 patent per researcher per year was previously used, this figure is not useful due to the varying review procedures and standards of different patent offices. A more useful benchmark is R&D expenditure per licensed patent (R50 million per patent licensed) and royalty income as a percentage of total research expenditure (2%). The CSIR figures for 2005/6 are R120.5 million and 1.0%, respectively. The former figure is a significant improvement as compared to the equivalent figure in 2004/5 of R217 million per licensed patent.

CSIR Unit/Centre	Number of Patents					Royalty Income (R mil)
	RSA Applications[1]	International & PCT Applications	RSA Granted	International Granted	Licensed	
Biosciences	2	8	0	2	4	0.35
Built Environment	0	0	0	0	0	0.00
Defence, Peace, Safety and Security	3	8	0	0	0	1.02
Materials Science and Manufacturing	0	2	0	0	0	0.51
Natural Resources and the Environment	4	2	1	1	0	0.83
Meraka Institute	0	0	0	0	1	0.00
National Metrology Laboratory	0	0	0	0	0	0.02
All CSIR	9	20	1	3	5	2.73

Notes:

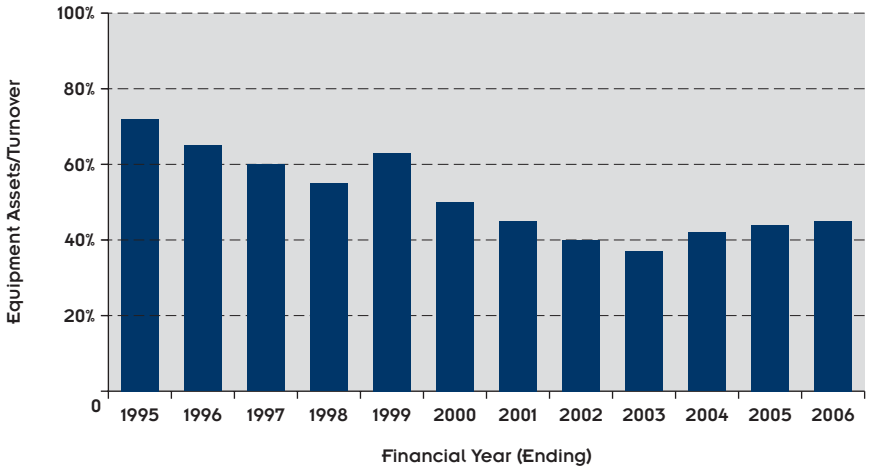
1. *Patent applications refer to new applications only; repeat filings of previous provisional applications are not included.*
2. *The same patent filed in different countries is not counted more than once.*

In addition to patents and publications, the CSIR also produces other forms of technical outputs such as technology demonstrators and designs. For instance, during the 2005/6 financial year, the organisation produced an estimated 12 technology demonstrators. The R&D Outcomes Office will be compiling more comprehensive reports for such categories in future reports.

Investment in Scientific Infrastructure

The purpose of this indicator is to show whether the investment in research infrastructure is sufficient to allow CSIR researchers to undertake their work. As for previous years, two indicators have been used, namely the value of the equipment assets at cost expressed as a percentage of the CSIR's financial turnover for the same year (benchmark is 55%), and the investment in scientific equipment[2] during the financial year, also expressed as a percentage of the total financial turnover for the same year (benchmark is 10%).

The latter value is R42.75 million or 4.2% of turnover; this compares to R42.57 million or 4.2% of turnover in 2004/5, indicating little improvement over previous years. It is clear that further investment is required to meet the benchmark of 55% (assets to turnover; see figure below), although it is likely that the full value of new equipment acquired during the past financial year may not be reported in the assets register for a number of reasons. In order to obtain better data, and to encourage increased re-investment in capital equipment, this indicator has been formally included in the CSIR KPIs for the 2006/7 financial year.



Office of the Group Manager: Research and Development

[2] Scientific equipment excludes vehicles, buildings, land, and low-value items (<R15 000)

Annual

Financial Statements

Corporate Governance

Governance Principles

Framework

Corporate governance is formally concerned with the organisational arrangements that have been put in place to provide an appropriate set of checks and balances within which the stewards of the organisation operate. The objective is to ensure that those to whom the stakeholders entrust the direction and success of the organisation act in the best interest of these stakeholders. It is about leadership with integrity, responsibility and transparency.

The CSIR is committed to principles and practices that will provide our stakeholders with the assurance that the organisation is managed soundly and ethically. We have established a management model that governs and provides guidance for the way that all employees, not only the leaders, interact with our various stakeholder groups.

The underpinning principles of the group's corporate governance rest upon the three cornerstones of an effective and efficient organisation, namely day-to-day management processes, a long-term strategic planning process and effective change processes. These processes are supported by systems that are used to plan, execute, monitor and control the strategic and operational domains of the organisation. The supporting infrastructure and its evolution are documented in our management model, which is reviewed and updated regularly.

The CSIR Board and the CSIR Executive Board believe that the organisation has applied and complied with the principles incorporated in the Code of Corporate Practices and Conduct, as set out in the King II Report.

Financial statements

The CSIR Board and the CSIR Executive Board confirm that they are responsible for preparing financial statements that fairly present the state of affairs of the group as at the end of the financial year and the results and cash flows for that period. The financial statements are prepared in accordance with statements of South African General Accounting Practice. In addition, the CSIR Board is satisfied that adequate accounting records have been maintained.

The external auditor is the Auditor-General, who is responsible for independently auditing and reporting on whether the financial statements are fairly presented in conformity with statements of International Auditing Standards. The Auditor-General's terms of reference do not allow for any non-audit work to be performed.

Risk management

In the case of risk management, the CSIR Board is accountable for the process of risk management and the systems of internal control. These are reviewed regularly for effectiveness. Appropriate risk and control policies are established and communicated throughout the organisation. The CSIR Board retains control through the final review of key risk matters affecting the organisation.

Risk management in the CSIR is an ongoing process and is focused on identifying, assessing, managing and monitoring all known forms of significant risk across all operating units and group companies. This has been in place for the year under review and up to the date of approval of the annual report and financial statements.

A structured process of risk management has been put in place to ensure that the growth and development of human capital, strengthening of the SET base, increased impact, operational excellence and financial sustainability will be achieved over time.

CSIR systems have been put in place to review aspects of economy, efficiency and effectiveness. Management is involved in a continuous process of improving procedures to ensure effective mechanisms for identifying and monitoring risks, such as skills, technology, contracting, research and related ethical issues, investment of the Parliamentary Grant (PG), legislation compliance, professional liability and general operating risks. Equal consideration is given to matters of safety, health and the environment as to the more obvious risks, such as financial risks.

Documented and tested processes are in place, which will allow the CSIR to continue its critical business process in the event of a disastrous incident impacting on its activities.

Operating risk management

The CSIR endeavours to minimise operating risk by ensuring that the appropriate infrastructure, controls, systems and people are in place throughout the group. Key practices employed in managing operating risk include segregation of duties, transaction approval frameworks, financial and management reporting and monitoring of metrics, which are designed to highlight positive or negative performance across a broad range of key performance areas. The Operations Committee, which is constituted by members of the Executive, operating unit/centre Executive Directors and Group Managers, oversees all operational matters. This Committee meets weekly.

Financial risk management

Financial risks are managed within predetermined procedures and constraints as identified and detailed in the various policies and the setting of annual goals and objectives. Compliance is measured through regular reporting against the business goals, internal audit checks and external audit verification.

Going concern

The CSIR Board has reviewed the group's financial budgets for the period 1 April 2005 to 31 March 2007 and is satisfied that adequate resources exist to continue business for the foreseeable future. The CSIR Board confirms that there is no reason to believe the business will not be a going concern in the year ahead.

Approval framework

The CSIR Board has adopted an approval framework that governs the authorisation processes in the CSIR. It deals with, inter alia, the construction of strategic plans, development of business plans and budgets, appointment of staff, approval of salaries and acquisition and disposal of assets. It also defines authority levels in relation to organisational positions.

Appropriate controls are in place to ensure compliance with the above framework. A comprehensive set of procedures exists to provide the necessary checks and balances for the economical, efficient and effective use of resources. The essence of this framework is that it is comprehensive, clear and unambiguous, and easy to assimilate and internalise.

Each group company's board of directors adopted an approval framework, which mirrors that of the CSIR. All group companies are under the control of the CSIR Board and CSIR Executive Board.

Internal control

The CSIR Board has ultimate responsibility for the system of internal controls. The key controls required to ensure the integrity and reliability of financial statements have been identified by the internal auditors. Close cooperation between the external and internal auditors ensures adequate and efficient audit reviews of the proper functioning of these key controls.

The annual audit plan is based on the key financial risks to the organisation. The work programme that gives effect to the plan is reviewed by the Audit Committee at its February meeting and ratified or modified, as required.

Employee participation

The CSIR strongly encourages effective and modern workplace practices and relationships to foster employee participation and work process involvement as a key practice at all levels in the organisation. Employee participation happens, for example, through self-directed teams, a management development programme, formal induction programmes, technical and strategic focus groups and task teams.

Charter of Ethics and organisational values

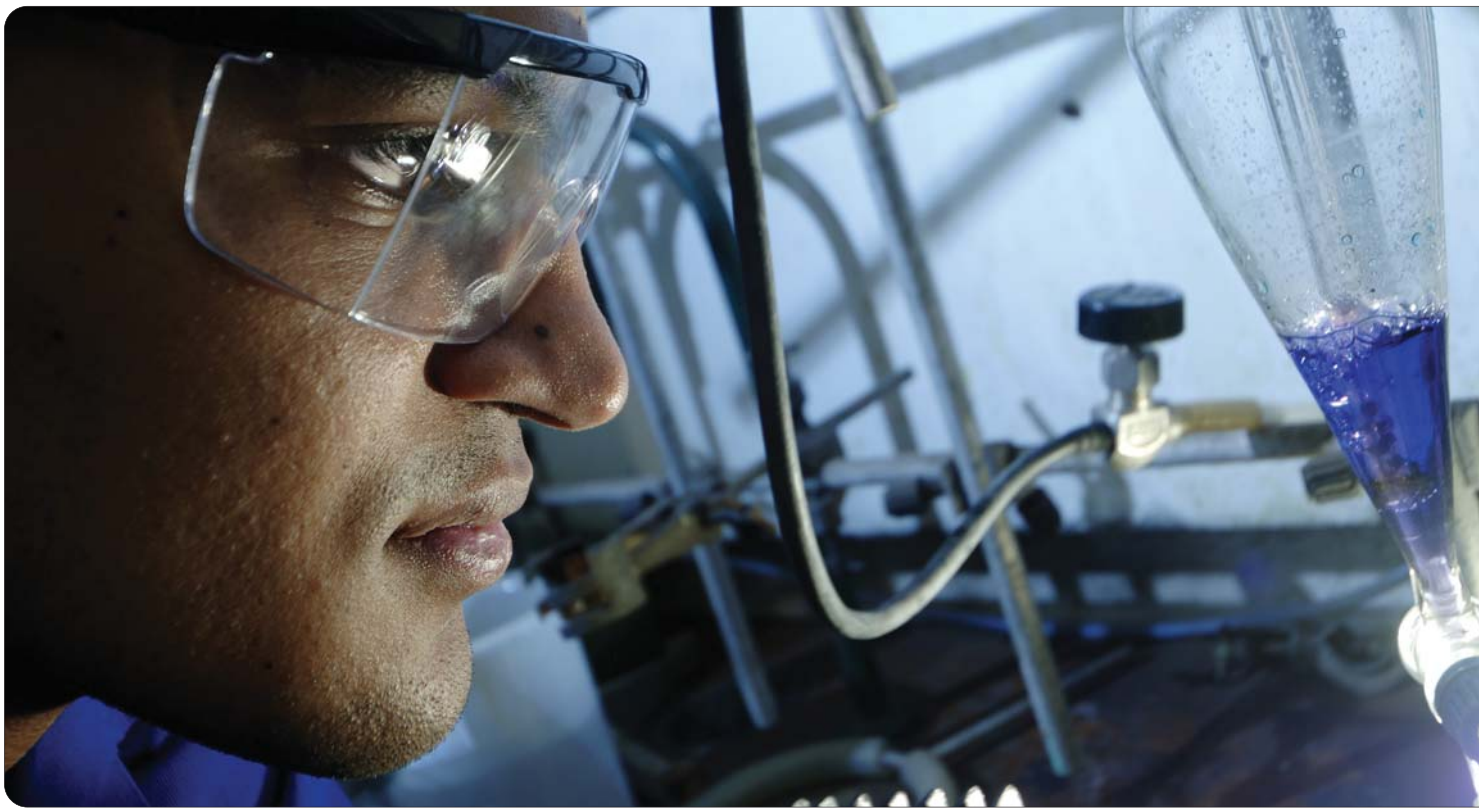
The CSIR Board and CSIR Executive Board have approved and adopted a Charter of Ethics, which reflects its commitment to a policy of fair dealing and integrity in conducting its business. The Charter, which incorporates the CSIR's Code of Conduct and links closely to its set of values, requires all employees to maintain the highest ethical standard, ensuring that business practices are conducted in a manner which, in all reasonable circumstances, is beyond reproach. Monitoring ethical behaviour is devolved to unit level and transgressions are addressed by means of procedures detailed in the CSIR's Conditions of Service and the Public Finance Management Act (PFMA), Act 1 of 1999, as amended by Act 29 of 1999.

The Board is satisfied there has been compliance with the Charter of Ethics.

Safety, Occupational Health and Environmental Management (SHE)

As a corporate citizen, the CSIR acknowledges its obligation to its employees and the communities it serves in conforming to safety, health and environmental laws and the internationally-accepted standards and practices. The CSIR maintained its certification to ISO 14001 and OHSAS 18001 and achieved a DIFR of 0.5 (below a target of < 1.0) and a reduction in the number of claims to the Compensation Commissioner. Various units achieved certification and/or accreditation to ISO 9001 and/or ISO 17025. A protocol for the management of organisational policies and procedures was developed and a Policy Review Committee was formed to review a number of organisational policies to ensure alignment with the Beyond 60 objectives.

With the emphasis on SET excellence, the CSIR adopted an integrated approach to management of business systems and more emphasis was placed on Good Laboratory Practice (GLP) implementation, heath and safety and environmental management. The CSIR is firmly on the road to achieving the highest standards of operational efficiency and effectiveness in all its activities and continuously improves its processes for the benefit of its stakeholders and clients.



CSIR Board

The responsibilities of the Board are governed by the Scientific Research Council Act, Act 46 of 1988, as amended by Act 71 of 1990. The Board approves the mission, strategy, goals, operating policies and priorities for the organisation and monitors compliance with policies and achievement against objectives.

CSIR Board members are appointed for a term of three years by the Minister of Science and Technology. The new CSIR Board was appointed with effect from January 2006. Some of the previous members have been re-elected to ensure continuity, while new members will provide fresh inputs. With the exception of the President of the CSIR, all the members of the CSIR Board are non-executive. CSIR Board members are actively involved in, and bring independent judgement to bear on Board deliberations and decisions. The CSIR Board, whose current number of members adheres to the statutory minimum requirements, meets quarterly. For the year under review, the Board met on 22 June 2005, 5 October 2005 and 22 February 2006. The annual financial statements for 2005/6 were approved on 7 June 2006.

The CSIR Board has the following committees: the Human Resources and Remuneration Committee, the Audit Committee and the Strategic Review Committee (see page 80). These committees are selected according to the skills sets required for the committees to fulfil their functions. The committees have complied with their respective terms of reference. An important initiative is a formal and structured Board induction process designed to provide new Board members with an understanding of the business and the associated risks. This induction took place for the new Board members appointed.

Schedule of attendance at CSIR Board and CSIR Board Committee meetings:

Board Member		Board Meetings (4)	Audit Committee (2)	Human Resources and Remuneration Committee (2)	Strategic Review Committee
Roger Jardine	❊	3		1	
Prof Cheryl de la Rey	✹	4			1
Dr Sibusiso Sibisi	✹	4	2	2	1
Imogen Mkhize	❊	3		1	
Dr Nhlanhla Msomi	✹	3		2	
Dr Zavareh Rustomjee	❊	0	2		2
Kymus Ginwala	❊	3			
Lionel October	❊	0	0		0
Nobusi Shikwane	✹	4	2	2	
Prof Mike Wingfield	✹	4			2
Dr Nomsa Dlamini	▲	1			
Dr Francis Petersen	▲	1	0		

❊ - Board member up to December 2005

✹ - Reappointed to Board with effect from January 2006

▲ - New Board member with effect from January 2006

Executive Management Board

The Executive Management Board has executive responsibility for the CSIR and consists of the Chief Executive Officer (CEO) and three Group Executive members responsible for the portfolios of Institutional Planning and Operations; Finance and Services; and Research and Development and Strategic Human Capital Development. The Executive Management Board meets weekly.

Changes to the Executive Management Board

Vishnu Pillay was appointed the Group Executive Member responsible for Institutional Planning and Operations. We welcome and congratulate him on this appointment. We took leave of Dr Phil Mjwara, CSIR Group Executive: R&D and Strategic Human Capital Development, on 31 March 2006 and wish him all the best in his new position as Director-General of the Department of Science and Technology.

CSIR Leadership Team

The CEO of the CSIR is the President. The CSIR Leadership Team is responsible for strategy implementation and managing the day-to-day affairs of the CSIR and its operating units in accordance with the policies and objectives approved by the CSIR Board. This Leadership Team comprises the members of the CSIR's Executive Board, Group Managers, and Operating Unit/Centre Executive Directors.

Board of Directors of Group Companies

The CSIR Executive has control over the Boards of the various group companies.

Board and Executive Management remuneration

Details of the CSIR Board are set out on page 78 and 79 of the Corporate Governance Report. The membership and terms of reference of each Board Committee are further described on page 78 and 79 of the Corporate Governance Report.

Remuneration to Board members and the Executive Management is set out in the annual financial statements.

General

The CSIR acknowledges that systems of corporate governance should be continuously reviewed to ensure that they are sound and consistent with world-class standards in a way that is relevant to the business of the group and the evolution thereof.

We shall continue to comply with all major recommendations of the Code of Corporate Practices and Conduct as set out in the King II Report on Corporate Governance.

Public Finance Management Act

The Public Finance Management Act (PFMA), Act 1 of 1999, as amended by Act 29 of 1999, came into effect on 1 April 2000 and has had an impact on governance matters in terms of the regulation of financial management in the public sector. The group complies, in all material aspects, with the Act.

Materiality framework

The materiality framework for reporting losses through criminal conduct and irregular, fruitless and wasteful expenditure, as well as for significant transactions envisaged per section 54(2) of the PFMA, has been finalised and incorporated into the shareholder compact. No significant losses through criminal conduct and irregular fruitless and wasteful expenditure were identified as having been incurred during the year.

CSIR Board members

Roger Jardine

Chairperson of the Board up to December 2005

Chief Executive, Kagiso Media

Imogen Mkhize

Member up to December 2005

CEO, World Petroleum Congress 2005

Kymus Ginwala

Member up to December 2005

Northern Research and Engineering Corporation, USA

Prof Cheryl de la Rey

Re-appointed to the new Board with effect from January 2006

Deputy Vice-Chancellor: Research and Innovation, University of Cape Town

Dr Nhlanhla Msomi

Re-appointed to the new Board with effect from January 2006

CEO, East Coast Biotechnology Innovation Projects

Lionel October

Member up to December 2005

Deputy Director-General: Enterprise and Innovation, Department of Trade and Industry

Dr Zavareh Rustomjee

Member up to December 2005

Executive Director, Southern Africa Energy, BHP Billiton

Nobusi Shikwane

Re-appointed to the new Board with effect from January 2006 and now Chairperson

CEO, Tshenolitha Business Services

Prof Mike Wingfield

Re-appointed to the new Board with effect from January 2006

Director, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria

Dr Nomsa Dlamini

New member with effect from January 2006

Managing Director, Masifundisane Training

Dr Francis Petersen

New member with effect from January 2006

Head of Strategy, Anglo Platinum

Dr Sibusiso Sibisi

CSIR President and CEO

CSIR Board Committees 2005/2006

Committee: **Audit**

Members: Nobusi Shikwane (Chairperson)
Dr Zavareh Rustomjee
Lionel October
Dr Sibusiso Sibisi

Meetings: 16 February 2006
9 June 2005

Purpose: Deals with all matters prescribed by the regulations issued in terms of the PFMA, Act 1 of 1999. Controls the final reviews of the key risk matters affecting the organisation. Agrees on the scope and reviews the annual external audit plan and the work of the CSIR internal auditors. Acts in an unfettered way to understand the dynamics and performance of the organisation with no artificial boundaries created by protocol. The Audit Committee has adopted formal terms of reference and is satisfied that it has complied with its responsibilities as set out in the terms of reference.

Committee: **Human Resources and Remuneration**

Members: Roger Jardine (Chairperson)
Nobusi Shikwane
Dr Nhlanhla Msomi
Imogen Mkhize
Dr Sibusiso Sibisi

Meetings: 22 September 2005
25 May 2005

Purpose: Provides the vehicle for the CSIR Board to influence and control human resources and remuneration in the organisation. Determines human resources policy and strategy. Approves remuneration changes and bonus payments. In addition, it reviews the remuneration and expenses of Executive Management.

Committee: **Strategic Review**

Members: Dr Zavareh Rustomjee (Chairperson)
Prof Cheryl de la Rey
Lionel October
Prof Mike Wingfield
Dr Sibusiso Sibisi

Meetings: 10 February 2006
27 October 2005

Purpose: Provides guidance and advice on the long-term trajectory and composition of the CSIR's science and technology portfolio in the context of the needs of the country. Ensures that key innovation and research processes are conducted effectively and benchmarked against international best practice, and that research outputs, organisational climate and credibility remain congruent with the role and objectives of the institution.

Report of the Audit Committee

Report of the Audit Committee required by Treasury Regulations 27.1.7 and 27.1.10 (b and c) of the Public Finance Management Act, Act 1 of 1999, as amended by Act 29 of 1999

The Audit Committee reports that it has adopted formal terms of reference as its Audit Committee Charter, and that it has discharged all of its responsibilities for the year, in compliance with the charter.

The Audit Committee is satisfied that an adequate system of internal control is in place to reduce significant risks faced by the organisation to an acceptable level, and that these controls have been effective during the period under review. The system is designed to manage, rather that eliminate, the risk of failure and to maximise opportunities to achieve business objectives. This can provide only reasonable, but not absolute, assurance.

The Audit Committee has evaluated the Annual Financial Statements of the CSIR group for the year ended 31 March 2006 and based on the information provided to the Audit Committee, considers that it complies, in all material respects with the requirements of the various Acts governing disclosure and reporting in the annual financial statements. The Audit Committee therefore recommends the adoption of the annual financial statements by the Board of the CSIR.

Nobusi Shikwane
Chairperson
7 June 2006

Report of the Auditor-General

Report of the Auditor-General to Parliament on the Financial Statements and Group Financial Statements of the CSIR for the year ended 31 March 2006

Audit Assignment

The financial statements, as set out on pages 106 to 137, for the year ended 31 March 2006 have been audited in terms of section 188 of the Constitution of the Republic of South Africa, 1996, read with sections 4 and 20 of the Public Audit Act (Act No 25 of 2004) and section 14(1) of the Scientific Research Council Act (Act No 46 of 1988) as amended by Act No 71 of 1990. These financial statements are the responsibility of the accounting authority. My responsibility is to express an opinion on these financial statements, based on the audit.

Scope

The audit was conducted in accordance with the International Standards on Auditing read with General Notice 544 of 2006, issued in Government Gazette No 28723 of 10 April 2006 and General Notice 808 of 2006, issued in Government Gazette No 28954 of 23 June 2006. These standards require that I plan and perform the audit to obtain reasonable assurance that the financial statements are free of material misstatement.

An audit includes:

- examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements
- assessing the accounting principles used and significant estimates made by management evaluating the overall financial statement presentation.

I believe that the audit provides a reasonable basis for my opinion.

Audit Opinion

In my opinion, the financial statements present fairly, in all material respects, the financial position of the CSIR and the group at 31 March 2006 and the results of its operations and its cash flows for the year then ended, in accordance with South African Statements of Generally Accepted Accounting Practice and in the manner required by the Public Finance Management Act (Act No 1 of 1999).

Appreciation

The assistance rendered by the staff of the CSIR during the audit is sincerely appreciated.

N Manik for Auditor-General
Pretoria
10 July 2006

AUDITOR-GENERAL

Executive Report

Introduction

On behalf of the CSIR Board, we have pleasure in submitting to Parliament, through the Minister of Science and Technology, this report and the audited financial statements of the CSIR group for the year ended 31 March 2006.

In the opinion of the CSIR Board, which fulfils the role of executive directors as envisaged by the Companies Act, Act 61 of 1973, the financial statements fairly reflect the financial position of the CSIR group as at 31 March 2006 and the results of its operations for the year then ended.

Our statutory basis

As a statutory research council established by government, the CSIR is governed by the Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990). The organisation is listed as a Public Business Enterprise in terms of the PFMA, Act 1 of 1999, as amended by Act 29 of 1999.

Our mandate

The CSIR's mandate is as stipulated in the Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990), section 3: Objects of CSIR:

"The objects of the CSIR are, through directed and particularly multi-disciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

Realignment with our core purpose

In order to more effectively fulfil its mandate of improving the quality of life of all South Africans, the CSIR embarked on a

transformation process, which was implemented in the course of 2005/6, to ensure that the organisation returns to its core science purpose. This entailed a fundamental change in priorities, with increasing emphasis on:

- strengthening the S&T base of the organisation
- building and transforming human capital
- performing relevant knowledge-generating research.

While retaining the excellence in operational integrity and financial sustainability, the CSIR's scope of activities will focus on growing the S&T base of the organisation so as to optimise the organisation's relevance to national priorities and contribute meaningfully to the development of the African continent. Building on a solid foundation, the CSIR is entering an era of regeneration in S&T towards building a national icon that will make a visible difference to our country.

Organisational priorities

Refocusing on the science core of the CSIR ensures that the organisation is strengthened in the arena of science that pursues outcomes addressing the challenges of sustainable socio-economic development. The key building blocks include:

- emerging research areas that comprise new areas of science that the CSIR wishes to pursue
- the core R&D base made up of five operational areas: biosciences; the built environment; defence, peace, safety and security; materials science and manufacturing; and natural resources and the environment
- four national research centres: Meraka Institute, the CSIR National Laser Centre, the CSIR National Metrology Laboratory and the CSIR Satellite Applications Centre
- CSIR Knowledge Services, which manages the routine and recurring application of knowledge in the CSIR, encompassing specialised and differentiated services
- CSIR Shared Services, designed to combine economies of scale achieved through the pooling of resources and the responsiveness of decentralised decision-making.

The organisational structure has evolved to take cognisance of the ratio of work between knowledge generation and application. The knowledge application aspect of the innovation value chain will be structured on a commercial basis, while the Parliamentary Grant (PG) will be deployed primarily for knowledge generation, and will be at the core of scientific and technological growth.

The essence of our strategy

The CSIR takes into account the needs of society, government and business. Whilst participating on global and regional platforms, the CSIR at the same time undertakes to make a positive contribution to our country's national imperatives. Our activities in the year under review reflect the CSIR's commitment to the upliftment of South Africa and the African continent through performing relevant knowledge-generating research and technology transfer, its progress in building a solid S&T base and its efforts in building human capital.

Furthermore, in an effort to contribute to placing our continent on a path of sustainable

growth and development, the CSIR supports and actively participates in NEPAD. In all its endeavours, the organisation strives to achieve a balance between sustainable development, sustainable business and a sustainable knowledge base, underpinned by quality and good practice.

Our goals

The CSIR's strategy for 2005/2006 translates into organisational priorities, informed by the DST framework, against which our performance is measured both quantitatively and qualitatively.

The CSIR's current five-year strategy largely shapes its agenda until 2008 and was informed by the DST's National R&D Strategy. It crafted the CSIR's response towards ensuring alignment with the national vision, and defined the following areas of relevance that need to be addressed:

- alignment with South Africa's National R&D Strategy
- SET excellence
- innovation and business excellence
- contributing to sustainable development
- accessing and developing the best minds.

In our quest to ensure that the CSIR continues to grow in the spirit of our mandate, we review our activities against the DST's Balanced Scorecard Framework, guided by our goals. In this way, we can build on the foundations already laid to advance towards a desired future in which the CSIR will continue to have relevance and impact. The following pages outline, in broad detail, the parameters within which we focus our operations to the benefit of the people of South Africa.

Alignment with strategic government initiatives

Supporting the National R&D Strategy through our contributions to various strategic initiatives

The continued development of the Advanced Manufacturing Technology Strategy (AMTS) with contributions to the aerospace initiative

The national AMTS implementation unit, launched by the DST and based on the CSIR Pretoria site, aims to support the growth and competitiveness of the South African manufacturing sector through the advancement of technological innovation. The focus is on the aerospace and automotive sectors founded on their ability to support the AMTS objective of increasing South Africa's Competitive Industrial Performance Index (CIPI). A focus on these areas will tend to have spin-offs in various other sectors and will draw substantially on advanced materials technologies, advanced product and process technologies and ICT and electronics. Read about the implementation of the first regional AMTS on page 34 in the R&D Highlights of this report.

Three cross-cutting, technology-focused Flagship Programmes were initiated for the 2005/2006 financial year.

Flagship Programme 1

Creation of a world-class competency in advanced lightweight materials that:

- reduce airframe weight and increase South African world market share of aero structures
- reduce the weight of automotives and increase South African local content
- facilitate beneficiation of local materials.

Flagship Programme 2

Creation of a world-class competency in advanced electronics that increases South Africa's world market share of the aerospace and automotive sectors.

Flagship Programme 3

Development and integration of advanced production technologies to enable South Africa to achieve Flagship Programme targets and become a world-class manufacturing nation.

The themes of the Flagship Programmes were strongly motivated by the Aerospace Network Core Group established during the past year. Comprising leading players in the aerospace industry, including Denel, Aerosud, ATE, SAAB and Turbomeca, the Core Group has advised the AMTS on issues that affect the broader aerospace network which currently consists of 85 private sector companies, 15 academic institutions and a number of government departments. The outcome has been a series of interest groups for composites, investment casting and electronics. The active participation of these interest groups has confirmed their suitability and a number of project proposals with the potential for cross-sectoral application have been received from task teams within these groups.

The further development of supply chain management/logistics

Second annual State of Logistics survey

The second annual national State of Logistics survey, conducted by the CSIR and Stellenbosch University Business School and published in November 2005, re-emphasised the importance of logistics and supply chain management for the South African economy. The survey once again identified the biggest logistics cost driver in South Africa as transportation costs. The outcomes of the survey are outlined in the R&D Highlights of this report on page 6. It is envisaged that the State of Logistics survey will become the premier reference for logistics in South Africa.

Logistics strategy to improve agriculture's competitiveness

An assessment of South Africa's agro-logistics system, commissioned by the Department of Agriculture, has identified critical areas of investment for the agricultural industry. The study, as described briefly in the R&D Highlights of this report on page 6, comprised a survey of the views of industry and logistics service providers, an assessment of the status of emerging farmer logistics issues, case studies of initiatives undertaken in development nodes and scenario development and modelling.

Supporting the biotechnology strategy through the biotechnology regional innovation centres

The CSIR contributes to national biotechnology priorities through funding from the Biotechnology Innovation Centres (BRICS). One of the projects completed, in collaboration with the University of Cape Town and LIFElab, involves the manufacture of active pharmaceutical ingredients for highly active anti-retroviral treatments (HAART) using a proprietary biocatalysis and liquid fermentation technology. Benefits include overall process efficiencies of the drugs and lower manufacturing cost.

With the support of the BioPAD regional innovation centre, the CSIR has been involved in various successful projects: the use of a microorganism to limit loss in ornamental fish by preventing bacterial ulcer (technology licensed to BaoBio Holdings (Pty) Ltd); technology to convert the waste component aloeresin A to high-value aloeresin for the international cosmetic market (in collaboration with the Agricultural Research Council); production of food and perfumery flavours using South African micro-organisms.

Supporting the ICT mission (including open source)

The Meraka Institute, hosted by the CSIR, has been working closely with the DST in the development of the ICT R&D and Innovation Strategy. The strategy builds on the National R&D Strategy of 2002, which identifies ICT as a key new technology platform. Issues addressed in the ICT strategy include the current high reliance on imported technology, the need for stronger R&D capacity – including advanced skills – and the need for improved innovation performance.

The Meraka Institute took on the role of secretariat for the strategy working group and the expert group on behalf of the DST. As part of its function, the institute developed a baseline study that collated relevant national and international data and other background material for the strategy working and expert groups, which comprised Meraka staff members, representatives from government, academia and industry. The secretariat facilitated interaction with international experts who reviewed the strategy, and it assisted with the editing of the strategy document.

The strategy is currently in the final stages of approval and is expected to be published during 2006. The Meraka Institute will also be supporting the DST in the implementation of the strategy through managing and implementing a national consultative process to engage stakeholders and interested parties in understanding and contributing to the implementation of the strategy. The institute is also envisaged as a key vehicle for implementation of the interventions proposed in the strategy. The R&D Highlights section on page 6 of this report briefly touches on projects undertaken by the Meraka Institute.

Supporting the poverty alleviation mission

During the 2005/2006 financial year, the CSIR has been involved in the creation and/or incubation of more than 50 community projects and enterprises throughout the country. These poverty alleviation initiatives have had a direct impact on about 750 people.

Most of the initiatives have been undertaken in close collaboration with the DST, the Department of Arts and Culture and the Provincial Government of the Western Cape, who also provided the necessary funding. The majority of the projects are located in rural and peri-urban areas that have high unemployment levels.

A range of projects have been undertaken, including leather beneficiation, essential oils, medicinal plants, hydroponically-grown herbs, herbal tea, mopane value addition, textiles and craft. A highlight of the year was when the Beaufort West Hydroponics Company received an Impumelelo Gold award in recognition of its role in alleviating poverty and enhancing the quality of life of a poor community.

A structured approach has been used to implement poverty alleviation initiatives. This approach is designed to take a product or business idea through various activities so that a sustainable enterprise is eventually created. This model will form the basis through which the newly created Technology Transfer for Social Impact (TTSI) office will undertake poverty alleviation initiatives.

Policies and practices to promote application of R&D outcomes for public good

The R&D outcomes portfolio in the organisation has been strengthened with a focus on dissemination of knowledge, management of intellectual property (IP) to maximise national benefit and the establishment of mechanisms to assess the impact achieved through the CSIR's research.

Technological outcomes also take the form of products and new knowledge, which are both socially and economically beneficial. This may be achieved through direct technology transfer to stakeholders or via intermediaries that provide stakeholders with access to products and services. In order for the technologies to have the desired social impact, they need to be affordable, accessible and appropriate.

The CSIR has established a vehicle with a strong focus on transferring knowledge and technologies for greater social impact. The purpose of the newly formed Technology Transfer for Social Impact (TTSI) office is to capture the opportunities that S&T will create to tackle poverty and especially stimulate economic growth in areas where substantial investment is required in infrastructure, amenities and services. To this end, the TTSI office will:

- break down the barriers of access to knowledge and technology products important for socio-economic development
- create an enabling environment for the transfer of technology and knowledge opportunities to both newly-found and existing community-based enterprises.

Support to South Africa's NEPAD interactions

The CSIR was instrumental in ensuring success in implementation of two of the three NEPAD S&T focus areas. CSIR Biosciences hosts SANBio, one of four African regional BioSciences hubs and secured significant funding for the secretariat function and implementation of the first of four flagship projects. The African Laser Centre was also launched as a Section 21 company and supported nine projects between South African and African researchers. The CSIR also contributed to NEPAD activities at a sector level, including the establishment of a continental metrology forum (AFRImets) to coordinate metrology activities and aid market access.

Collaborative Partnerships

Alignment and engagement in the National System of Innovation

The National R&D Strategy provided a baseline through which to understand the role of the CSIR within the National System of Innovation (NSI) and hence to inform the organisation's S&T strategy. The CSIR's S&T strategy document sets out the role of the organisation within the NSI and thereby defines a number of S&T priorities.

In this context, the CSIR has undertaken a mixture of research types with a highly-integrated research and innovation value chain, stretching from strategic basic research to technology transfer and commercialisation, but with applied research (leading to innovative products and services) being dominant. Since this portfolio is mostly far from market and subject to high risk, it receives block funding from government to which is attached a number of other responsibilities including human capital development, diffusion of technologies from other countries, undertaking of longer-term research of high social importance, and the establishment within South Africa of research programmes in emerging areas of S&T.

Extent of strategic collaborative partnerships

During 2005/6, the CSIR continued to strengthen its alignment with relevant strategic national strategies and played an active role in their support through participation in policy developments such as the development of the National ICT R&D Strategy, finalisation of the National Spatial Development perspective and development of the National Energy Research Strategy. Support has also been realised by the generation of new knowledge for a host of national and provincial strategies, including aspects such as the Provincial Growth and Development Strategy guidelines and the development of a geo-economic information system for the National Industrial Strategy.

A number of MoUs were signed with TEIs during the year, with focus on long-term strategic R&D projects in technology and application domains, the establishment of new joint facilities, the pursuit of joint contract research projects and cooperation in the development of human capital development. Formal cooperation was established with Mintek in the field of light metal alloys and platinum-based alloys and the SABS in the fields of legal metrology, technical standards (ISO committees) and reference materials (ISO REMCO).

Excellent progress was also made in the development of long-term contract R&D relationships with large industrial role players. Notables include Eskom, Armscor, BHP Billiton, Sasol, the textile and clothing federations, and metal and casting associations.

Proportion of all contract R&D funded under multi-year research agreements with single customers

The proportion of R&D funded under multi-year research agreements with single customers amounts to 51% of all research.

International cooperation

International collaboration was enhanced with a number of partners. The Boeing relationship is progressing in a number of technical areas, including aspects such as titanium beneficiation, metal casting and composites. The collaboration with Alcatel Alenia is focusing on cooperation in, amongst others, the areas of landcover mapping and satellite navigation. The Syngenta partnership has seen the development of a number of large cooperative projects in areas such as predictive modelling and biotechnology (GMOs and sustainable agriculture).

Stakeholder satisfaction and service quality

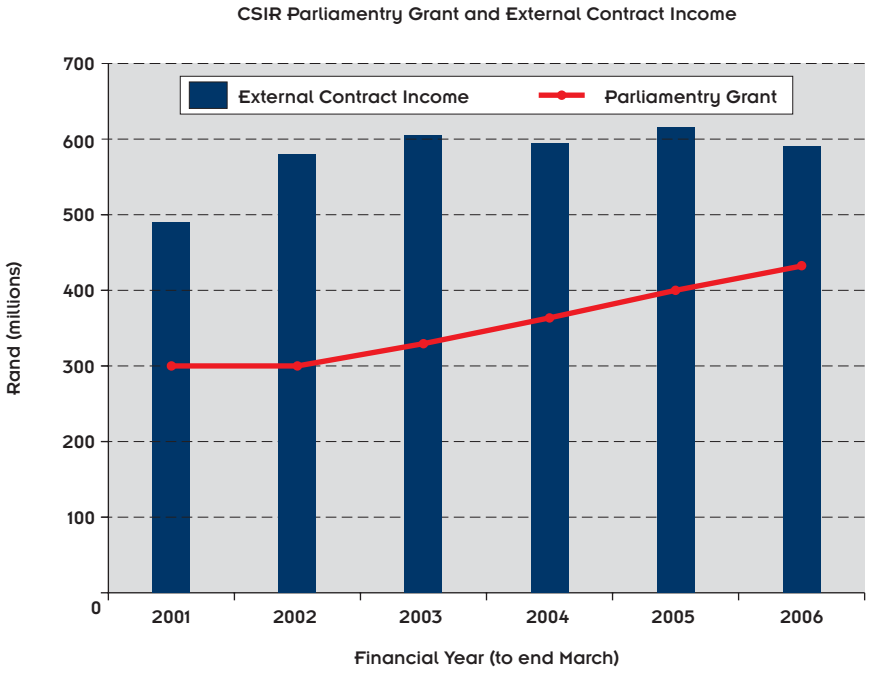
Quality of research outputs (Moment of Truth)

The CSIR continued to measure its stakeholder and customer satisfaction and service quality results through the Moment of Truth (MOT) system and managed to achieve an average of 87,5%, which meets the target for exceptional performance.

Finance and Investment

Financial sustainability

Parliamentary Grant (PG)
The PG allocated to the CSIR – the key investment resource of the CSIR for the 2005/6 financial year – amounted to R394,4 million (2005: R366,4 million) which represents an increase of 7.7%.



Financial performance overview
The external operating revenue of R569,4 million is 5.1% lower than the previous year and falls 11% short of the budget. The shortfall can be ascribed to the strategic changes in the organisation, which resulted in some activities being discontinued to make space for appropriate growth in research contract income aligned with the new strategy. The year-on-year growth for the past four years since 2002 reflects a growth of 6.4%. The most significant year-on-year growth (18.2%) was achieved in the public sector. In addition, good growth occurred in the national safety and security sector (10.9%).

The total operating revenue of R994,4 million for the year is 0.4% higher than the 2005 income, while the PG is 7.7% higher. The results show a surplus of R52,9 million (2005: R76,2 million). The surplus was achieved after non-operational adjustments for cost of retrenchments, fair value adjustments on investments and the settlement of the Post Retirement Medical Benefit.

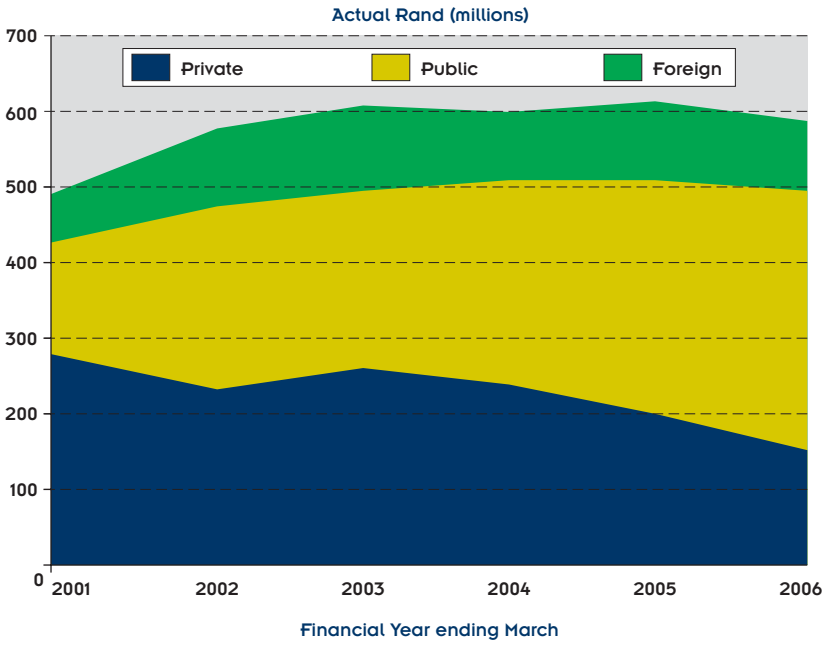
Financial sustainability (continued)

There was a post retirement medical liability of R380,0 million existed as at the end of March 2005. Of this amount, R107,3 million was unfunded. During this financial year, the full liability was settled with all the eligible members. Not only did the CSIR change the subsidy policy, but was also extremely successful with the acceptance of the voluntary offer by its members. Of the 666 in-service members, 99.85% elected to accept the buy-out option. A success rate of 86,5% was achieved with the voluntary offer made to the 1 174 continuation members (83 declined the annuity offer and remained on the revised subsidy policy whilst 75 members have not been traced to date).

This resulted in an actuarial gain of R56,6 million for the CSIR. This will also save a further R13 million per annum due to the immediate settlement of the unfunded portion at the time of offer.

Cash flow generated from operating activities for the year being reported on is R146,6 million (2005: R131,9 million). The cash and cash equivalent holdings decreased to R289,1 million (2005: R295,4 million).

Sources of External Contract Income



The CSIR's international income decreased to R70,8 million in 2006 (2005: R96,3 million) or 26.5%. As a key provider of technology solutions, the organisation's focus is on regional linkages through networks and alliances, internationally-financed projects and regional business development. A strategic framework has been formulated to integrate and manage CSIR business interactions in Africa within the context of NEPAD.

The group operating revenue decreased by R5,1 million (2005: R52,1 million) to R1 007,9 million (2005: R1 013,0 million), reflecting a decrease of 0.4% (2005: increase of 5.4%).

Governance and strategies for implementation of IP and commercialisation

The R&D outcomes portfolio serves as a bridge between science and its application. Effective technology transfer is influenced by the IP management practices and policies in place. During the past year, the CSIR revised its IP management policies. To underpin the policy, IP management guidelines will ensure that processes and procedures for handling IP are transparent, understood and in line with the CSIR mandate.

Improvements to the CSIR's IP management system will, as far as possible, anticipate new developments arising from the Framework for Intellectual Property Rights from Publicly-Financed Research recently tabled by the DST.

The CSIR has provided input to the framework and looking ahead, the IP management portfolio will position itself to set an example of good practice with respect to the capturing and tracking of IP; patent brokering and enrichment; IP and socialisation; benefit-sharing models; inward and outward licensing; IP partnerships and adopting new patent strategies such as patent clubbing, pooling and cross-licensing. Decisions in these areas will be influenced by the need to strengthen the S&T base and address both social and economic needs.

Organisational Aspects

Operational best practice

Implement revised organisational design regarding R&D agenda and human capital development

The pivotal achievement under the organisational dimension was the successful completion of the Beyond 60 reconfiguration of the CSIR ahead of the expected schedule. An operations model with a renewed focus on strengthening science and engineering competences and human capital development in the SET domains has been adopted. Organisational structures have been re-shaped to reflect the renewed priorities. This specifically included the establishment of a dedicated Knowledge Services unit into which all repetitive and routine services have been consolidated, and the creation of a Shared Services unit that harmonises the manner in which support services are provided in the CSIR.

RAPs appointed in units to assist with strategic research decisions and research quality management

Operating units and national research centres are now constituted with an exclusive focus on the research and innovation value chain. By the end of the 2005/6 year, all research units had appointed Research Advisory Panels (RAPs) with external representation from eminent scientists. These are actively involved in advising on scientific quality and PG deployment in six of the research units and centres (with the exception of the CSIR Satellite Applications Centre, which has an advisory board). S&T strategies and human capital development plans, based on RAP guidance, have been established throughout.

Improved processes for managing PG

Enhanced processes for management of the PG have been developed and adopted in 2005/6 as articulated in the CSIR's newly approved S&T strategy. These include:

- establishment of a framework for evaluating the effectiveness and quality of core PG investment which will influence core allocations to units in future years
- growth of competitive and focused mechanisms for deployment of PG, including upscaling of the thematic investment programme, Young Researchers Establishment Fund and research equipment support
- introduction of processes for identifying and selecting emerging research areas which will receive dedicated PG funding.

Planning for investment of PG for the 2006/7 operational cycle was based on the renewed criteria.

Organisational culture and values aligned with CSIR strategy

The process of refreshing the organisational culture and values has made good progress. As expected, further work will be required to cascade this fully to all levels in the organisation. The new organisational values have been communicated throughout the organisation through various means. They are as follows:

P	People:	striving to attain full potential in support of science
R	Reputation:	enhancing relevance, integrity, quality and delivery
I	Ingenuity:	realising the collective intellect of our people in creating solutions
D	Diversity:	embracing an environment that respects the individual and our multi-cultural heritage
E	Energy:	working together to achieve impact through passion, drive and agility

Adherence to standards of good corporate governance

In relation to the components of the KPI framework addressing governance and safety, health, environment and quality, the CSIR has generally exceeded the expected performance requirements that were established. Audits have resulted in a limited number of minor queries that have been rectified and implementation of quality systems is ahead of schedule for expected performance. In addition to progress with general quality management systems, a strong emphasis has been placed on instituting Good Laboratory Practice (GLP) and standards for laboratory testing in relevant environments.

Safety, health and environment and quality

Operational efficiency and effectiveness were identified as the main focus area during the Beyond 60 restructuring process. The CSIR continued to monitor operational activities to ensure that these met the highest standards of quality and ensured that the implementation of business management systems was consistent and effective throughout the organisation.

As reported in the Corporate Governance section of this report, the CSIR maintained its certification to ISO 14001 and OHSAS 18001 and achieved a DIFR of 0.5 (below a target of < 1.0) and a reduction in the number of claims to the Compensation Commissioner. Various units achieved certification and/or accreditation to ISO 9001 and/or ISO 17025. A protocol for the management of organisational policies and procedures was developed and a Policy Review Committee formed to review a number of organisational policies to ensure alignment with the Beyond 60 objectives.

Research effectiveness and productivity

Total number of publication equivalents

A pleasing highlight was exceeding the targets established for publication equivalents during a year when significant operational disruption was being experienced due to the organisational reconfiguration. A provisional total of 176,5 publication equivalents was determined in accordance with the Department of Education guidelines, which represents a major increase over previous years.

Total number of international patents and registered designs granted and technology demonstrators

The number of patents produced by a research institution is a frequently-used measure of research productivity. In 2005, 12 international patents and technology demonstrators were granted to the CSIR. During the course of this year, it is the intention of the R&D Outcomes Office to:

- strengthen the CSIR's propriety advantage of IP
- improve IP management performance
- enhance competitiveness
- accelerate the development of technologies that are close to market.

Mix of Type A, B and C research calculated on total turnover

The mix of research activities (as determined by the phases of the research and innovation cycle based on a classification into types A, B and C) now includes a more favourable proportion of knowledge-generating work and achieved the expected level of performance. However, the proportion of type A work is below the proportion desired in the research profile. The mix of Type A, B, C research respectively calculated on total turnover is: 20:40:40.

Proportion of staff who are researchers as per the CSIR HR categorisation

Good progress was made towards the strengthening of the CSIR's human capital base during 2005/6. A research career ladder was adopted for CSIR-wide implementation, based on criteria reflecting generally-accepted standards for advancement in a research career. The stricter categorisation will influence the number of staff who are categorised as researchers in future. However, based on the lenient classification system currently in use, the CSIR exceeded its target for the proportion of researchers in its staff complement. This is to a large extent due to the re-shaping of the CSIR's staff profile through the Beyond 60 reconfiguration process.

[3] A – strategic basic and applied research;
B – experimental development;
C – technology and knowledge transfer

Advancement of human capital in the S&T environment

Total number of newly-enrolled Masters and Doctorates

Communication of the CSIR's refreshed values reinforced by initiatives such as introduction of the research career ladder, has acted as a catalyst for a total of 182 staff members to register for degrees at Masters and Doctoral level. This is far in excess of the superlative level of performance that was established. The demographic profile of these staff members is pleasing to note, especially at Masters level, and is regarded as a key sustainable measure in favour of demographic transformation in senior research posts over the next five years.

The total number of newly enrolled Masters amounts to 104, newly enrolled black Masters are 58 and female Masters are 33. The total number of newly enrolled Doctorates amounts to 78, newly enrolled black Doctorates are 21 and female Doctorates are 32.

Education and training

Employee training

Based on the targeted three days of training per individual, the achievement of five days per employee is in line with the CSIR's commitment to develop its people. This trend bodes well for the CSIR's future capacity-building efforts.

Bursars and interns

The talent pipeline for the CSIR was also strengthened with the target level of bursaries, internships and in-service traineeships being exceeded. The future demographic profile of the CSIR based on the percentage of black bursars is most encouraging.

Black bursars are at 84% of the total number of bursars, while female bursars are 40% of the total. The number of interns amounts to 126.

Organisational Demographics

Employment equity and diversity

The growth of human capital and the retention of skills are crucial for the purposes of sustaining a strong S&T base to enable the CSIR to fulfil its mandate. Professional growth of research staff, higher proportions of knowledge generation through a culture of learning and sharing, the creation of opportunities for young researchers and a strong transformation drive are fundamental to the CSIR's human resource development drive.

Due to the Beyond 60 restructuring process implemented to streamline the CSIR's R&D activities, staff numbers were reduced from 2 379 (March 2005) to 2 088 (March 2006). This has had an impact on our demographic profile. In addition, black professionals are sought after and leave the organisation to pursue their career goals. Transformation continues to remain a challenge.

The number of professionals as a percentage of total staff amounts to 52%. Black professionals as a percentage of professional staff are 32.94%, while female professionals are at 32.75%.

Transformation of the S&T base

Transformation continues to pose a formidable challenge, not only for the CSIR, but for most organisations in the country. However, it is encouraging to note that we have surpassed our targets with regard to the total of black Masters as well as black and female Doctorates.

From the total number of Masters, which stood at 354 in March 2006, 106 are black (six more than the target) and 129 are female (12 under target). From the total number of Doctorates (197), 60 are black (16 more than the target), while 46 were female (three more than the target).

Performance against DST KPIs and CSIR goals

DST KPI	CSIR Goal	Performance Area	Key Performance Indicator	Target	Performance Result
Stakeholders and Customers	Alignment with government initiatives and Contributing to sustainable development	Alignment with strategic national priorities	Active support to implement relevant national strategies (e.g. science and technology missions (National R&D Strategy), Aerospace Industry Support, Logistics, AMTS, AMI, Mining Charter)	Fully involved in implementation of three strategies	Involvement in 10 clearly identified strategies across the CSIR
			Policies and practices to promote application of R&D outcomes for public good	CSIR IP policy approved and circulated for implementation	IP policy in the process of being finalised. R&D outcomes capacity established in research units addressing public good aspect
			Support to South Africa's NEPAD interactions	Strategy developed for engagement with NEPAD key priority areas	Active involvement in four NEPAD priority areas: e-schools, metrology, African Laser Centre, Southern African Biosciences Hub
		Collaborative partnerships	Alignment and engagement in National System of Innovation	Formal cooperation active with two science councils or TEIs	60 projects identified with various science councils or TEIs
			Extent of strategic collaborative partnerships with South African public and private industry sectors including public-private partnerships	Partnerships established with three new government departments and three new private sector players	Four new public and four new private sector partnerships established
			Proportion of all contract R&D (i.e. R&D income excluding PG) funded under multi-year research agreements with single customers	15%	51%
			Increase international collaboration	Collaboration with six new partners for A and B research purposes	Collaboration with 10 new partners for A and B research purposes
		Stakeholder satisfaction and service quality	Quality of research outputs (Moment of Truth) based on assessment of client and stakeholder satisfaction	85%	87.5%
Finance and investment	Enhanced professionalism in innovation and business excellence	Financial sustainability	Increase total external revenue (R millions)	11%	0.2%
			Net margin (R millions)	R33,8 m	R52,9 m
			Net margin (% external income)	5.2%	9.3%
		Diversification of funding sources	Revenue from IP (royalties, software licences, specialised publications etc.) (R millions)	R5.9 m	R2.73 m
			Ratio of external : total revenue	60.4%	61.4%
			Funding from donor agencies, including research funding agencies, for Type A research activities (R millions)	R10K	R14.6K
			Governance and strategies for implementation of IP and commercialisation	Implementation of IP policy	IP policy not yet finalised

Performance against DST KPIs and CSIR goals *(cont.)*

DST KPI	CSIR Goal	Performance Area	Key Performance Indicator	Target	Performance Result
Organisational	Enhanced professionalism in innovation and business excellence and Consolidating excellence in S&T	Operational best practice	Implement revised organisation design regarding R&D agenda and human capital development	Design implementation and S&T strategy by March 2006	Design implemented in October 2005 and S&T strategy in place
			RAPs appointed in units to assist with strategic research decisions and research quality management	RAPs in 70% of units and centres	RAPs active in six out of nine research units and centres
			Improved processes for management of PG investment	SRP advises on research programmes and evaluates quality of 50% of SET output	CSIR mechanisms for allocation and evaluation of PG revised and partially implemented through S&T strategy
			Organisational culture and values aligned with CSIR strategy	Performance targets set in context of CSIR value system	Performance targets fully aligned at unit level and being cascaded to individual level. Research career ladder with scientific criteria established and approved for adoption
			CSIR staff satisfaction	75%	Assessment postponed until after the restructuring process
			Adherence to standards of good corporate governance	No significant shortfalls in compliance	Minor isolated queries rectified
		Safety, health, environment and quality	Disabling injury frequency rate	≤1.0	0.5
			ISO 14001 & OHSAS 18001	Certification retained CSIR-wide	Retained at all sites
			Progress with quality system implementation (e.g. ISO 9001:2000)	25% implemented in one unit	Over 25% in three units
Learning and Growth	Consolidating excellence in SET and Accessing and developing the best minds	Research effectiveness and productivity	Total number of publication equivalents	R33,8 m	R52,9 m
			Total number of international patents and registered designs granted, and technology demonstrators	6	12
			Mix of Type A, B and C research calculated on total turnover	20:40:40	20.6%, 38.4%, 41.0%
		Advancement of human capital in S&T environment	Total number of newly-enrolled Masters	50	104
			Total number of newly-enrolled black Masters	35	58
			Total number of newly-enrolled female Masters	30	33
			Total number of newly-enrolled Doctorates	20	78
			Total number of newly-enrolled black Doctorates	4	21
			Total number of newly enrolled female Doctorates	7	32
		Education and training	Employee training	3 days/fte/year	5.10
			Black bursars (% of total number of bursars)	80%	84%
			Female bursars (% of total number of bursars)	50%	40%
			Number of interns	100	126

Performance against DST KPIs and CSIR goals *(cont.)*

DST KPI	CSIR Goal	Performance Area	Key Performance Indicator	Target	Performance Result
Organisational Demographics	Accessing and developing the best minds	Employment equity and diversity	Professionals as percentage of total staff	53%	52.35%
			Black professionals as percentage of professional staff	35%	32.94%
			Female professionals as percentage of professional staff	36%	32.75%
		Transformation of S&T base	Masters (total number)	363	354
			Masters black (total number)	100	106
			Masters female (total number)	141	129
			Doctorates (total number)	197	197
			Doctorates black (total number)	44	60
			Doctorates female (total number)	43	46

Acquisitions and Disposals

Acquisitions and Disposals

There were no business acquisitions within the CSIR during the 2005/6 financial year.

Our Subsidiaries

The activities of the CSIR's subsidiaries, as set out in Addendum A to the financial statements, are to invest in developing research, transfer technology to industry, provide finance for development technology and venture capital to exploit it respectively.

Post Balance Sheet Events

Subsequent to the balance sheet date, negotiations to sell the building under construction, as disclosed in the annual financial statements in note 6, are being finalised.

Board Approval

The annual financial statements of the CSIR for the year ended 31 March 2006, as set out in this report, have been approved by the CSIR Board at its meeting on 27 June 2006. The Board is of the opinion that the CSIR is financially sound and operates as a going concern.

Nobusi Shikwane
CSIR Board Chairperson

Dr Sibusiso Sibisi
CSIR CEO and President

CSIR Five-year Financial Review
31 March 2006

FINANCIAL INDICATORS	2006 R'000	2005 R'000	2004 R'000	2003 R'000	2002 R'000
BALANCE SHEET					
Total reserves	**345 599**	384 491	342 709	326 472	308 986
Total assets	**828 017**	754 390	650 334	576 479	551 001
Net assets	**345 600**	384 491	340 889	326 472	310 360
INCOME AND EXPENSE INDICATORS					
Parliamentary grant recognised as income	**391 077**	356 992	321 996	295 429	296 883
External operating revenue incl. royalty and other income	**603 323**	634 724	627 714	642 590	580 113
Expenditure	**1 037 343**	987 348	948 481	934 368	899 661
Investment income	**17 819**	25 752	15 008	13 835	14 778
Net surplus/(deficit)	**(25 124)**	42 584	16 237	17 486	(7 887)
CASH FLOW					
Net cash from operating activities	**146 659**	131 909	110 937	70 278	18 937
Net cash used in investing activities	**(113 480)**	(45 229)	(33 944)	(42 358)	(15 114)
Net cash used in financing activities	**-**	-	-	(1 374)	(4 182)
Cash and cash equivalents beginning of year	**295 417**	208 737	105 712	79 166	79 525
Cash and cash equivalents end of year	**289 070**	295 417	208 737	105 712	79 166
RATIO ANALYSIS					
Asset management					
Net asset turn	**2.9**	2.7	2.8	2.9	2.9
Return on net assets	**(7.3%)**	11.1%	4.8%	5.4%	(2.5%)
Current ratio	**1.0**	1.2	1.2	1.3	1.3
Performance					
Total revenue (excl. investment income) per employee	**476.2**	404.7	390.7	381.6	343.8
Total external operating revenue per employee	**288.9**	254.7	258.2	261.4	227.4
Total revenue (excl. investment income) per R1 operating expenditure	**2.5**	2.5	2.5	2.2	2.1
Remuneration as a % of total expenditure	**59.0%**	56.5%	55.6%	51.7%	49.2%
Net cash generated from operating activities per employee	**70.2**	54.5	45.6	28.6	33.2
Independence ratio	**61.4%**	63.9%	66.6%	69.0%	66.7%
Number of employees	**2 088**	2 379	2 431	2 458	2 551

DEFINITIONS

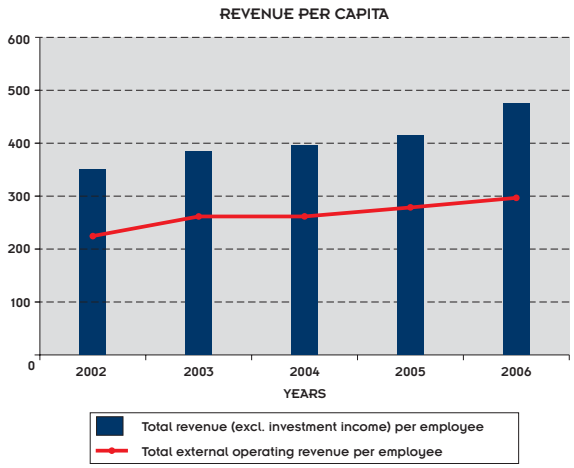
Net asset turn - Total revenue (incl. investment income) divided by net assets

Return on net assets - Net surplus/(deficit) expressed as a percentage of net assets

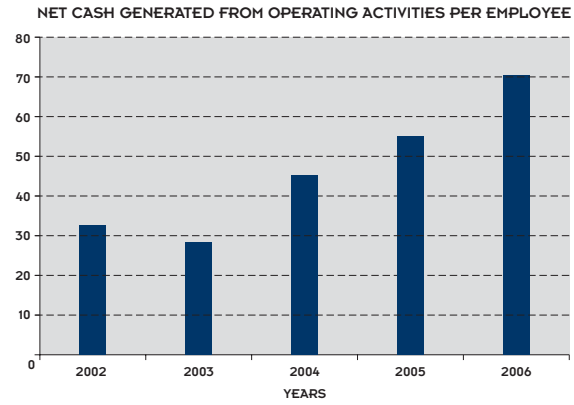
Current ratio - Current assets divided by current liabilities

Independence ratio - Total external income (incl. investment income) divided by total income.

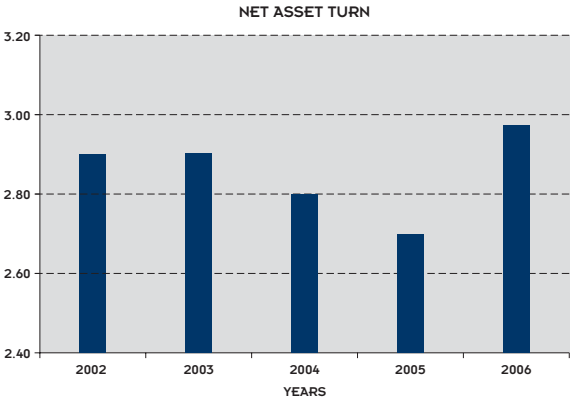
The post-retirement medical benefit expense and liability, distribution from the National Laser Centre Trust (2004) and the effects of the adoption of SA GAAP, AC133: Financial instruments - recognition and measurement have been excluded for comparison of financial indicators.



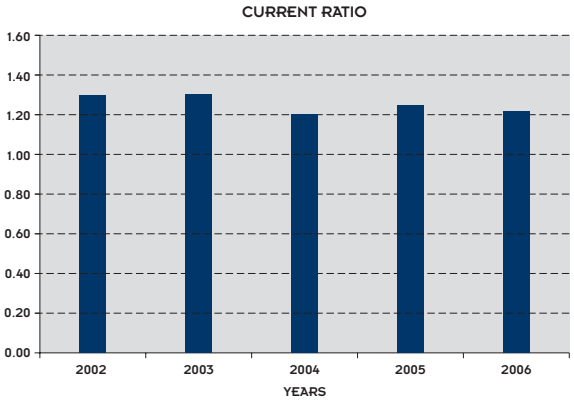
The improvement in revenue per employee is due to the increase in parliamentary grant as well as the decrease in number of employees.



The net cash generated per employee increased due to the increase in advances received and increase in trade and other payables.



The increase in net asset turn is the result of the decrease in net assets.



The decrease in the current ratio is due to the decrease in cash and contracts in progress and an increase in trade and other payables.

Income Statements

for the year ended 31 March 2006

	Notes	GROUP 2006 R'000	GROUP 2005 R'000	CSIR 2006 R'000	CSIR 2005 R'000
Revenue	2	**1 006 680**	1 010 927	**993 725**	991 505
Other income		**1 229**	2 034	**674**	211
Profit on disposal of property, plant and equipment		**24**	22	**-**	-
Profit on disposal of interest in subsidiary	28	**4**	-	**-**	-
Total operating revenue		**1 007 937**	1 012 983	**994 399**	991 716
Expenditure					
Employees' remuneration		**634 196**	567 621	**624 202**	557 593
Depreciation and amortisation	6 & 7	**40 239**	42 272	**39 386**	41 163
Operating expenses		**388 270**	385 298	**391 619**	388 161
Loss on disposal of property, plant and equipment		**2 003**	523	**1 993**	431
Loss on disposal of interest in joint ventures and associates		**-**	1 704	**-**	-
Loss on disposal and deregistration of interest in subsidiaries	29	**-**	-	**-**	-
Total expenditure		**1 064 708**	997 418	**1 057 200**	987 348
Operating surplus/(deficit) before:	3	**(56 771)**	15 565	**(62 801)**	4 368
Post-retirement medical benefits	19.4	**92 410**	40 917	**92 410**	40 917
Financial income	4	**31 544**	27 379	**31 159**	38 216
Financial cost	4	**(7 943)**	(7 492)	**(7 801)**	(7 250)
Share of profit/(deficit) of joint ventures and associates		**(1 114)**	1 086	**-**	-
Operating surplus for the year before taxation		**58 126**	77 455	**52 967**	76 251
Income tax expense	5	**(7)**	(3)	**-**	-
Surplus for the year		**58 119**	77 452	**52 967**	76 251
Attributable to:					
Minority interest	13	**-**	805	**-**	-
Stakeholders		**58 119**	78 257	**52 967**	76 251
Surplus for the year		**58 119**	77 452	**52 967**	76 251

Balance Sheets

31 March 2006

	Notes	GROUP 2006 R'000	GROUP 2005 R'000	CSIR 2006 R'000	CSIR 2005 R'000
ASSETS					
Non-current assets		**317 981**	258 845	**327 436**	274 222
Property, plant and equipment	6	**299 511**	225 964	**299 236**	225 604
Intangible assets	7	**628**	2 986	**-**	-
Interest in joint ventures and associates	8	**16 983**	20 825	**15 000**	15 000
Interest in subsidiaries	9	**-**	-	**12 341**	24 553
Investments	10	**859**	9 070	**859**	9 065
Current assets		**500 857**	512 870	**492 780**	501 283
Trade and other receivables	11	**159 980**	143 157	**156 844**	140 518
Inventory and contracts in progress	12	**46 866**	65 504	**46 866**	65 348
Bank balances and cash on hand	26	**294 011**	304 209	**289 070**	295 417
TOTAL ASSETS		**818 838**	*771 715*	**820 216**	*775 505*
EQUITY AND LIABILITIES					
Reserves		**319 932**	262 388	**322 901**	269 934
Accumulated funds		**308 190**	250 071	**312 151**	259 184
Self-insurance reserve		**10 750**	10 750	**10 750**	10 750
Non-distributable reserve:					
Foreign currency translation reserve		**989**	1 564	**-**	-
Minority interest	13	**3**	3	**-**	-
Non-current liabilities		**14 916**	107 331	**14 897**	107 307
Post-retirement medical benefit obligation	19.4	**14 897**	107 307	**14 897**	107 307
Deferred tax liabilities	14	**19**	24	**-**	-
Current liabilities		**483 990**	401 996	**482 418**	398 264
Advances received	15	**153 774**	114 160	**153 774**	114 160
Trade and other payables	16	**264 916**	228 976	**263 347**	225 338
Provisions	17	**65 300**	58 860	**65 297**	58 766
TOTAL EQUITY AND LIABILITIES		**818 838**	*771 715*	**820 216**	*775 505*

Statements of Change in Equity

for the year ended 31 March 2006

	Accumulated funds	Self insurance reserve *	Non distributable reserve **	Minority interest	Total
GROUP					
Balance at 31 March 2004	171 814	10 750	568	843	**183 975**
Minority interest	-	-	-	(35)	**(35)**
Surplus for the year	78 257	-	-	(805)	**77 452**
Exchange differences arising from translations of foreign operations	-	-	996	-	**996**
Balance at 31 March 2005	**250 071**	**10 750**	**1 564**	**3**	**262 388**
Minority interest	-	-	-	-	-
Surplus for the year	58 119	-	-	-	**58 119**
Exchange differences arising from translations of foreign operations	-	-	(575)	-	**(575)**
Balance at 31 March 2006	**308 190**	**10 750**	**989**	**3**	**319 932**
CSIR					
Balance at 31 March 2004	182 933	10 750	-	-	193 683
Surplus for the year	76 251	-	-	-	76 251
Balance at 31 March 2005	**259 184**	**10 750**	**-**	**-**	**269 934**
Surplus for the year	52 967	-	-	-	**52 967**
Balance at 31 March 2006	**312 151**	**10 750**	**-**	**-**	**322 901**

* Refer to note 21

** The non-distributable reserve consists of a foreign currency translation reserve

Cash Flow Statements

for the year ended 31 March 2006

	Notes	GROUP 2006 R'000	GROUP 2005 R'000	CSIR 2006 R'000	CSIR 2005 R'000
Cash flow from operating activities					
Cash receipts from external customers		**627 230**	656 863	**611 214**	638 039
Parliamentary grant received		**394 429**	366 326	**394 429**	366 326
Cash paid to suppliers and employees		**(910 473)**	(925 938)	**(890 143)**	(910 672)
Cash generated by operations	25	**111 186**	97 251	**115 500**	93 693
Financial income	4	**31 402**	27 137	**31 159**	38 216
Income taxes paid		**(12)**	(12)	**-**	-
Net cash from operating activities		**142 576**	124 376	**146 659**	131 909
Cash flow from investing activities					
Property, plant and equipment acquired		**(119 359)**	(54 056)	**(119 278)**	(53 868)
Proceeds on disposal of property, plant and equipment		**4 299**	1 896	**4 266**	1 849
Decrease in net interest in subsidiaries		**-**	-	**(1 197)**	6 000
Proceeds on disposal of interest in joint ventures		**-**	16 912	**-**	-
Deregistration of subsidiary	29	**-**	-	**-**	-
Disposal of interest in subsidiaries	28	**4**	-	**-**	-
Decrease/(increase) in interest in joint ventures and associates		**2 729**	(19 210)	**2 729**	(19 210)
Decrease/(increase) in investments		**-**	20 000	**-**	20 000
Acquisition of long-term patents		**(368)**	(674)	**-**	-
Net cash used in investing activities		**(112 695)**	(35 132)	**(113 480)**	(45 229)
Cash flow from financing activities					
Decrease in long-term liabilities		**(39 526)**	(98)	**(39 526)**	-
Decrease in minority interest		**-**	(35)	**-**	-
Net cash used in financing activities		**(39 526)**	(133)	**(39 526)**	-
Net (decrease)/increase in cash and cash equivalent		**(9 645)**	89 111	**(6 347)**	86 680
Cash and cash equivalents at beginning of the year					
Bank balances and cash		**304 209**	214 108	**295 417**	208 737
Effect of foreign exchange rate changes		**(553)**	990	**-**	-
Cash and cash equivalents at end of the year					
Bank balances and cash	26	**294 011**	304 209	**289 070**	295 417

1. PRINCIPAL ACCOUNTING POLICIES

The consolidated annual financial statements are prepared on the historical cost basis except for financial instruments held for trading and financial instruments classified as available-for-sale, stated at fair value in accordance with Statements of South African Generally Accepted Accounting Practice (SA GAAP) and the Public Finance Management Act (Act 1 of 1999 as amended by Act 29 of 1999). The following principal accounting policies have been consistently applied by group entities in all material respects.

The preparation of financial statements requires management to make judgements, estimates and assumptions that affect the application of policies and reported amounts of assets and liabilities, income and expenses. The estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable under the circumstances, the result of which form the basis of making judgements about carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates.

The consolidated annual financial statements are presented in South African rands (R) and are rounded off to the nearest thousand.

Basis of consolidation

Interest in subsidiaries

The consolidated annual financial statements incorporate the annual financial statements of the CSIR and the annual financial statements of the entities under its control from the date that control commences until the date that control ceases. Control is achieved where the CSIR has the power to govern the financial and operating policies of an investee entity so as to obtain benefits from its activities.

On acquisition, the assets and liabilities of the relevant subsidiaries are measured at their fair values at the date of acquisition. The interest of minority shareholders is stated at the minority's proportion of the fair values of the assets and liabilities recognised. The operating results of subsidiaries acquired or disposed of during the reporting period are included in the consolidated income statement from the effective date of acquisition or up to the effective date of disposal. All significant inter-company balances between group entities have been eliminated on consolidation.

Where a group enterprise transacts with a subsidiary company, unrealised gains and losses are eliminated to the extent of the group's interest in the relevant subsidiary company, except where unrealised losses provide evidence of an impairment of the asset transferred.

Any excess of net assets of a subsidiary over the cost of an acquisition is treated in terms of the group's accounting policy on goodwill.

Interest in associates

An associate is an entity over which the group is in a position to exercise significant influence, but not control, through participation in the financial and operating policy decisions of the investee. The group share of the total recognised gains and losses of associates is incorporated in the consolidated financial statements, from the date that significant influence commences until

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Basis of consolidation (continued)

Interest in associates (continued)

the date that significant influence ceases, using the equity method of accounting. The carrying amount of such interests is reduced to recognise any impairment, other than a temporary impairment, in the value of individual investments.

Where a group enterprise transacts with an associate company, unrealised gains and losses are eliminated to the extent of the group's interest in the relevant associate company, except where unrealised losses provide evidence of an impairment of the asset transferred.
Any excess of net assets of an associate over the cost of an acquisition is treated in terms of the group's accounting policy on goodwill.

Interest in joint ventures

A joint venture is a contractual arrangement whereby the CSIR and other parties undertake economic activity, which is subject to joint control.

Interests in jointly controlled entities are accounted for by means of the equity method from the date that joint control commences until the date that joint control ceases. The carrying amount of such interests is reduced to recognise any impairment, other than a temporary impairment, in the value of individual investments.

Where a group enterprise transacts with a joint venture, unrealised gains and losses are eliminated to the extent of the group's interest in the relevant joint venture, except where unrealised losses provide evidence of an impairment of the asset transferred.

Any excess of net assets of a joint venture over the cost of an acquisition is treated in terms of the group's accounting policy on goodwill.

Foreign currencies

Foreign operations

All foreign subsidiaries of the CSIR are foreign operations.

The financial statements of foreign subsidiaries are translated into South African rands as follows:

- Assets and liabilities, including goodwill and fair value adjustments on consolidation, at rates of exchange ruling at the reporting entities' financial year end
- Revenue, expenditure and cash flow items at the average rates of exchange during the relevant financial year.

Differences arising on translation are reflected as non-distributable reserves called a foreign currency translation reserve.

Foreign currency transactions and balances

Transactions in foreign currencies are converted to South African rands at the rate of exchange ruling at the date of the transactions. Monetary assets and liabilities denominated in foreign currencies are stated in South African rands using the rates of exchange ruling on the balance sheet date. The resulting exchange differences are dealt with in the income statement. Non-monetary assets and liabilities stated at fair value are translated at foreign exchange rates ruling at the date the fair value was determined.

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Property, plant and equipment

Owned assets

Land is stated at cost less accumulated impairment losses. Buildings, plant, equipment and vehicles are stated at cost less accumulated depreciation and accumulated impairment losses.

The cost of self-constructed assets includes the cost of materials, direct labour, the initial estimate, where relevant, of the costs of dismantling and removing the items and restoring the site on which they are located and an appropriate proportion of production overheads.

Where parts of an item of property, plant and equipment have different useful lives, they are accounted for as separate items of property, plant and equipment.

Leased assets

Assets acquired by way of finance lease are stated at an amount equal to the lower of their fair value and their present value of the minimum lease payments at inception of the lease, less accumulated depreciation and impairment losses. Assets held under finance leases are depreciated over their expected useful lives on the same basis as owned assets or, where shorter, the term of the relevant lease.

Subsequent costs

The group recognises in the carrying amount of an item of property, plant and equipment the cost of replacing a part of such an item when that cost is incurred if it is probable that the future economic benefits embodied in the item will flow to the group and the cost of the item can be measured reliably. All other costs are recognised in the income statement as an expense when incurred.

Depreciation

Depreciation is based on cost and calculated on the straight-line method from the day the assets are available for use, at rates considered appropriate to write off carrying values over the estimated useful lives of the assets, except for:

- Assets specifically acquired for a contract, which are depreciated over the life of the contract
- Strategic assets of limited commercial application, which are written down to expected future commercial recoverable value at acquisition, with the remaining carrying value depreciated over the estimated useful lives of the assets.

The estimated lives of the main categories of property, plant and equipment are as follows:

- Buildings - 40 years
- Plant - 10 years
- Equipment - 3 to 10 years
- Vehicles - 5 years

The gain or loss arising on the disposal of an asset is determined as the difference between the sales proceeds and the carrying amount of the asset and is recognised in gain or loss.

The residual value, if not insignificant, is reassessed annually.

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Intangible assets

Research and development

Research costs are recognised against the income statement as and when incurred. Development costs of clearly defined products, of which the future technical feasibility and commercial viability have been proven to the satisfaction of the Board, are capitalised (refer to development expenditure and intellectual property). The extent of capitalisation is limited to an amount equal to the present value of expected net future income.

Investment in technology

Investment in technology licensing projects and dividend producing rights is capitalised at cost and is stated at cost less accumulated amortisation and accumulated impairment losses. Investment in technology is amortised over the expected useful lives or impaired based on their viability, whichever is the shorter.

Development expenditure and intellectual property

Development expenditure and intellectual property consist of capitalised development costs as approved by the Board. Capitalisation is limited to the present value of expected net future income (refer to research and development).

Goodwill

Goodwill arising on consolidation represents the excess of the cost of an acquisition over the fair value of the group's interest of the net assets of the acquired subsidiary, associate or joint venture at the date of the acquisition (refer to basis of consolidation, interest in associates and interest in joint ventures). All business combinations are accounted for by applying the purchase method.

Goodwill arising from the acquisition of a joint venture or an associated company is included within the carrying amount of the joint venture or associated company. Goodwill arising from a subsidiary is presented separately in the balance sheet and tested annually for impairment and is stated at cost less accumulated impairment losses. Goodwill is allocated to cash-generating units. On disposal of a subsidiary, joint venture or associated company, the attributable amount of goodwill is included in the determination of the profit or loss on disposal.

Negative goodwill arising from an acquisition is recognised directly in profit.

Subsequent costs

Subsequent expenditure on capitalised intangible assets is capitilised only when it increases the future economic benefits embodied in the specific asset to which it relates. All other expenditure is expensed as incurred.

Amortisation

Amortisation is based on cost and calculated on the straight-line method at rates considered appropriate to write off carrying values over the estimated useful lives of the intangible assets with definite useful lives. Intangible assets are amortised from the day they are available for use.

The estimated lives of intangible assets with definite useful lives are as follows:

- Investment in technology - 3 to 10 years
- Development expenditure and intellectual property - 1 to 3 years

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Impairment
The carrying amount of the group's assets is reviewed at each balance sheet date to determine if there is any indication of impairment. If any such indication exists, the asset's recoverable amount is estimated. An impairment loss is recognised in the income statement whenever the carrying amount of an asset or its cash generating unit exceeds its recoverable amount.

Calculation of recoverable amount
The recoverable amount is the greater of the net selling price or value in use. In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discounted rate that reflects current market assessments of the time value of money and the risks specific to the asset. For an asset that does not generate largely independant cash inflows, the recoverable amount is determined for the cash generating unit to which the asset belongs.

Reversals of impairments
An impairment loss in respect of a held-to-maturity security or receivable carried at amortised cost is reversed if the subsequent increase in recoverable amount can be related objectively to an event occuring after the impairment loss was recognised.

An impairment loss in respect of goodwill is not reversed. In respect of other assets, an impairment loss is reversed if there has been a change in the estimates used to determine the recoverable amount.

Retirement benefits
Pension fund
The group operates a defined contribution plan, the assets of which are held in a separate trustee-administered fund. The benefits payable by the fund in the future, due to retirements and withdrawals from the fund, are contributions by members to the fund together with fund interest at a rate determined by the valuator with the consent of the trustees. The rate is so determined that the value of the total of the fund shall not exceed the value of the total assets of the fund. The group's contribution to the plan is charged to the income statement when incurred.

Post retirement benefits other than pensions
The group provides post-retirement medical benefits to qualifying employees. The expected costs of these benefits are determined using the projected unit credit method, with actuarial valuations being carried out at each balance sheet date. Contributions are made to the relevant funds over the expected service lives of the employees entitled to those funds. The estimated cost of providing such benefits is charged to the income statement on a systematic basis over the employees' working lives within the group.

Actuarial gains and losses are recognised in full in the income statement in the year when actuarially determined. The amount recognised in the balance sheet represents the present value of the post-retirement medical aid contribution reduced by the fair value of the plan assets. Any asset resulting from this calculation is limited to actuarial losses and the present value of available refunds and reductions in future contributions to the plan.

Inventory and contracts in progress
Raw materials and finished goods are stated at the lower of cost and net realisable value. Cost of inventory is determined by the weighted average method. Net realisable value represents the estimated selling price less all estimated costs to completion and costs to be incurred in selling. Contracts in progress are stated as a percentage of the sales value of work completed, after provision for losses relating to the stage of completion and any foreseeable losses to completion of the contract.

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Taxation

The charge for taxation is based on the profit or loss for the year as adjusted for items that are non-taxable or disallowed. It is calculated using tax rates that have been enacted or substantially enacted on the balance sheet date. Deferred tax is accounted for using the balance sheet liability method in respect of temporary differences arising from differences between the carrying amounts of assets and liabilities in the financial statements and the corresponding tax basis used in the computation of the taxable profit.

Where the tax effects of temporary differences, including those arising from tax losses, give rise to a deferred tax asset, the asset is recognised only if it is probable that future taxable profits will be sufficient to allow the tax benefit of the loss to be realised. Deferred tax assets and liabilities are offset when they relate to income taxes levied by the same taxation authority and the group intends to settle its current tax assets and liabilities on a net basis.

The amount of deferred tax provided is based on the expected manner of realisation or settlement of the carrying amount of assets and liabilities using tax rates enacted or substantively enacted at the balance sheet date. Deferred tax is charged to the income statement except to the extent that it relates to a transaction that is recognised directly in equity. The effect on deferred tax of any changes in tax rates is recognised in the income statement except to the extent that it relates to items previously charged or credited directly to equity.

Provisions

Provisions are recognised when the group has a present legal or constructive obligation as a result of past events, for which it is probable that an outflow of economic benefits will be required to settle the obligation, and a reliable estimate can be made of the amount of the obligation.

Government assistance

Government assistance is recognised as income on a systematic basis over periods necessary to match the assistance with the related costs it is intended to compensate.

Revenue recognition

Revenue comprises:

- The net invoiced value of research, development and implementation contracts, excluding Value Added Tax
- Income acknowledged on contracts in progress is recognised in the income statement in proportion to the stage of completion of the transaction at the balance sheet date. The stage of completion is assessed by reference to work performed as at the balance sheet date
- The annual parliamentary grant adjusted for the grant received for projects started before year end, but was not completed as detailed above (see government assistance)
- Royalties are accrued based on the stipulations of the applicable contracts.

Financial income

Financing income comprises interest receivable on funds invested, dividend income, fair value adjustments on investments and interest payable on borrowings. Interest income is recognised in the income statement as it accrues, using the effective interest rate method. Dividend income is recognised in the income statement on the date the entity's right to receive payments is established. Interest payable on borrowings is calculated using the effective interest rate method.

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Expenses

Operating lease payments

Payments made under operating leases are recognised in the income statement on a straight-line basis over the term of the lease. Lease incentives received are recognised in the income statement as an integral part of the total lease expense.

Finance lease payments

Minimum lease payments are apportioned between the finance charge and the reduction of the outstanding liability. The finance charge is allocated to each period during the lease term so as to produce a constant periodic rate of interest on the remaining balance of the liability.

Financial instruments

Financial instruments are initially measured at fair value when the group has become a party to contractual provision of the instrument. Subsequent to initial recognition, these instruments are measured as set out below.

Trade and other receivables

Trade receivables are subsequently measured at amortised cost as reduced by impairment losses, which approximate their fair value due to the short-term nature thereof.

The following categories of other receivables are measured at amortised cost using the effective interest rate method if they have a fixed maturity.

- Receivables originated by the group and not held for trading.

Investments and loans

Investments, other than in subsidiaries, associates or joint ventures, are recognised at fair value. Dividends are accounted for on the last day of registration in respect of listed investments and when declared in respect of unlisted investments. On disposal of an investment, the difference between the net disposal proceeds and the carrying amount is charged or credited to the income statement.

Loans are measured at amortised cost using the effective interest rate method if they have a fixed maturity, or at cost if there is no fixed maturity.

Bank balances and cash on hand

Cash on hand is stated at face value, which is its fair value. Bank balances and cash on hand comprise bank balances, cash on deposit and cash on hand.

Forward exchange contracts

Forward exchange contracts are fair valued and gains and losses are dealt with in the income statement. Hedge accounting is not applied.

1. PRINCIPAL ACCOUNTING POLICIES (continued)

Financial instruments (continued)

Trade and other payables and advances received

Trade and other payables and advances received are stated at amortised cost, which approximates their fair value due to the short-term nature thereof.

De-recognition

Financial assets (or a portion thereof) are de-recognised when the group realises the rights to the benefits specified in the contract, the rights expire or the group surrenders or otherwise loses control of the contractual rights that comprise the financial asset. On de-recognition, the difference between the carrying amount of the financial asset and proceeds receivable is included in the income statement.

Financial liabilities (or a portion thereof) are de-recognised when the obligation specified in the contract is discharged, cancelled or expires. On de-recognition, the difference between the carrying amount of the financial liability and amount paid for is included in the income statement.

Fair value methods and assumptions

The fair value of financial instruments traded in an organised financial market is measured at the applicable quoted prices necessary to realise the asset or settle the liability.

The fair value of financial instruments not traded in an organised financial market is determined using a variety of valuation methods and assumptions that are based on market conditions and risk existing at balance sheet date, including independent appraisals and discounted cash flow methods.

Related parties

The group operates in an economic environment currently dominated by entities directly or indirectly owned by the South African Government. As a result of the constitutional independence of all three spheres of government in South Africa, only parties within the national sphere of government will be considered to be related parties.

Key management is defined as being individuals with the authority and responsibility for planning, directing and controlling the activities of the entity. All individuals from the level of Group Executive up to the Board of Directors are regarded as key management.

Close family members of key management personnel are considered to be those family members who may be expected to influence, or be influenced by key management individuals or other parties related to the entity.

	GROUP				CSIR			
	2006 R'000	%	2005 R'000	%	2006 R'000	%	2005 R'000	%
2. REVENUE								
Parliamentary grant	**391 077**	**39**	356 992	35	**391 077**	**40**	356 992	36
Parliamentary grant received	**394 429**	**39**	366 326	36	**394 429**	**40**	366 326	37
Less:								
Grant received for projects started before year end but not completed	**(31 280)**	**(3)**	(27 928)	(3)	**(31 280)**	**(3)**	(27 928)	(3)
Add:								
Grant received in prior year for projects completed in this year	**27 928**	**3**	18 594	2	**27 928**	**3**	18 594	2
National Metrology Laboratory grant	**30 554**	**3**	28 860	3	**30 554**	**3**	28 860	3
Contract income*	**581 602**	**58**	617 917	61	**569 357**	**57**	598 495	60
Private sector	**134 257**	**13**	195 695	19	**134 030**	**13**	187 592	19
Public sector	**248 095**	**25**	219 077	22	**248 095**	**25**	219 077	22
National safety and security sector	**118 085**	**12**	97 535	10	**118 085**	**12**	97 535	10
International sector (including Africa)	**81 165**	**8**	105 610	10	**69 148**	**7**	94 291	9
Royalties	**3 447**	**-**	7 158	1	**2 737**	**-**	7 158	1
	1 006 680	**100**	1 010 927	100	**993 725**	**100**	991 505	100

*Comparative figures have been reclassified to ensure that the figures are comparable

Estimates on parliamentary grant recognition are based on cost to completion, budgets and percentage of completion

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

3. OPERATING SURPLUS/(DEFICIT)

The net operating surplus/(deficit) is arrived at after taking the following items into account:

Auditors' remuneration	**2 444**	1 444	**2 233**	1 240
Audit fees	**2 322**	1 372	**2 198**	1 178
Expenses	**122**	72	**35**	62
Fees for services	**143 104**	133 224	**139 738**	133 195
Patent costs	**3 361**	1 863	**2 820**	1 863
Legal costs	**453**	241	**280**	241
Consultants, consortium sub-contractors and outsourced services	**139 290**	131 120	**136 035**	131 091
Operating leases	**16 176**	21 229	**15 762**	20 607
Buildings	**5 496**	4 955	**5 146**	4 449
Equipment	**8 335**	13 621	**8 283**	13 533
Vehicles	**2 345**	2 653	**2 333**	2 625
Net realised foreign exchange (gain)/loss	**157**	1 357	**147**	1 387
Net unrealised foreign exchange (gain)/loss	**(806)**	(1 593)	**(810)**	(1 596)
Board members' and executive management's emoluments (note 21)	**11 688**	11 486	**8 158**	8 816
Impairments	**1 924**	7 345	**10 618**	21 715
Impairment on loans to subsidaries, joint ventures and associates	**-**	381	**10 680**	4 217
Impairment (reversal on impairment) on trade receivables	**(329)**	1 389	**(317)**	16 923
Impairment on stock	**255**	5 575	**255**	575
Impairment on intangible assets	**1 998**	-	**-**	-
Provision for bonuses and leave*	**36 777**	27 395	**36 777**	27 395
Lost and/or stolen equipment	**626**	555	**626**	555
Damaged equipment	**512**	2 068	**512**	2 068
Theft and/or damage to hired vehicles	**452**	445	**452**	445

*Comparative figures have been reclassified to ensure that the figures are comparable

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

4. FINANCIAL INCOME

Financial income	**31 544**	27 379	**31 159**	38 216
Interest on bank balances and investments	**18 204**	14 915	**17 819**	14 477
Dividends received	**-**	-	**-**	11 275
Fair value adjustment on initial recognition of contract income*	**13 340**	12 464	**13 340**	12 464
Financial cost	**(7 943)**	(7 492)	**(7 801)**	(7 250)
Interest paid on loans and liabilities	**(142)**	(242)	**-**	-
Fair value adjustment	**(7 801)**	(7 250)	**(7 801)**	(7 250)
	23 601	19 887	**23 358**	30 966

* Comparative figures have been reclassified to ensure that figures are comparable

5. INCOME TAX EXPENSE

The CSIR and its subsidiary, South African Inventions Development Corporation (SAIDCOR), are exempt from South African income tax.

South African normal taxation	**-**	-
Current taxation: current year	**-**	-
Current taxation: prior year	**-**	-
Foreign taxation	**7**	3
Current taxation	**12**	13
Deferred taxation - temporary differences	**(5)**	(10)
	7	3
South African normal rate of taxation	**29.00%**	30.00%
Surplus attributable to tax exempt entities	**(30.39%)**	(26.78%)
Assessed loss	**1.40%**	(1.44%)
Effect of foreign taxation	**0.00%**	(1.78%)
Decrease in corporate tax rate	**0.00%**	0.00%
Current and deferred taxation - effective rate	**0.00%**	0.00%

6. PROPERTY, PLANT AND EQUIPMENT

	2006				2005		
	Depreciation for the year R'000	Cost R'000	Accumulated depreciation R'000	Carrying value R'000	Cost R'000	Accumulated depreciation R'000	Carrying value R'000
Group							
Land	-	5 549	-	5 549	8 197	-	8 197
Buildings	203	281 051	82 836	198 215	195 964	83 181	112 783
Equipment	38 990	455 360	360 421	94 939	445 987	341 656	104 331
Vehicles	318	4 655	3 847	808	4 278	3 625	653
	39 511	746 615	447 104	299 511	654 426	428 462	225 964
CSIR							
Land	-	5 549	-	5 549	8 197	-	8 197
Buildings	202	281 051	82 836	198 215	195 953	83 176	112 777
Equipment	38 873	453 762	359 098	94 664	444 081	340 089	103 992
Vehicles	311	4 655	3 847	808	4 223	3 585	638
	39 386	745 017	445 781	299 236	652 454	426 850	225 604

	Land R'000	Buildings R'000	Equipment R'000	Vehicles R'000	Total R'000
Group					
Carrying value 31 March 2004	8 197	106 569	100 253	725	**215 744**
Additions	-	11 015	42 757	284	**54 056**
Disposals	-	(959)	(1 414)	(25)	**(2 398)**
Depreciation	-	(3 842)	(37 271)	(331)	**(41 444)**
Exchange differences	-	-	6	-	**6**
Carrying value 31 March 2005	8 197	112 783	104 331	653	**225 964**
Additions	-	88 142	30 742	482	**119 366**
Disposals	(2 648)	(2 507)	(1 122)	(9)	**(6 286)**
Depreciation	-	(203)	(38 990)	(318)	**(39 511)**
Exchange differences	-	-	(22)	-	**(22)**
Carrying value 31 March 2006	**5 549**	**198 215**	**94 939**	**808**	**299 511**
CSIR					
Carrying value 31 March 2004	8 197	106 562	99 761	659	**215 179**
Additions	-	11 014	42 570	284	**53 868**
Disposals	-	(959)	(1 311)	(10)	**(2 280)**
Depreciation	-	(3 840)	(37 028)	(295)	**(41 163)**
Carrying value 31 March 2005	8 197	112 777	103 992	638	**225 604**
Additions	-	88 142	30 655	481	**119 278**
Disposals	(2 648)	(2 502)	(1 110)	-	**(6 260)**
Depreciation	-	(202)	(38 873)	(311)	**(39 386)**
Carrying value 31 March 2006	**5 549**	**198 215**	**94 664**	**808**	**299 236**

Land and buildings are unencumbered and full details of the titles are available at the registered office of the CSIR. A building of R87,23 million under construction is included in buildings.

A change in the depreciation estimate due to a change in the residual value of buildings had an impact of R3,710 million on the current financial year figures (2005: nil).

7. INTANGIBLE ASSETS

	2006				2005		
	Amortisation for the year R'000	**Cost R'000**	**Accumulated amortisation R'000**	**Carrying value R'000**	Cost R'000	Accumulated amortisation R'000	Carrying value R'000
Group							
Investments in technology	**728**	**7 837**	**7 209**	**628**	7 468	4 482	2 986
CSIR							
Investments in technology	-	-	-	-	-	-	-

	Group R'000	**CSIR R'000**
Carrying value 31 March 2004	3 140	-
Additions	674	-
Disposals	-	-
Amortisation	(828)	-
Carrying value 31 March 2005	2 986	-
Additions	368	-
Disposals	-	-
Impairment	(1 998)	-
Amortisation	(728)	-
Carrying value 31 March 2006	**628**	-

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

8. INTEREST IN JOINT VENTURES AND ASSOCIATES

Cost of investments less impairment losses	1	1	-	-
Loans to joint ventures and associates	**33 172**	35 900	**15 000**	15 000
Share of post-acquisition losses	**(16 190)**	(15 076)	-	-
	16 983	20 825	**15 000**	15 000

Agreements have been entered into between the CSIR and certain joint ventures and associates to subordinate the loans made to those joint ventures and associates. The subordination agreements will remain in force for as long as the liabilities of the relevant joint ventures or associates exceed their assets, fairly valued.

Details of the joint ventures and associates at 31 March 2006 are as follows:

The following are details of the significant joint ventures' and associate's assets, liabilities, income and expenses:

Name of joint venture/associate	Place of Incorporation	Portion of ownership interest	Portion of voting power held	Principal activity	Carrying value **2006 R'000**	Carrying value 2005 R'000	Financial year end
Joint ventures							
Mbuyu Biotech (Pty) Ltd	South Africa	49%	49%	Development and trading in biotechnology and expertise	**630**	1 180	31 March
Sera (Pty) Ltd	South Africa	50%	50%	Commercialisation and licensing of patents	**16 056**	19 559	31 March
Ellipsoid Technology (Pty) Ltd	South Africa	50%	50%	Development encapsulation technology	**999**	26	31 March
Associates							
AIDC Development Centre Eastern Cape (Pty) Ltd	South Africa	25%	25%	Automotive industry development and support services	**(702)**	60	31 March
Eyeborn (Pty) Ltd	South Africa	26%	26%	Holding, licensing and exploitation of IP technology	**-**	-	31 March
					16 983	20 825	

	Joint ventures Group		Associates Group	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000
Current assets	**35 045**	43 723	**4 229**	2 541
Long-term assets	**1 232**	1 638	**195**	192
Current liabilities	**2 100**	3 363	**4 647**	2 485
Long-term liabilities	**65 172**	72 269	**2 586**	-
Income	**2 830**	2 801	**17 180**	12 468
Expenses	**5 214**	11 398	**16 057**	12 248

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

9. INTEREST IN SUBSIDIARIES

Shares at cost less impairment losses			**18 364**	31 773
Indebtedness			**(6 023)**	(7 220)
- by subsidiaries			**18 758**	19 728
- impairment of loans			**(16 130)**	(18 137)
- to subsidiaries			**(8 651)**	(8 811)
			12 341	24 553

Details disclosed in Addendum A

Agreements have been entered into between the CSIR and certain subsidiaries to subordinate the loans made to those subsidiaries. The subordination agreements will remain in force for as long as the liabilities of the relevant subsidiaries exceed their assets, fairly valued.

10. INVESTMENTS

	% held	Number of shares held		Class of shares				
		2006	2005					
Listed Shares					**859**	9 065	**859**	9 065
Samsys Technologies Ltd	**2.30**	**1 100 000**	1 100 000	Ordinary	**859**	9 065	**859**	9 065
Unlisted Shares					**-**	*5*	**-**	-
Breathetex (Pty) Ltd	**30.00%**	**12 000**	14 800	Ordinary	**9 195**	9 195	**9 195**	9 195
Breathetex (Pty) Ltd	**10.18%**	**11 680**	-	Preference	**-**	-	**-**	-
Accumulated impairment losses					**(9 195)**	(9 195)	**(9 195)**	(9 195)
Aluminium Squeeze Castors (Pty) Ltd	**-**	**-**	10 000	Ordinary	**-**	*5*	**-**	-
Pan-A-Cam (Pty) Ltd	**15**	**18**	18	Ordinary	**-**	-	**-**	-
					859	9 070	**859**	9 065

11. TRADE AND OTHER RECEIVABLES

Trade receivables	**145 770**	124 342	**142 729**	121 813
Prepaid expenditure	**4 839**	3 006	**4 839**	3 006
Other receivables	**9 371**	15 809	**9 276**	15 699
	159 980	143 157	**156 844**	140 518

Trade receivables are shown net of impairment losses. Impairment (reversals)/losses amounting to (R317 thousand)(2005: R16,9 million) have been recognised in the income statement.

12. INVENTORY AND CONTRACTS IN PROGRESS

Inventory	**1 160**	3 304	**1 160**	3 148
Contracts in progress less provision for losses	**45 706**	62 200	**45 706**	62 200
	46 866	65 504	**46 866**	65 348

Estimates on contract in progress recognition are based on cost to completion, budgets and percentage of completion.

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000
13. MINORITY INTEREST				
Shareholders' loans	**3**	3		
Profit attributable to outside shareholders	**-**	-		
Prior years	**-**	805		
Current year	**-**	(805)		
	3	3		

The loans are interest free, unsecured and there are no fixed terms of repayment.

14. DEFERRED TAX LIABILITIES				
Balance at the beginning of the year	**24**	33		
Accelerated capital allowances	**(5)**	(9)		
	19	24		
15. ADVANCES RECEIVED				
Advances on contracts received from clients	**153 774**	114 160	**153 774**	114 160
16. TRADE AND OTHER PAYABLES				
Accounts payable and accruals	**264 916**	228 976	**263 347**	225 338

17. PROVISIONS

	Opening balance* R'000	Additional provisions R'000	Utilised and reversed R'000	**Closing balance R'000**
GROUP				
Provision for salary and related expenses	58 860	36 777	(30 337)	**65 300**
The provision for salary and related expenses includes provisions for leave pay and bonuses. The provision for leave is based on the actual number of leave days outstanding per employee. The provision for bonus is based on the principals of Value Based Performance bonus management. Value Based Perfomance bonus management combines the concept of economic perfomance and non-financial performance.				
	58 860	36 777	(30 337)	**65 300**
CSIR				
Provision for salary and related expenses	58 766	36 777	(30 246)	**65 297**
The provision for salary and related expenses includes provisions for leave pay and bonuses. The provision for leave is based on the actual number of leave days outstanding per employee. The provision for bonus is based on the principals of Value Based Performance bonus management. Value Based Perfomance bonus management combines the concept of economic performance and non-financial performance.				
	58 766	36 777	(30 246)	**65 297**

* Opening balances have been reclassified to ensure that the figures are comparable

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

18. OPERATING LEASE COMMITMENTS

Financial commitments under non-cancellable operating leases will result in the following payments falling due:

Within one year:	**9 578**	21 260	**9 578**	21 048
Land and buildings	**3 342**	5 943	**3 342**	5 732
Equipment	**4 706**	12 627	**4 706**	12 626
Vehicles	**1 530**	2 690	**1 530**	2 690
Within two to five years:	**5 994**	28 102	**5 994**	28 102
Land and buildings	**1 181**	10 853	**1 181**	10 853
Equipment	**3 105**	14 486	**3 105**	14 486
Vehicles	**1 708**	2 763	**1 708**	2 763

Agreements relating to operating lease payments for equipment and vehicles vary between 12 and 60 months and are fixed for the term of the agreements.

The CSIR leases buildings under operating leases. The leases typically run for a period of five years. Lease payments are increased with a fixed annual escalation percentage to reflect market rentals. None of the leases includes contingent rentals.

19. RETIREMENT BENEFITS OF EMPLOYEES

19.1 CSIR Pension Fund

The Fund is registered in terms of the Pension Funds Act of 1956, and is a defined contribution plan. The CSIR's liability to the Fund is limited to paying the employer contributions. Life cover and dependants' pensions are fully secured by a continued income and life insurance policy. All the CSIR's permanent employees are members of the fund. Employer contributions of R43,2 million (2005: R42,0 million) and employee contributions of R22,1 million (2005: R21,5 million) were paid over during the year. Employer contributions are charged against income when incurred.

19.2 Mine Officials Pension Fund and Sentinal

At the time of the merger with the Chamber of Mines Research Organisation (COMRO) in 1993 certain COMRO (Sentinal Mining) employees elected to remain members of the Mine Officials Pension Fund (one member) and Sentinal (three members)(previously Chamber of Mines Pension Fund). In terms of the agreement with the Chamber of Mines, this election holds no liability for the CSIR other than paying the monthly employee contributions. The funds are defined benefit plans. On 1 March 2001 the members of the Chamber of Mines Pension Fund moved to Sentinal. In respect of the employees who have formally converted their secondment to a CSIR appointment, employer contributions of R158,032 (2005: R159,912) and employee contribution of R86,779 (2005: R87,786) were paid over during the year. Employer contributions are charged against income when incurred.

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

19. RETIREMENT BENEFITS OF EMPLOYEES (continued)

19.3 Associated Institutions Pension Fund (AIPF)

The Fund is a defined benefit plan. The formula used to determine pensions is based on the pensionable earnings of the final year, and the aggregate period of uninterrupted membership. The CSIR has two employees (2005: four employees) who are members of the AIPF. The fund is controlled by the State, which has assumed responsibility for the unfunded portions of these funds. Employer contributions of R17,398 (2005: R39,587) and employee contributions of R10,873 (2005: R24,507) were paid over during the year to the AIPF.

19.4 Post-retirement medical benefits

The CSIR formed its own Medical Aid Scheme, based on managed health care principles, with a strong emphasis on co-responsibility between the fund and its members. The objective is to provide sustainable health care and simultaneously limit the cost, present and future, to a level that is affordable. The CSIR Board approved a cash payment of R190 million in 1997 to the Medical Aid Scheme, thereby transferring the liability for retirement benefits of members to the scheme. Due to changes in the Medical Schemes Act of 1998, the scheme can no longer accept the liability for retirement benefits of qualifying members of the scheme.

The accumulated benefit obligation and the annual cost of accrual of benefits are assessed by independent qualified actuaries using the projected unit credit method. The estimated present value of the anticipated expenditure, for both in-service and continuation members, was recalculated by the actuaries as at 31 March 2006.

The amount included in the balance sheet arising from the CSIR's obligation in respect of post-retirement medical benefits is as follows:

Present value of obligations	**14 897**	380 992	**14 897**	380 992
Fair value of plan assets	**-**	(273 685)	**-**	(273 685)
Net liability on balance sheet	**14 897**	107 307	**14 897**	107 307
Amounts recognised in income in respect of the scheme are as follows:				
Current service cost	**6 061**	5 901	**6 061**	5 901
Interest on obligation	**16 920**	34 522	**16 920**	34 522
Expected return on plan assets	**(9 822)**	(20 918)	**(9 822)**	(20 918)
Actuarial gains recognised during the year	**(69 760)**	(44 470)	**(69 760)**	(44 470)
Total	**(56 601)**	(24 965)	**(56 601)**	(24 965)
Movement in the net liability recognised in the balance sheets is as follows:				
Net liability at the beginning of the year	**107 307**	148 224	**107 307**	148 224
	(92 410)	(40 917)	**(92 410)**	(40 917)
Net income recognised in the income statement	**(56 601)**	(24 965)	**(56 601)**	(24 965)
Contributions	**(35 809)**	(15 952)	**(35 809)**	(15 952)
Net liability at the end of the year	**14 897**	107 307	**14 897**	107 307
Actual return on plan assets	**56.68%**	25.60%	**56.68%**	25.60%
Principal actuarial assumptions at the balance sheet date				
Discount rate at 31 March	**8.00%**	9.50%	**8.00%**	9.50%
Expected return on plan assets at 31 March	**8.00%**	9.50%	**8.00%**	9.50%
Medical inflation costs	**3.85%**	7.35%	**3.85%**	7.35%

20. BOARD MEMBERS, DIRECTORS AND EXECUTIVE MANAGEMENT'S REMUNERATION

			Managerial Services			
	Entity	Fees for services as director R'000	Basic salary R'000	Bonuses and performance related payments R'000	Retirement fund & medical aid contribution R'000	**Total R'000**
Board members and Executive Directors						
Dr S Sibisi	CSIR	-	1 419	847	285	**2 551**
Dr O Safriel*	Technology Finance Corporation (Pty) Ltd	-	1 332	150	20	**1 502**
Foreign subsidiaries						
Dr NA Waterman	Quotec Limited (UK)	-	209	-	-	**209**
Dr A Hickman	Quotec Limited (UK)	-	919	264	6	**1 189**
Dr J Galsworth	Quotec Limited (UK)	-	546	80	5	**631**
Remunerated in Pound sterling						
Non-executive Board members						
Prof C De la Rey	CSIR	7	-	-	-	**7**
Mr K Ginwala (up to Dec 05)	CSIR	6	-	-	-	**6**
Prof M Wingfield	CSIR	7	-	-	-	**7**
Dr N Msomi	CSIR	9	-	-	-	**9**
Dr Z Rustomjee (up to Dec 05)	CSIR	5	-	-	-	**5**
Ms I Mkhize (up to Dec 05)	CSIR	8	-	-	-	**8**
Ms N Shikwane	CSIR	10	-	-	-	**10**
Executive Management						
Mr AJ Jordaan	CSIR	-	1 034	1 183	318	**2 535**
Dr P Mjwara**	CSIR	-	1 037	1 017	147	**2 201**
Mr V Pillay (since July 05)	CSIR	-	557	172	90	**819**
2006		**52**	**7 052**	**3 713**	**871**	**11 688**
2005		73	8 693	1 829	891	11 486

* Including severence and leave payout
** Including leave payout

21. INSURANCE AND RISK MANAGEMENT

The insurance and risk management policies adopted by the CSIR are aimed at obtaining sufficient cover at the minimum cost to protect its asset base, earning capacity and legal obligations against unacceptable losses.

All property, plant and equipment are insured at current replacement value. Risks of a possible catastrophic nature are identified and insured while acceptable risks of a non-catastrophic nature are self-insured. Self-insurance has been instituted where the cost-to-benefit relationship exceeds the risk and the incidence of losses, is of a minor and infrequent nature. Self-insured risks are reviewed on an annual basis to ensure cover is adequate. An amount of R10,75 million (2005: R10,75 million) is held in a self-insurance fund to cover these risks. This amount is disclosed as part of reserves in the balance sheet. No major losses were experienced during the year under review. Claims of a general nature were adequately covered.

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

22. CONTINGENT LIABILITIES AND FACILITIES

Bank guarantees issued in respect of third party liabilities	**13 990**	33 062	**13 990**	33 062
South African Revenue Services (SARS)	**-**	1 000	**-**	1 000
	13 990	34 062	**13 990**	34 062

South African Revenue Services (SARS):
Prior to the National Laser Centre (NLC) being incorporated into the CSIR, it was reported as a Trust for public benefit. An application for income tax exemption has been lodged with SARS. Subsequent to 31 March 2005 the matter was resolved and the NLC will not be liable for the payment.

Legal costs and litigation:
In the nature of the CSIR's business, agreements with complex deliverables may be entered into. All necessary steps are taken to manage the risks inherent to these transactions. If and when it is evident that there is a reasonable probability that a dispute on a transaction could lead to costs against the CSIR, such costs will be disclosed. Management was not aware of any pending legal action and litigation against the CSIR up to the date of this report which could result in any material losses to the CSIR.

Banking facilities:
The CSIR has a short-term general banking facility of R44,990 million available.

23. CAPITAL COMMITMENTS

Authorised but not contracted	**16 369**	96 380	**16 369**	96 380

Included in these amounts is an amount of R6,2 million for the erection of a building.
This capital expenditure is to be financed from internal sources.

24. FINANCIAL INSTRUMENTS

24.1 Foreign currency risk

The group enters into forward exchange contracts to buy specified amounts of foreign currencies in the future at a predetermined exchange rate. Forward exchange contracts are entered into mainly to cover import orders. The group has no policy to enter into forward exchange contracts for anticipated foreign receipts. The group does not use derivative financial instruments for speculative purposes.

Accounts receivable at 31 March 2006 include foreign trade receivables of R14,4 million (2005: R11,7 million).

The following summarises amounts to be paid under forward exchange contracts:

US dollars 3 - 6 months at rates averaging USD 6,2557 (2005: USD 5,9429)	**-**	144	**-**	144
Euro 3 - 6 months at rates averaging EUR 7,5489 (2005: EUR 7,8308)	**-**	207	**-**	207
	-	351	**-**	351

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

24. FINANCIAL INSTRUMENTS (continued)

24.2 Credit risk

Financial assets that could subject the group to credit risk consist principally of bank balances and deposits, trade and other receivables and loans to joint ventures and subsidiaries. The group's bank balances and cash are placed with high credit quality financial institutions. Trade and other receivables and loans to joint ventures and subsidiaries are presented net of impairment losses. Credit risk with respect to trade receivables is limited due to the large number of customers comprising the group's customer base and their dispersion across different industries and geographical areas. Accordingly, the group does not have a significant concentration of credit risk. The carrying amounts of financial assets included in the balance sheet represent the group's exposure to credit risk in relation to these assets. The group does not have any significant exposure to any individual customer or counter party.

24.3 Fair values

At 31 March 2006 the carrying amount of bank balances and cash, deposits, trade and other receivables, contracts in progress, advances received and trade and other payables approximated their fair values due to the short-term maturities of these assets and liabilities.

24.4 Interest rate risk

Interest rate exposure and investment strategies are evaluated by management on a regular basis. Interest-bearing investments are held with reputable banks in order to minimise exposure.

25. RECONCILIATION OF OPERATING SURPLUS/(DEFICIT) TO CASH GENERATED BY OPERATIONS

Operating surplus after post-retirement medical benefits*	**35 639**	56 482	**29 609**	45 285
Adjusted for:				
Profit on disposal of property, plant and equipment	**(24)**	(22)	**-**	-
Profit on disposal of interest in subsidiary	**(4)**	-	**-**	-
Depreciation and amortisation	**40 239**	42 272	**39 386**	41 163
Net unrealised foreign exchange (gain)/loss	**(806)**	(2 051)	**(810)**	(2 051)
Unrealised gain on investment	**-**	(15 063)	**-**	(15 063)
Post-retirement medical benefit	**(52 884)**	(40 917)	**(52 884)**	(40 917)
Straight-lining adjustment of operating leases	**702**	-	**702**	-
Provision for bonuses and leave	**36 777**	41 136	**36 777**	41 136
Impairments	**1 937**	1 608	**10 619**	10 827
Loss on disposal of property, plant and equipment	**2 002**	523	**1 993**	431
Loss on disposal of joint venture	**-**	1 704	**-**	-
Operating surplus before changes in working capital	**63 578**	85 672	**65 392**	80 811
(Increase)/decrease in trade and other receivables	**(15 772)**	5 092	**(15 275)**	6 273
Decrease/(Increase) in inventory and contracts in progress	**18 384**	(15 472)	**18 228**	(15 497)
Increase in advances received	**39 614**	23 638	**39 614**	23 638
Increase/(decrease) in trade and other payables and provisions	**5 382**	(1 679)	**7 541**	(1 532)
Net working capital changes	**47 608**	11 579	**50 108**	12 882
Cash generated by operations	**111 186**	97 251	**115 500**	93 693

* Comparative figures have been reclassified to ensure that the figures are comparable

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

26. BANK BALANCES AND CASH ON HAND

Cash on deposit	**229 929**	217 121	**226 153**	209 000
Bank balances	**63 926**	86 645	**62 763**	85 974
Cash on hand	**156**	443	**154**	443
	294 011	304 209	**289 070**	295 417

27. RELATED PARTY TRANSACTIONS

The CSIR is one of twenty nine schedule 3B National Government Business Enterprises in terms of the Public Finance Management Act (Act 1 of 1999 as amended by Act 29 of 1999) and therefore falls within the national sphere of government. As a consequence, the CSIR has a significant number of related parties being entities that fall within the national sphere of government. In addition, the CSIR has a related party relationship with its subsidiaries (see Annexure A) and joint ventures and associates (see note 8). Unless specifically disclosed these transactions are concluded on an arm's length basis and the group is able to transact with any entity.

27.1 Transactions with related parties

The following is a summary of transactions with related parties during the year and balances due at year-end:

Constitutional Institutions				
Services rendered*	**121**	36	**121**	36
Services received	**324**	262	**324**	262
Amount due from/(to)	**3**	-	**3**	-
Major Public Entities				
Services rendered*	**108 343**	55 592	**108 343**	55 592
Services received	**11 692**	11 792	**11 692**	11 792
Amount due from/(to)	**11 409**	12 314	**11 409**	12 314
National Public Entities				
Services rendered*	**53 015**	23 901	**53 015**	23 901
Services received	**2 660**	3 125	**2 660**	3 125
Amount due from/(to)	**13 499**	15 308	**13 499**	15 308
National Government Business Enterprises				
Services rendered*	**4 052**	2 025	**4 052**	2 025
Services received	**1 255**	1 157	**1 255**	1 157
Amount due from/(to)	**1 200**	1 661	**1 200**	1 661
Government Departments				
Services rendered*	**492 677**	427 610	**492 677**	427 610
Services received	**95**	268	**95**	268
Amount due from/(to)	**5 828**	21 269	**5 828**	21 269
Subsidiaries				
Services rendered	**-**	-	**1 852**	2 299
Services received	**-**	-	**1 130**	1 550
Amount due from/(to)	**-**	-	**(6 023)**	(7 220)
Associates				
Services rendered	**60**	247	**60**	247
Services received	**-**	-	**-**	-
Amount due from/(to)	**14 813**	15 168	**14 813**	15 168

*Comparative figures for services rendered are for seven months only. This is due to the fact that the CSIR changed financial systems during the 2004/5 financial year and it will not be economically viable to extract the data required

	GROUP		CSIR	
	2006	2005	**2006**	2005
	R'000	R'000	**R'000**	R'000

27. RELATED PARTY TRANSACTIONS (continued)

27.2 Transactions with key management personnel

There were no new loans to key management during the year (2005: nil) and R92,617 (2005: R162,081) are included in the other receivables (see note 11). No interest is payable by key management.

Total remuneration is included in employee remuneration (see note 20).

Directors	**4 053**	2 905	**2 551**	1 900
Executive Officers	**7 584**	8 508	**5 555**	6 842

28. DISPOSAL OF INTEREST IN SUBSIDIARIES

28.1 Technovent Administration (Pty) Ltd

The group held 100% of the issued share capital in Technovent Administration (Pty) Ltd.
The shares held were sold effective 31 July 2005.

The net assets of Technovent Administration (Pty) Ltd on 31 July 2005 were as follows:

Net asset value	-
Profit on disposal	**2**
Total consideration	**2**
Net cash outflow arising on disposal of interest in subsidiary	
Bank balance and cash disposed	-

28.2 Technovent Engineering (Pty) Ltd

The group held 100% of the issued share capital in Technovent Engineering (Pty) Ltd. The shares held were sold effective 31 July 2005.

The net assets of Technovent Engineering (Pty) Ltd on 31 July 2005 were as follows:

Net asset value disposed	-
Profit on disposal	**2**
Total consideration	**2**
Net cash outflow arising on disposal of interest in subsidiary	
Bank balance and cash disposed	-

29. DEREGISTRATION OF SUBSIDIARY

29.1 Full Motion Systems (Pty) Ltd

The group held 100% of the issued share capital in Full Motion Systems (Pty) Ltd. The company was deregistered on 8 February 2006.

The net assets of Full Motion Systems (Pty) Ltd on deregistration were as follows:

Net asset value disposed	-
Loss on deregistration	-
Total consideration	-
Net cash outflow arising on deregistration of interest in subsidiary	
Bank balance and cash disposed	-

30. SUBSEQUENT EVENT

Subsequent to balance sheet date, negotiations to sell the building under construction, as disclosed in note 6, are being finalised.

31. STANDARDS AND INTERPRETATIONS ISSUED, NOT YET EFFECTIVE

At the date of authorisation of the financial statements of the group for the year ended 31 March 2006, the following standards and interpretations were in issue but not yet effective:

Standard/Interpretation	Description	Effective Date
IFRS 7 (AC144)	Financial instruments: Disclosures (including amendments to IAS 1 (AC 101), Presentation of Financial Statements: Capital Disclosure)	Annual periods commencing on or after 1 January 2007
IAS 19 (AC 119)	Employee benefits	Annual periods commencing on or after 1 January 2006
IAS 39 (AC 133) amendment	Financial instruments: Recognition and measurement (April 2005) Cash flow hedge accounting of forecast intragroup transactions	Annual periods commencing on or after 1 January 2006
IAS 39 (AC 133) amendment	Financial instruments: Recognition and measurement (June 2005) Fair value option	Annual periods commencing on or after 1 January 2006
IAS 39 (AC 133) & IFRS 4 (AC 141)	Financial instruments: Recognition and measurement (August 2005) Insurance contracts - financial guarantee contracts	Annual periods commencing on or after 1 January 2006
IAS 21 (AC112)	The effects of changes in foreign exchange rate (December 2005) - Net investment in a foreign operation	Annual periods commencing on or after 1 January 2006
IFRIC 4 (AC 437)	Determining whether an arrangement contains a lease	Annual periods commencing on or after 1 January 2006

The effect of adopting the above standards or interpretations has not yet been determined, but will be applied after the effective date.

Addendum A: Interest in subsidiaries

31 March 2006

Consolidated subsidiaries	Country of incorporation	Interests of the CSIR Issued capital	Effective holding		Financial year end	Shares at cost less accumulated impairment	
			2006	2005		2006	2005
		R'000	%	%		R'000	R'000
Direct Investments							
South African Inventions Development Corporation (SAIDCOR)	South Africa	**27 220**	**100**	100	31 March	**13 812**	27 220
Technovent (Pty) Ltd	South Africa	**5 000**	**100**	100	31 March	**-**	-
CSIR International Limited*	British Virgin Island	**326**	**100**	100	31 March	**326**	326
Quotec Limited	United Kingdom	**100**	**100**	100	31 March	**4 226**	4 227
						18 364	31 773
Indirect Investments							
Included in SAIDCOR:							
Technology Finance Corporation (Pty) Ltd (Technifin)	South Africa	**5 200**	**100**	100	31 March	**4 650**	4 650
Included in Technifin carrying value:							
Implico BV (Incorporated in the Netherlands	Netherlands/ South Africa	**71**	**100**	100	31 March	**-**	-
Included in Technovent (Pty) Ltd							
Brilliant Security Solutions (Pty) Ltd*	South Africa	**-**	**88**	88	31 March	**-**	-
Plasmatherm (Pty) Ltd**	South Africa	**-**	**100**	100	31 March	**-**	-
Agrimage (Pty) Ltd***	South Africa	**-**	**100**	100	31 March	**-**	-

* No statutory audit was performed

* Issued capital R100 and shares at cost R88
** Issued capital R1 and shares at cost R1
*** Issued capital R100 and shares at cost R80

The group has interests in eight dormant companies. Details of these interests are available at the CSIR's registered office.

Net indebtedness to subsidiaries		Net indebtedness by subsidiaries		Net Investment		General nature of business
2006 R'000	2005 R'000	**2006 R'000**	2005 R'000	**2006 R'000**	2005 R'000	
8 651	8 811	**-**	-	**5 160**	18 409	Investment in research development and implementation of technology.
-	-	**-**	-	**-**	-	The company sources technologies and entrepreneurs from the CSIR, other S&T institutions, universities or any developer of technology and develops them into viable businesses with the aim of spinning them off for capital gain.
-	-	**-**	-	**326**	326	The company serves as a holding company for certain CSIR international activities
-	-	**2 628**	1 591	**6 855**	5 819	The principal activity of the company is that of consultants on technology auditing, technology evaluation and technology transfer on behalf of clients in the public and private sectors.
8 651	8 811	**2 628**	1 591	**12 341**	24 554	

The acquisition and transfer of technology to industry by licensing new inventions, providing finance to develop technology and venture capital for the exploitation thereof.

Assisting research institutes, companies and individuals to acquire and/or develop and transfer to industry commercially viable technology. Supports the commercialisation of technology by licensing inventions, providing finance to develop technology and selling certain products.

Commercialising and exploiting a range of intrusion alarm systems. The company will be deregistered during the 2007 financial year.

Providing plasma nitrating surface hardening services to the industry.

Providing satellite images to farmers for precision farming. The business was sold during the 2005 financial year.

8 651	8 811	**2 628**	1 591	**12 341**	24 554	

CSIR Group Executive and Executive Directors

CSIR Board

Dr Sibusiso Sibisi
CSIR President and CEO

Dr Phil Mjwara
Group Executive:
R&D and Strategic HCD

Vishnu Pillay
Group Executive:
Institutional Planning and Operations

Albert Jordaan
Group Executive:
Finance and Services

André Nepgen
CSIR Defence, Peace, Safety and Security

Dr Hoffie Maree
CSIR Built Environment

Dr Gatsha Mazithulela
CSIR Biosciences

Johan le Roux (acting)
CSIR Materials Science and Manufacturing

Khungeka Njobe
CSIR Natural Resources and the Environment

Phil Hendricks
CSIR National Research Centres, Strategic Relationship Management and Contract R&D

Dr Rodney Milford
CSIR Knowledge Services

Abbreviations

AIDC	Automotive Industry Development Centre
AFIS	Advanced Fire Information System
AMTS	Advanced Manufacturing Technology Strategy
API	Air Pollution Index
APT	Accelerated Pavement Testing
BioPAD	Biotechnology Partnership and Development
BIPM	Bureau International de Poids et Mésures
BIRU	Blast Impact and Survivability Research Unit
BRICS	Biotechnology Research Innovation Centres
CAA	Commonwealth Association of Architects
CAPT	Consortium of APT and Technical Exchange Partnership
CDC	Centres for Disease Control
CEO	Chief Executive Officer
CIPI	Competitive Industrial Performance Index
CIT	Cash-in-transit
CMC	Calibration and Measurement Capability
CNES	French National Space Agency
COIN	Community-owned Information Network
COSAMP	Collaborative Spatial and Modelling Platform
CPTED	Crime Prevention through Environmental Design
CSIR	Council for Scientific and Industrial Research
CSSG	Cyber Security Science Centre
DAPPS	Dynamic Air Pollution Prediction System
DSC	Dye-sensitised Solar Cells
DST	Department of Science and Technology
DTI	Department of Trade and Industry
ECT	Electronic Communications and Transactions
EHS	Environment, Health and Safety
EODC	Earth Observation Data Centre
ERP	Enterprise Resource Planning
ESASTAP	European South African S&T Advancement Programme
EU	European Union
FLOSS	Free/Libre Open Source Software
FOSSFA	Free Software and Open Source Foundation for Africa
GBADS	Ground-based Air Defence System
GEOSS	Group Earth Observation System of Systems
GLP	Good Laboratory Practice
GMO	Genetically Modified Organism
GSFC	Goddard Space Flight Centre
HCD	Human Capital Development
HLT	Human Language Technologies
HM	High Methodoxyl
HR	Human Resources
HVS	Heavy Vehicle Simulator
ICT	Information and Communications Technology
IFR	Injury Frequency Rate
IMS	Integrated Manufacturing Strategy
IP	Intellectual Property
IT	Information Technology
IUGG	International Union of Geodesy and Geophysics
IW	Information Warfare
LAP	Load Accreditation Programme
LCPT	Local Crime Prevention Toolkit
LM	Low Methodoxyl
MEA	Millennium Ecosystem Assessment
MODIS	Moderate Resolution Imaging Spectroradiometer
MPV	Multi-purpose Vehicle
MRC	Medical Research Council
MVGD	Mobile Virtual Ground-based Air Defence Demonstrator
NAP	National Accessibility Portal
NASA	National Aeronautics and Space Administration
NHRD	National Human Resources Development
NEPAD	New Partnership for Africa's Development
NFAC	National Forestry Advisory Council
NMI	National Metrology Institute
NOSA	National Occupational Safety Association
NPA	National Ports Authority
NRDS	National R&D Strategy
NRF	National Research Foundation
NSI	National System for Innovation
ORSSA	Operations Research Society of South Africa
OSC	Open Source Centre
OSS	Open Source Software
PCT	Patent Cooperation Treaty
PG	Parliamentary Grant
PTB	Physikalisch-Technische Bundesanstat (Germany)
R&D	Research and Development
REEF	Regional Expensive Forum Equipment
SANDF	South African National Defence Force
SET	Science, Engineering and Technology
SHE	Safety, Health and Environment
SMME	Small, Medium and Micro Enterprises
S&T	Science and Technology
SWE	Sensor Web Enablement
TB	Tuberculosis
TEI	Tertiary Education Institutions
TfD	Technology for Development
THRIP	Technology and Human Resources for Industry Programme
TT&C	Telemetry, Tracking and Command
TTS	Text-to-screen
TTSI	Technology Transfer for Social Impact
UNDP	United Nations Development Programme
UP	University of Pretoria
VGD	Virtual GBADS Demonstrator
WC PAMTS	Western Cape Provincial AMTS
WWRF	Wireless World Research Forum

Notes

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