

# CSIR ANNUAL REPORT 2004/5



celebrating 60 years of excellence in science and technology



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The CSIR was founded on 5 October 1945 (Scientific Research Council Act, Act No 33 of 1945) and was constituted as a Science Council by the Scientific Research Council Act (Act No 46 of 1988, as amended by Act 71/1990), with the following objects (referred to as the mandate):

"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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**Roger Jardine**  
Chairperson of the CSIR Board

## Chairperson's Review

**A**s a leading science and technology (S&T) research organisation, the CSIR has played an integral part in the development of South Africa as a technologically advanced society, but it continues to review its role in the context of national priorities to ensure that it maintains a solid foundation to respond appropriately to national needs.

On the eve of its 60th birthday, the CSIR stands at a crossroads that will determine its future. The organisation's leadership has acknowledged a watershed in its development and has responded with admirable fortitude, setting about implementing a process that will refocus its core activities to ensure that it adheres to its founding purpose, which ultimately strives to improve the quality of life of the people of South Africa. I see this as an opportunity to recharge the science and research agenda within the CSIR in order to reposition South Africa as a global S&T hub. While focusing on strengthening its S&T base, the CSIR will continue to retain and grow its sound business and commercial

discipline, and work towards achieving enhanced relevance and impact.

I am pleased that the CSIR continues to focus on investment in human resource development (HRD) as part of its integrated strategy appropriate to a directed research environment. The result will be a sound HRD strategy, properly resourced and linked to an appropriate reward and recognition system. Building an organisation that has a strong skills base is crucial for the future of the CSIR; it must attract the best minds to develop a future generation of researchers who can flourish and grow to play a role in national development.

The organisation has been working with the Department of Trade and Industry (the dti) in response to a foreign-funded study that identified the need for venture capital to support technology transfer. The focus is in its early stages as there is limited capital supporting such initiatives and the study has advocated more funding. However, the legal structure for a venture fund has been established with funding contribution totalling

R120 million from various sources. Such initiatives are inevitably long term in nature and the challenge now is to find promising technologies with all the right ingredients (such as an experienced team of entrepreneurs) to take the technology to market, or companies that will adopt the technologies. The primary source of technologies will be science councils and higher education institutions.

Increasing international concern about climate change, poverty and the apparent inability of parts of the world to meet the Millennium Development Goals has contributed towards a growing awareness of the role of S&T. The CSIR has responded to these changes by building relevant alliances with leading international institutions and agencies. The strong rand has clearly had an impact on many organisations involved in foreign sales. Although it may have had some effect on the CSIR's foreign operations, the organisation has never really competed on a price basis. The emphasis has always been on the quality of the technology produced. Multinational partners continue to collaborate with the CSIR on a variety of projects and the organisation still plays a crucial role in the Global Research Alliance (GRA). The outcome of the CSIR's reconfiguration process is expected to reflect a fresh approach to its

international objectives, strategies and thinking.

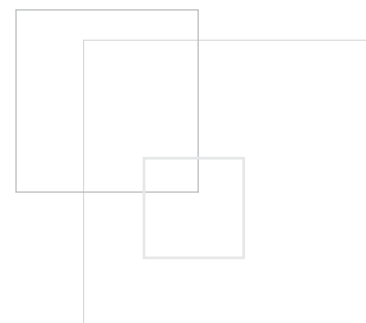
The CSIR has adapted well to its changing environment, both nationally and abroad, forging ahead with renewed purpose and vigour. The organisation's financial health is sound and it has performed well in finding holistic technology solutions to the challenges facing South Africa. I do believe that the CSIR has the necessary substance and motivation to make a significant impact on the national S&T landscape. Its reputation for technological excellence and innovation spanning more than half a century, coupled with its renewed focus on meeting the needs of our people through the application of world-class scientific knowledge, will propel the CSIR forward as an innovative knowledge-intensive force.

I would like to convey my thanks to the CSIR Board members for their valuable support and commitment throughout the year, in particular, Llew Jones, who completed his last year on the Board and has served us well over the years. I am confident that he will add immense value to the CSIR in his new role as Acting Executive Director of the Meraka Institute. My appreciation must also go to the CSIR management and the dedicated and capable staff.

The organisation has seen various shifts in its Executive team. We are much indebted to Dr Anthos Yannakou and Tina Eboka for the years they dedicated to the CSIR. It is encouraging to know that we have nurtured and developed people who are sought after in the private sector and wish them well in their new positions. We are very pleased to welcome Dr Phil Mjwara as Group Executive for Research and Development (R&D) and Human Capital Development. This portfolio will focus on knowledge generation, including strategic research, contract R&D, S&T management and strategic research partnerships and strategic HRD. This new appointment bodes well for the CSIR's realignment with its core purpose grounded in S&T.



**Roger Jardine**  
**Chairperson of the CSIR Board**







**Dr Sibusiso Sibisi**  
**CSIR President and CEO**

## President's Overview

The dawn of the CSIR's 60th birthday in October 2005 has given us cause to reflect on our future and to review our role in the science and research landscape of our country. We cannot deny a clear call for greater balance between our business effectiveness and a strong replenished base of S&T expertise, all the while adhering to our core purpose, expressed through our mandate, of having a positive impact on the nation. With this in mind, we embarked on what we have called the CSIR Beyond 60 process to ensure that our structure and operations are configured accordingly.

The purpose of this initiative is to shape the organisation to serve South Africa's needs beyond the CSIR's 60th birthday by ensuring a stronger S&T capability, continued high standards in business operations, and the transfer of knowledge for positive impact on the quality of life of all South Africans.

The roadmap that has emerged from the process will be implemented within the coming financial year with the hope of achieving a large-scale renewal to ensure that the CSIR remains relevant

in the ongoing development of our country's economy and society.

The results for the past year reflect both the strength and resilience of the CSIR's operations. These have been developed over many years on sound business principles and technological innovation. I know that the coming year will mark a transition in our organisation's history, requiring a fundamental change in our priorities, with an increasing emphasis on transforming human capital and performing relevant knowledge-generating research in order to fulfil our mandate more effectively.

Our international relations continue to flourish, particularly with regard to our involvement with the GRA. The CSIR has been appointed as the lead agency in the GRA's global health initiative and is collaborating with various international partners in a World Bank project. A global drive to raise the profile of indigenous knowledge and address the challenges in this area was led by the CSIR in February this year, involving traditional healers and scientists from five continents. Collaborative ventures with various

multinational corporations have enjoyed prominence in the past financial year and discussions are under way to forge new partnerships.

With the growing importance of the continental perspective, the CSIR's purpose extends to sharing and acquiring knowledge and expertise to support the development of Africa. Partnerships are sought to pursue the development of appropriate technological solutions in support of regional strategic interventions such as the New Partnership for Africa Development (NEPAD). One such initiative is the Regional Research Alliance, which came into being in October 2004 with the purpose of pooling resources to strengthen the impact on regional challenges in the areas of water resource management, energy and infrastructure. This initiative has sparked considerable interest and currently involves Botswana, Zimbabwe and South Africa.

Participation in national strategies has been secured in key areas, with progress in the manufacturing and biotechnology domains. Further involvement is foreseen through the injection of technology into resource-based industries and participation in

the national science programmes. The quest for renewal at the CSIR will focus on developing the competitiveness of key industrial sectors targeted for growth as a critical national objective for job creation.

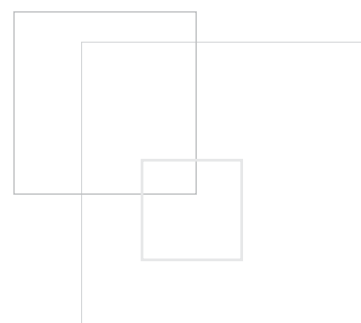
Our S&T offerings must also contain an appropriate focus on our unskilled population to ensure a meaningful contribution to transformation. Fulfilment of the CSIR's agenda to enhance its S&T base for purposes of economic and social upliftment is interlinked with growth in human capital. Over the next three years the organisation aims to increase the proportion of staff with post-graduate qualifications from the present level of 22.5% to in excess of 28%, with a strong focus on transforming the staff composition to approach national demographics. Contributing towards national HRD through increasing our research and technical capacity is an imperative that will receive the highest level of attention over the next five to 10 years. Creating appropriate opportunities for the professional growth of research staff, particularly young researchers, will be a crucial component of our programmes. Strategic recruitment of young graduates is also an important aspect of developing a strong influx of new

talent into the organisation. Our strengths are encapsulated in our people, bringing together diverse skills, cultures and perspectives in pursuit of a greater goal. My thanks must go to our staff, the leadership team and the CSIR Board for their significant contributions over the past year to the progress of the CSIR. While we are proud of where the organisation is positioned today and the significant strides made over the years, we recognise the profound challenges we face now as a uniquely South African yet world-class S&T organisation.

My hope is that our 60th birthday celebrations will not only commemorate our past achievements, but that it will create a new culture of innovation, bringing with it renewed excellence in S&T.



**Dr Sibusiso Sibisi**  
**CSIR President and CEO**



# Research and



celebrating **60** years of excellence in science and technology



# Development Highlights

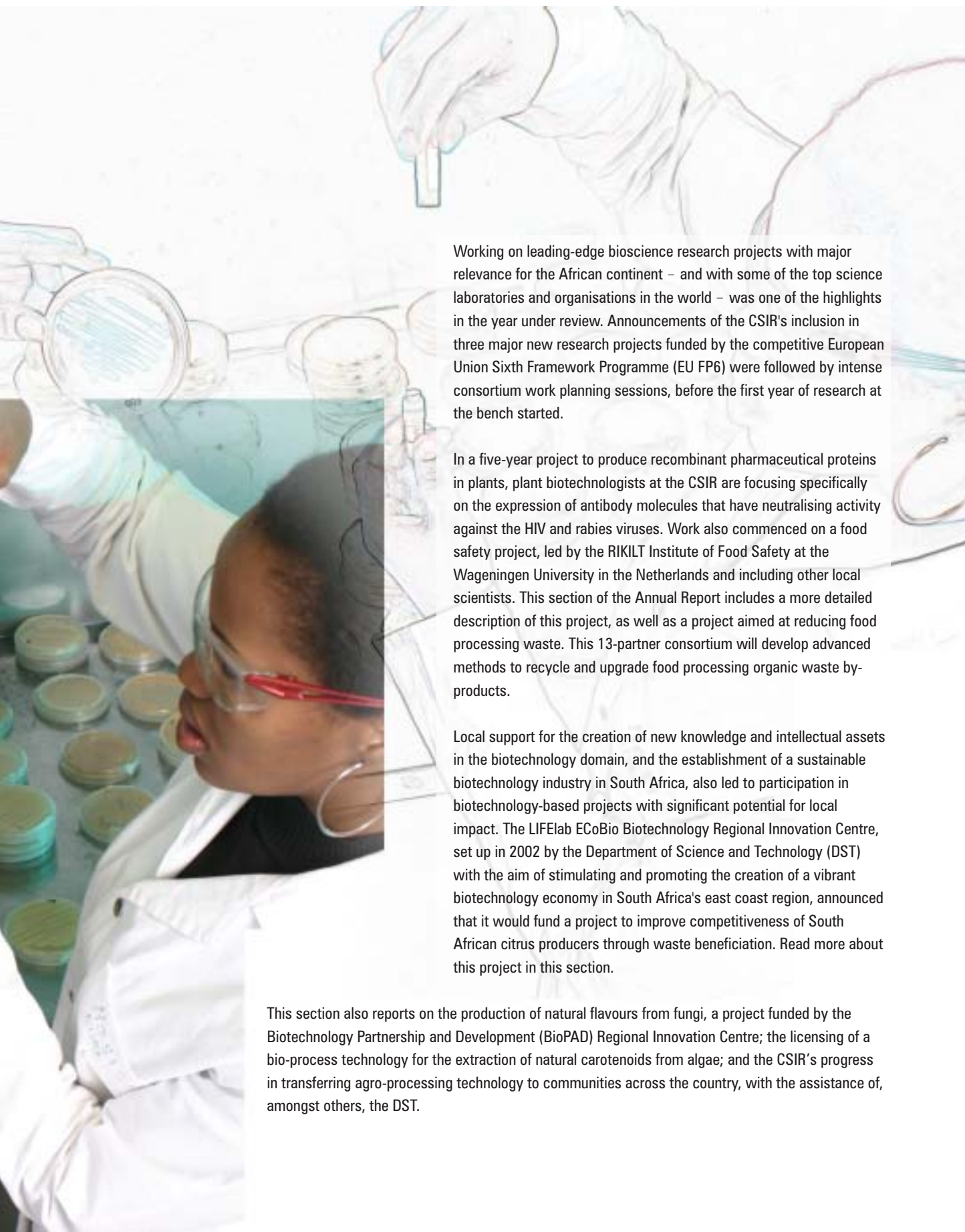
Technological core competences form the basis of the CSIR's long-term sustainability and relate to the unique ability to acquire, develop and transfer technology within a number of specific market-related themes. Largely similar to the technology missions of the National R&D Strategy, the CSIR has defined its technological core competences as manufacturing and materials, ICT, environment, infrastructure and bioscience. The organisation is also active in the areas of mining and defence technologies. This section of the Annual Report offers a brief snapshot of the CSIR's activities during the year under review by highlighting a number of innovative projects and initiatives in these areas.



# Bioscience

celebrating **60** years of excellence in science and technology





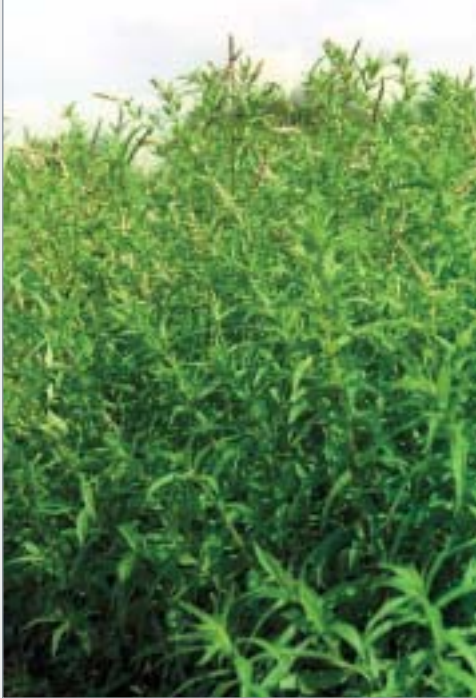
Working on leading-edge bioscience research projects with major relevance for the African continent – and with some of the top science laboratories and organisations in the world – was one of the highlights in the year under review. Announcements of the CSIR's inclusion in three major new research projects funded by the competitive European Union Sixth Framework Programme (EU FP6) were followed by intense consortium work planning sessions, before the first year of research at the bench started.

In a five-year project to produce recombinant pharmaceutical proteins in plants, plant biotechnologists at the CSIR are focusing specifically on the expression of antibody molecules that have neutralising activity against the HIV and rabies viruses. Work also commenced on a food safety project, led by the RIKILT Institute of Food Safety at the Wageningen University in the Netherlands and including other local scientists. This section of the Annual Report includes a more detailed description of this project, as well as a project aimed at reducing food processing waste. This 13-partner consortium will develop advanced methods to recycle and upgrade food processing organic waste by-products.

Local support for the creation of new knowledge and intellectual assets in the biotechnology domain, and the establishment of a sustainable biotechnology industry in South Africa, also led to participation in biotechnology-based projects with significant potential for local impact. The LIFElab ECoBio Biotechnology Regional Innovation Centre, set up in 2002 by the Department of Science and Technology (DST) with the aim of stimulating and promoting the creation of a vibrant biotechnology economy in South Africa's east coast region, announced that it would fund a project to improve competitiveness of South African citrus producers through waste beneficiation. Read more about this project in this section.

This section also reports on the production of natural flavours from fungi, a project funded by the Biotechnology Partnership and Development (BioPAD) Regional Innovation Centre; the licensing of a bio-process technology for the extraction of natural carotenoids from algae; and the CSIR's progress in transferring agro-processing technology to communities across the country, with the assistance of, amongst others, the DST.





**The CSIR is supporting a number of communities in the cultivation and processing of medicinal and aromatic plants**



**Citrus peel is an excellent source of pectin, a polysaccharide used as a thickening or gelling agent in formulated foods**



**The CSIR and its partners have developed a novel microwave technology system for the pasteurisation of raw, whole shell eggs**

## Transferring agro-processing technology to communities

The CSIR has dedicated significant research over the last decade to unlocking the potential economic value of South Africa's biodiversity and indigenous knowledge. At the same time, the organisation has begun to transfer agro-processing technology to communities. This development was a logical extension of the relationship between science, biodiversity and indigenous knowledge and also presented an ideal opportunity for community empowerment. Knowledge transfer was achieved with support from primarily the DST, as part of its poverty alleviation drive.

Today, communities in different parts of South Africa are in varying stages of cultivating and processing medicinal and aromatic plants of high value. The products are sought-after trade items that are finding their way into cosmetics, pharmaceutical and personal care products worldwide. In Limpopo, projects are run in Gyani, Maswanganyi and Stemora; in the Western Cape, at Genadenberg and Pacaltsdorp; in Mpumalanga at Drie Koppies, Hazyview and Badplaas; in the Eastern Cape at Kwa Nobuhle and Mount Frere; in the Free State at Letsemeng; and in the Northern Cape at Onseepkans and Pella.

## Biotechnology extraction process licensed

The CSIR has licensed a biotechnology-based process to Natural Carotenoids South Africa for the extraction of natural carotenoids from algae. Carotenoids are natural compounds

responsible for the characteristic colour of many plant organs, such as ripe tomatoes and carrots. Beta-carotene yields vitamin A when broken down, while other carotenoids are responsible for anti-oxidant properties and eye health. These properties make carotenoids sought after in the health, food and cosmetics markets.

The transfer of a pilot plant has been included in the technology licence agreement. The plant was established by the CSIR in Upington where sunny conditions, access to water and low pollution levels are conducive for cultivating the algae in large dams.

## Putting citrus waste to good use

Biochemists at the CSIR joined forces this year with the University of Durban-Westville, the Chemin incubator and Kat River Citrus Co-op Ltd to set up a pectin production plant that uses enzymes in the production of pectins from citrus waste. The project is funded by the LIFElab ECoBio Regional Innovation Centre which hopes to improve the competitiveness of South Africa's citrus producers through waste beneficiation.

The South African citrus industry is one of the largest exporters in the world and produces large volumes of waste in the form of citrus peel. Pectin is a polysaccharide found abundantly in the primary walls and the intercellular layers of plant cells. In citrus fruit, pectin is a constituent of the white spongy inner part of the peel. Pectins are used as thickening or gelling agents in a broad range of formulated foods such as yoghurt, milk desserts and



jellies. Traditionally, pectin is produced by chemical hydrolysis, with significant yield losses and the production of substantial waste streams.

The extraction of crude high methoxyl (HM) pectin from citrus peel lends itself to application in rural environments close to the citrus producers. Therefore, the first focus of this three-year project is to adapt the current HM pectin extraction process to enable SMMEs to operate the extraction facilities. The second focus, which represents a significant opportunity for long-term sustainability, is to convert HM pectin to value-added low methoxyl pectin, using an enzyme-based process.

### Novel egg pasteurisation technology

A novel microwave technology system for the pasteurisation of raw, whole shell eggs has resulted from a collaborative research project in which food scientists, electronic engineers, physicists and the egg industry pooled their knowledge.

The safety of eggs has become a global issue with the emergence of the pathogen *Salmonella enteritidis* as a major hazard associated with the consumption of eggs. The risk is higher for HIV-positive people, for whom exposure to pathogenic microorganisms can prove devastating.

The research team has developed technology that pasteurises eggs, thereby significantly reducing the risk of food poisoning and improving the

shelf-life of eggs at ambient temperatures.

A dry pasteurisation system is used that eliminates the problems associated with liquid immersion treatment systems. Limited market testing of the technology is currently under way.

### Innovative edible coating for export fruit

Scientists at the CSIR and the University of Pretoria (UP) are making final improvements to a new edible, biodegradable, plant-based protein to be used as a coating to extend the shelf-life of fruit and nuts. This research was completed as part of a European Commission-funded project aimed at improving southern Africa's fruit and nut exports, utilising by-products from sorghum processing. The fruit industry is of vital importance to the South African economy, with almost half of its fresh fruit production being exported.

When exporting climacteric fruits, which ripen after being harvested, ripening needs to be prevented by slowing down respiration and preventing dehydration.

The coating acts as a gas barrier, slowing down outward loss of carbon dioxide and inward movement of oxygen, while still allowing for normal respiration as well as reducing microbial spoilage.

## Nanotechnology in bioscience

### ■ Characterising dietary fibre with nanotechnology

The CSIR has undertaken a project to characterise and determine the molecular structure of various fruit and cereal dietary fibres at the molecular level, using nanotechnology.

One of the aspects to be investigated is the water-binding capacity of dietary fibres, which is considered an important marker used by healthcare industries and research organisations to screen proposed fibre-based products. It also plays a significant role in the determination of the intrinsic commercial value of the dietary fibres. The research will help improve the application of various cereal and fruit dietary fibres in a wide range of products throughout the food industry.

### ■ Nano-based DNA delivery systems for insulin gene therapy

The CSIR is using nanotechnology to develop a controlled DNA-based insulin delivery system that can mimic the functions of pancreatic cells. Being DNA-based, the system will enable regulated delivery of insulin that would be acutely sensitive to the physiological changes in glucose levels. A multi-disciplinary approach is used to develop a micro-system that would detect physiological glucose levels and then initiate a response that will result in the expression of a recombinant insulin gene, as well as synthesis and secretion of insulin.

The project involves collaboration between scientists at the CSIR, the University of the Witwatersrand, the University of the Free State, and the Medical Research Council (MRC). Once developed, this system can be adapted to many diseases that require genetic-based therapy such as sickle cell anaemia, cancers that result from defects or down-regulation of tumour-suppressor genes and cystic fibrosis.



**Developing a new edible coating for export fruit**



**The CSIR is participating in a research project to improve the quality of dried fruit products**

## Reducing food-processing waste

Food scientists and biotechnologists this year started research aimed at reducing food-processing waste. The project is a European Union-funded initiative awarded to a research consortium comprising 13 partners who will aim to develop advanced methods to recycle and upgrade food processing organic waste by-products into high value-added products. The outputs are expected to include nutraceuticals, food ingredients and feed ingredients.

A sustainable future for many food-processors requires that agro-waste co-products are exploited to prevent them from becoming waste. The CSIR is developing a fish feed ingredient from non-animal waste products and fermentation methods for omega-3 and omega-6 fatty acid production. Specific essential fatty acids are being required by carnivorous commercial fish species intended for mariculture practices (such as salmon and the Cape stumpnose). In the broader scope of the project, the research is focusing on the extraction and exploitation of the considerable amounts of protein and nutrients in cereal and vegetable trimmings. South Africa is the only non-European country to participate.

## Technologies in pursuit of shelf-stable fruit products

A new processing technology that combines osmotic dehydration and microwave drying, followed by suitable protective packaging, is being re-researched in the quest for high-quality shelf-stable fruit products.

It is estimated that up to 40% of agricultural produce in developing countries is wasted, mainly due to lack of storage and processing facilities, but also due to limited knowledge of processing technologies.

Fruits, which are traditionally sun-dried, are often of poor quality due to the difficulty in controlling the rate of drying and the extent of cell damage in the fruit tissue. This leads to a collapse of the fruit's structure, discolouration, tough texture and a resultant lack of flavour and nutritional value.

Three research institutions in Europe and four from Africa have combined their specialist knowledge to improve the overall quality of dried fruit products in this European Union-funded project.



*Members of the CSIR team involved in microbial process development*

## Microbial bioprocess development

### Supporting South Africa's biotechnology industry

The CSIR houses one of the largest biotechnology research facilities in South Africa, with more than 60 biotechnologists, organic chemists, molecular biologists and technologists. In the industrial biotechnology domain, the organisation's core expertise relates to the improvement of microorganisms and enzymes through genetic engineering, optimising yield in fermentation processes and bioproduct formulation.

"Substances produced by microorganisms include, for instance, amino acids, antibiotics, biological agents and enzymes," explains Raj Laloo, manager of the CSIR's Microbial Bioprocess Group. "Unique new molecules can also be produced from bacteria, fungi and algae. To supply large quantities of these biological products, and to produce products competitively, these microorganisms must function at an optimum."

At the CSIR laboratories, organisms are grown through various intermediate stages up to a pilot plant scale, where the organisms are grown in fermenters and the envisaged commercial scale process is mimicked before being implemented at industrial scale. Additional challenges during product development include down-stream process development and formulation of biologicals.

Recent project successes include the development of biological agents for aquaculture and agriculture applications. In one example, a product has been developed that prevents bacterial ulcer disease in farmed and

ornamental fish. Stabilised liquid and solid product forms have been developed and a pipeline of further products is under development.

According to Laloo, natural flavours are becoming increasingly relevant due to consumer demands for natural products. "South Africa houses a wide variety of animal and plant life, including microorganisms like fungi, which have the ability to produce interesting metabolites such as flavours and fragrances."

The CSIR, the UP and Clive Teubes (Pty) Ltd have combined forces to screen and utilise indigenous fungi as potential producers of flavours and fragrances in a project funded by the BioPAD Biotechnology Regional Innovation Centre. Biotechnology-based processes have been formulated to develop natural, safe and environmentally-friendly flavour products from fungi.

The project resulted in a natural blue cheese flavour from a fungus that has been isolated in South Africa. Yield of the flavour was significantly increased through the development of a solid-state fermentation process and by optimising crucial parameters.

"Through our research, we aim to contribute to the growth of the biotechnology industry in South Africa, in particular the SMME sector," comments Laloo. "It is most rewarding to see the economic and social impact of a technology package that has come from finding a suitable microorganism and submitting it to laboratory testing, through pilot-scale testing and successful commercialisation."







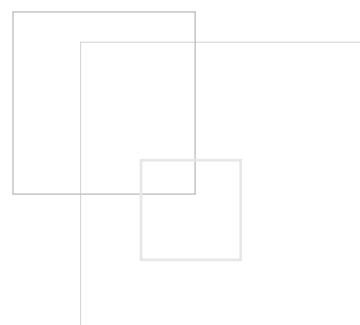


# Environmental Sciences

There is a growing recognition of the fact that human well-being is closely tied to environmental health, and that management of the environment must be based on sound science. The development of a robust environmental science base for the country is central to the achievement of sustainable development.

Environmental science encompasses a wide range of disciplines and requires a significant degree of integration. In partnership with various other organisations and institutions, the CSIR has played an active role in promoting research and its application in sound environmental management over the past year. This section of the Annual Report highlights a few of the organisation's activities in this regard, including significant contributions to national and international initiatives.

The CSIR's participation in the Millennium Assessment formed part of a global synthesis of the state of the planet at the turn of the millennium. In the field of freshwater conservation, the CSIR's contribution is part of a drive towards the implementation of new legislation that came to fruition in South Africa's 10th year of democracy. Other projects and initiatives being highlighted include the development of local nanotechnological expertise, innovative treatments for acid mine drainage and the rehabilitation of degraded catchments.





**The Catchment2Coast programme investigated the linkages between river catchments and their associated economically important coastal ecosystem services. A healthy mangrove is the key link between river and coastal systems**



**The Millennium Ecosystem Assessment is the first comprehensive, global scientific study of the capacity of ecosystems to continue to deliver services at the required rate to ensure human well-being**

### Catchment2Coast update

The CSIR is leading the Catchment2Coast programme, an interdisciplinary, multi-institutional ecosystem modelling research programme. It aims to improve scientific understanding of the linkages between river catchments and their associated economically important coastal ecosystem services.

The main objective of the three-year project, now in its final year, is to investigate and validate an integrated river catchment coastal ecosystem framework that can support policy development and a shift towards ecosystem management. It is generic enough to be applied beyond the southern African region. The Incomati River-Maputo Bay system in Mozambique was used as a case study.

The project is a partnership between the European Union - International Cooperation (INCO) programme (part of the Fifth Framework Programme), six institutions in southern Africa and three centres in Europe. Regional partners include the University of Cape Town (UCT), the University of KwaZulu-Natal (UKZN), the Eduardo Mondlane University and the Fisheries Research Institute (both in Mozambique) and the University of Swaziland.

The initiative has contributed significantly to regional capacity-building in science, and enhancing the technical skills of managers. The final six-month phase of the project will focus on the synthesis of the science, publications, dissemination to stakeholder communities and the legacy plan.

### Landmark study on southern African ecosystems

The CSIR is participating in the Millennium Ecosystem Assessment, the first comprehensive, global scientific study of the capacity of ecosystems to continue to deliver services at the required rate to ensure human well-being. Dr Bob Scholes of the CSIR is co-chair of the working group reporting on the condition and trend of ecosystems worldwide, together with Prof Rashid Hassan of the University of Pretoria. Their team includes over 200 natural and social scientists from around the world.

A team of scientists, including several from the CSIR, studied ecosystem services in the southern African region, as part of the assessment process. The study was an experiment to see how assessments of ecosystem services would vary in terms of their methods, findings and impacts if they were carried out at different geographical scales.

Throughout southern Africa, biodiversity is generally in relatively good condition, and is fast becoming the basis of a major economic sector. In many countries, nature-based tourism is already the largest foreign currency earner, ahead of agriculture or mining.

The Southern African Millennium Assessment (SAfMA) Integrated Report, cutting across all the geographical scales, was published by the CSIR, as was the SAfMA Regional Scale Report, put together by a CSIR team led by Scholes.

The reports are available on the website [www.MAweb.org](http://www.MAweb.org).



*Members of the freshwater biodiversity research team in Stellenbosch include (left to right) Lindie Smith-Adao, Belinda Reyers, David le Maitre, Christine Colvin and Jeanne Nel (front). Lynette Dollar was absent when the photograph was taken*



*The Pretoria team consists of (left to right) Devlyn Hardwick, Peter MacMillan, Tinyiko Malungani, Gillian Maree, Dr Dirk Roux and Liesl Hill*

## Conserving freshwater biodiversity

Biodiversity conservation is about sustaining the diversity of life on Earth for the benefits people derive from ecosystems and their services. Building on concepts developed for terrestrial ecosystems, the CSIR, in partnership with the Department of Water Affairs and Forestry (DWA), initiated a study two years ago on developing a policy and planning tool for conserving river biodiversity within South Africa.

According to CSIR project leader, Dr Dirk Roux, the science of conservation planning is much further advanced for terrestrial ecosystems than for aquatic ecosystems. "Most conservation exercises have a primary focus on terrestrial features of biodiversity, with rivers and other aquatic ecosystems receiving secondary attention," Roux comments. "The challenge is to elevate the weight of freshwater biodiversity features so that these could contribute to the

planning process as well-defined and independent components of the overall biodiversity pattern."

Trade-offs are inevitably required between protecting rivers (achieving biodiversity conservation) and achieving economic development. "Not all rivers can be maintained in natural or even good states. The question is, how many rivers should reflect a high level of protection (natural and good states) in order to say that South Africa's collective network of rivers is healthy?" Roux asks. "A second question is, which rivers should be protected in order to claim that a representative mosaic of rivers (and riverine biodiversity) is protected or conserved?"

The key objectives of the project are to extend policy on the protection of aquatic ecosystems to include explicit targets for the conservation of rivers at a national scale, and to develop a conceptual framework to spatially map river biodiversity, both in terms of pattern and processes. "We also

aim to develop and test a systematic and relatively simple planning tool that could be used to generate spatial options for satisfying set conservation targets," Roux comments.

The project attempts to marry concepts from at least three different disciplines, namely river ecology, systematic conservation planning and water resources management. It will draw extensively from the field of systematic conservation planning, which has been developed over many years with a primary focus on representation of biodiversity patterns in reserves. "It is likely that a number of concepts and terms will be introduced that are relatively new in the water management arena. However, these new concepts will, as far as possible, be developed alongside more established and familiar conceptual models," Roux explains.

Visit the project website at [www.csir.co.za/rivercons](http://www.csir.co.za/rivercons) for more information.





**The CSIR's Dr Colin Everson (left) and Joshua Xaba (centre) demonstrating an erosion monitoring technique to a member of the local community**



**Nanotechnology will add value to the manufacture of wood and wood composites**

## Rehabilitating degraded catchments with local communities

A project funded by the Water Research Commission, involving the CSIR, the UKZN, the Farmer Support Group, the Department of Agriculture and KZN Wildlife, is assisting the rural communities of Mnweni and Okhombe, situated in the foothills of the Drakensberg, to control soil erosion in the area.

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.

Intensive job creation programmes have been launched, focusing on the rehabilitation of degraded areas. People have been trained in the implementation of a number of different erosion control techniques, including physical structures (e.g. stone packs, stone lines, swales, cattle steps) and vegetative structures, such as vetiver grass planted on contour lines, trees planted in micro-catchments, and indigenous and exotic grasses planted on eroded slopes.

One of the objectives of the project is to implement participatory monitoring, which provides an opportunity for learning and empowers communities to take subsequent decisions.

## Treating acid mine drainage

The production of acid mine drainage (AMD), a metal-rich, saline and usually acid water, formed from chemical and biological reactions between water and rocks containing sulphur-bearing minerals, remains a challenging pollution issue in the mining industry. During the past five years, the CSIR has developed a suite of cost-effective treatment technologies for the mining industry, of which the limestone neutralisation technology for treatment of acidic effluents is most often applied.

The process comprises limestone and lime treatment technologies, which are used for treating acid and metals, and for partial sulphate removal, using powder calcium carbonate and lime, respectively. Biological sulphate removal technology can be applied after neutralisation of acid mine drainage. A 10-fold reduction in sulphate can be achieved, using the single-stage reactor system.

Benefits of the limestone technology, which is currently applied in South Africa, Botswana and Australia, include reduced costs and improved safety, since limestone is both cheaper and safer to handle than lime. Plants in operation can be viewed at Anglo Coal in the Witbank area and at Ticom Mines near Empangeni. In addition, a plant is ready to be commissioned at Namaqua Sands in the Western Cape.



## Developing synthetic forests of the future

Developing local nanotechnological expertise would add value to the manufacture of wood and wood composites, pulp, paper and cellulose derivatives of relevance to the textile industry, such as acetate, rayon and viscose. New nanotechnology capabilities could also contribute to reduced energy consumption.

The CSIR is investigating the possibility of using the process of cell wall formation as a template to engineer mimicking devices allowing the manufacture of cellulose fibres and composites outside the cell, using cellulose synthase proteins as building blocks. The ultimate goal of this research would be to engineer an "artificial cell" capable of engaging simultaneously in photosynthesis and cellulose synthesis, in other words, develop a synthetic forest.

The potential benefits from nanotechnology include increased rate of fibre production; reduced dependence on harvesting; elimination of the lignin removal process for pulps; molecular scale control of composite material production; engineering of new material properties to add value to products; lower energy consumption and environmentally-friendly production processes.

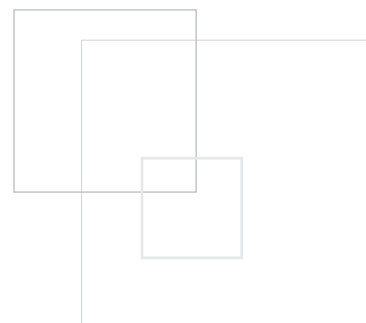
## Strategy for South African coastline

The Department of Environmental Affairs and Tourism (DEAT) has commissioned the CSIR to develop an information system, based on marine and coastal indicators, that aims to support national decision-making and reporting on the coastal environment in South Africa.

The information system will provide updates on the current condition of the

coastal environment, and will highlight some of the reasons that changes have taken place. It will also help decision-makers to understand the implications of these changes, and what society's responses should be. This project forms the foundation for a long-term monitoring and reporting strategy for the South African coastline and will result in the production of the first State of the Coast Report for South Africa.

Set for completion in 2005, the project will have ongoing stakeholder communication and peer review. Initial work by the CSIR has identified the arrangements, systems and networks within which the State of the Coast reporting process is to be undertaken. In addition, key issues have been identified and will lay the foundation for developing a comprehensive set of marine and coastal indicators for South Africa.





# Comm Sp

# Information, Communications and Space Technology

The National R&D Strategy, published in 2002, identifies ICT as a key technology platform that requires focused attention. The CSIR is assisting the DST by providing the secretariat function for the development of the strategy, while also forming part of both the working group developing the strategy and the reference panel that provides guidance to the process. In addition, the CSIR actively supports other ICT-related strategy processes, such as the development of a national earth observation strategy, which is described in more detail in the following pages.

The industry phase of the National ICT Roadmap initiative, coordinated by the CSIR on behalf of the DST, was formally launched in May 2004. The initiative aims to increase the R&D intensity in the South African ICT industry and foster collaborative and cooperative R&D relationships between industry, research and technology organisations and academia.

The CSIR provides technical support to a number of international initiatives driven by the DST, such as the implementation plan for the Global Earth Observation System of Systems (GEOSS). South Africa is a co-chair of the Group on Earth Observation (GEO), which was established after the World Summit on Sustainable Development held in Johannesburg in 2002. GEO was tasked to develop an implementation plan for GEOSS. The CSIR also provides support for the Square Kilometre Array project and the linkage to the EU high-speed research network, GéANT.

The CSIR Satellite Applications Centre (SAC) has been advising the NEPAD e-Africa Commission on the conceptual designs of the satellite communications network for the Commission's e-School project.

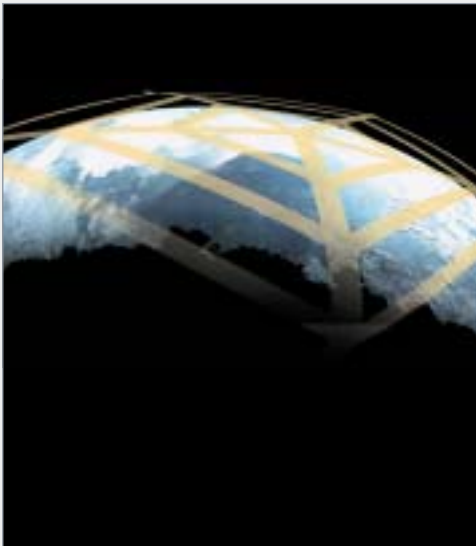
The build-up towards the launch of the Meraka Institute (formerly the African Advanced Institute for ICT (AAIICT)) accelerated during the last six months of the year under review. The concept of the AAIICT, developed by an inter-ministerial committee, was approved by Cabinet in July 2002. In 2004, the CSIR became responsible for implementing the initiative, culminating in the launch of the institute in May 2005.

The institute will play a key role in equipping people with world-class ICT skills, while focusing on needs-based research and innovation in conjunction with South African higher education institutions. A number of the institute's current projects and initiatives are described in this section, including research into sustainable ICT for developing countries, the use of ICT to help empower persons with disabilities, and the use of minimally invasive education to promote large-scale computer literacy.





*The Wireless Africa initiative entails ICT for developing countries*



*The Sensor Web is a revolutionary new concept in earth observation*

## Closing the digital divide

The Wireless Africa initiative, driven by the Meraka Institute, entails research into sustainable ICT for developing countries in order to close the digital divide that exists within and between developing countries. It has two components:

- Research and demonstration of new approaches and technologies through projects in communities in South Africa, Angola and Mozambique. The aim of these projects is sustainable, community owned wireless infrastructure for applications in health, education and related service delivery.

At the heart of this initiative is the First Mile, First Inch concept. First Mile technology comprises connectivity technologies such as WiFi, wired Ethernet, powerline technologies, Bluetooth, narrowband HF/VHF/UHF and mesh networks, while First Inch technology focuses on access devices such as traditional PCs, PCs running open source software, recycled PCs, cellular devices and handheld personal digital assistants, and the applications running on these devices.

- The Community Owned Information Network (COIN) aims to remove technology barriers to enable bottom-up creation of wireless access infrastructure. This includes mesh networking, low-cost voice/messaging devices, low-cost access points and antennas, and network security. COIN also supports the concept of sharing costs for internet connectivity. **Sensor**

## Web research programme

The CSIR Satellite Applications Centre (SAC) has embarked on an ambitious research programme aimed at Sensor Web enablement. A revolutionary new concept in earth observation, the Sensor Web will allow the animation and analysis of the behaviour of real world objects instead of just mapping their spatial distribution. It will have an impact on many areas including disaster management, transportation planning, agriculture, ecology, security and defence.

The Sensor Web research programme is aligned with the DST's National R&D Strategy and incorporates much of the department's ICT Roadmap themes (future web, high performance computing and geomatics). The initiative will also lead to the development of a critical mass of highly competent scientists through collaborative research with local and international partners. In addition, the science plan caters for developing historically disadvantaged doctoral students interested in this concept. The project will facilitate funding, strengthen local and global science networks and lead to a more coherent national approach to earth observation.



## Election forecasting

The CSIR played an important role in forecasting the final results of the 2004 general election, when only a few of the voting districts had tallied their votes. Contracted by the SABC, the team worked in shifts around the clock from 14 April at the Independent Electoral Commission headquarters in Pretoria to provide the public broadcaster with valuable information. With the aid of a statistical model, the team could accurately predict the main trends of the election such as voter behaviour in the voting districts and provinces.

The model is specifically designed to counter the bias in the order in which subsequent results come in. By segmenting the electorate, it is possible to predict the voting behaviour of voting districts, long before the actual results have come in.

Political analysts as well as journalists used the data in their discussions around the elections and the team's work received a great deal of television and radio coverage. Refinement of the model is under way to improve its capability to automatically highlight interesting features in the forecast results.

## Satellite imagery and data boost decision-making and research

Following the inauguration of two earth observing satellite systems, the Moderate Resolution Imaging Spectroradiometer (MODIS) and Landsat, at the CSIR SAC at

*The CSIR used biomechanical analysis to isolate ways of improving the preparation of Pretoria Boys High learner Oscar Pistorius, who sprinted to a sensational world record in the 200 m event at the Athens Paralympic Games*



## Sports technology

### Supporting South Africa's athletes

In an environment where split seconds can turn mere athletes into sporting heroes, the CSIR is recognised internationally as a pioneer in the development and use of technologies that can be used in the coaching process to measure and improve performance objectively. South Africa's Olympic and Paralympic athletes, participating in sports such as baseball, taekwondo, rowing, canoeing, swimming, hockey, volleyball, and athletics, had the opportunity to benefit from what is known as notational or performance analysis.

The primary objective of notational analysis is to analyse performance with a view to improving future performance. Digital cameras are positioned strategically around athletes to record and monitor their performance from various angles. This information can then be analysed in a variety of ways to suit the individual athlete or coach.

The CSIR's track record for developing analysis technologies includes contracts with the United Cricket Board of SA, SA Rugby, the International Cricket Council, the All Africa Games, and the Commonwealth Games Association. In the run-up to Athens 2004, the CSIR provided technology interventions in a project funded by the National Olympic Committee of South Africa and Disability Sport South Africa.

### Unique technology assesses cricket umpires

In an effort to ensure that umpiring standards are upheld and that decisions during a match are consistent and accurate, the International Cricket Council (ICC) makes use of a sophisticated video-based umpire assessment system, known as Umpirestat, devised by the CSIR. This unique bespoke software was originally developed from Crickstat, a programme the CSIR devised to analyse cricket matches.

All international cricket matches in which elite umpires are involved are recorded on video tape, which is subsequently sent to the ICC along with the referee and captain's reports on the umpires' performance. An analyst extracts the video clips of all decisions, including any controversial calls made by both the international and/or local umpire in a particular match. These decisions can then be reviewed by the assessor or individual umpire.

The ICC reviews the video clips to determine the accuracy of the umpires' decisions and provides them with a comprehensive report. These assessments provide the basis on which the ICC's Umpires and Referees Manager is able to discuss any areas of concern with the umpires directly and provide feedback underpinned with video footage.



**Satellite imagery and data improve decision-making in Africa**



**Mosibudi Mangena, Minister of Science and Technology, observing the Digital Doorway in action**

Hartebeesthoek in July 2004, decision-makers and researchers in Africa have access to improved satellite images and remote-sensing data in the fields of risk management, land use, agriculture and various others.

This is the first MODIS direct broadcast receiving station in Africa developed to monitor land, ocean and atmospheric processes that provide information on food security, crop yield monitoring, grazing capacity, and land degradation assessments, as well as global change, disaster management and mitigation. CSIR SAC has been developing novel applications based on MODIS images, notably an advanced fire warning service that will greatly benefit the Southern African Development Communities (SADC).

The Advanced Fire Information System (AFIS), the first near real-time operational satellite fire-monitoring system in southern Africa, has been developed to deliver fire information products for researchers, fire protection agencies and disaster managers all over southern Africa in support of effective decision-making in the monitoring of natural and man-made fires. Eskom, the Department of Agriculture and the CSIR jointly funded the development, installation and operational running of the system.

### Digital Doorway gains momentum

The Digital Doorway, an initiative between the DST and the Meraka Institute, uses minimally invasive education to promote large-scale computer literacy. The project is

proving to be an effective means of ensuring that South Africans everywhere are able to benefit from the information society.

By exposing people to computer technology on their own terms through a device that is accessible and easy to use, computer literacy is improved and a growing awareness of science and technology created. The incentive to explore and learn is further encouraged by the option to customise content on a Digital Doorway to the needs of the relevant local community. As such, it can be used for other applications, including government service delivery and information distribution.

Kiosks have already been installed in the towns of Cwili, Mamelodi, Mapela, Mamitwa, Itsoseng, Phuthaditjhaba and Welkom, with another 25 four-seater terminals to be installed during the course of 2005, in a mix of rural, peri-urban and urban areas. Apart from being cost-effective, the Digital Doorway requires low maintenance and makes remote management and administration possible through the use of open source software.

### ICT Hub for community development

The CSIR has partnered with the City of Johannesburg Metro in a joint venture to establish an ICT Hub in Orange Farm. The initiative is part of the Metro's 2030 strategy aimed at developing and growing the city's economy over the next three decades.

The project implements and replicates an innovative communications

infrastructure and develops capacity within the community by providing relevant information content to support sustainable development. This cost-effective and sustainable ICT for development project contributes substantially to resolving the constraints to communication and information flow experienced by small businesses. An ICT Hub was established at an existing centre within the community where the technology is housed, training takes place and business support services are offered to the community.

The overall plan is to develop capacity and attract investment in manufacturing and services in the ICT sector to Orange Farm. The local communities will benefit significantly from this project through access to information that is of specific relevance to their daily lives and overall development.

### Using technology to break down barriers

Human language technologies (HLT) enable people to access information and services, and interact with technology, through language. The aim is to overcome barriers related to language, illiteracy or disability and to support language diversity.

A long-term goal of advanced research in this field is the creation of automatic translation services. HLT include text-based language processing that extracts meaningful information from text documents, potentially in multiple languages, and speech processing, including technologies such as speech recognition, speech synthesis and spoken dialogue systems.

The OpenPhone project is an example of an innovation project where HLT is a key technology. The project combines the HLT research competence with applied research and software innovation to develop a fully open source telephony platform that aims to provide multilingual voice services in all South Africa's local languages. Initial work in this regard was a project sponsored by the DST, which tested assumptions on providing government services over the telephone in an e-government context.

Through prototype development and a series of contrastive experiments, the project investigated the interplay between system usability, speech and language technology options, and issues of culture and user exposure to technology.

#### *Members of the Meraka Institute's HLT research team*

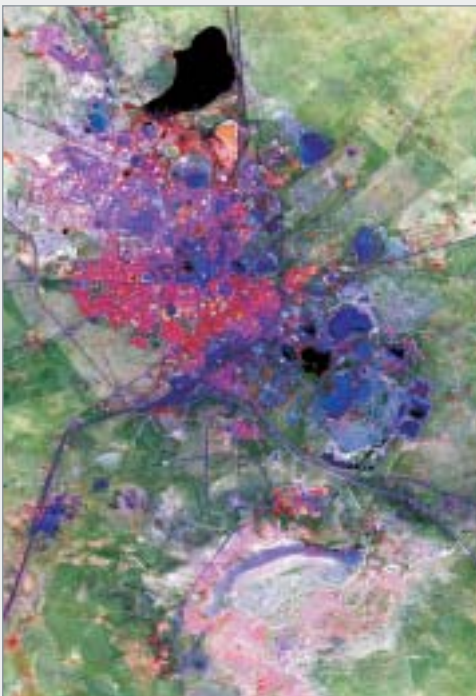


### Promoting open source software

The Open Source Centre, which forms part of the Meraka Institute, promotes understanding and the use of Free/Libre and Open Source Software (FLOSS) in the public, private and civil sectors. The three focus areas of this project are:

- OpenSpeak, which deals with raising awareness of open source, in collaboration with the Shuttleworth Foundation and industry partners, through the Go Open Source public campaign.
- OpenProject, which is concerned with enabling access to FLOSS applications. A current priority is the migration of the CSIR to FLOSS.
- OpenMentor, which empowers users and producers of FLOSS with the knowledge required to ensure success.





*One of the Landsat 7 images made available to the team compiling the map work resource for geography learners depicts the Kimberley mining hole, showing the extent of the mining excavation and the surrounding features*

### ICT for small manufacturers

The SmartFactory project, a partnership between the CSIR and the Automotive Industry Development Centre (AIDC), aims to establish a low-cost technological infrastructure for smaller manufacturing companies to tackle aspects such as quality and efficiency.

The project addresses the limited availability and use of open and low-cost ICT that could benefit the operations of small manufacturers. A top-down complete solution will be offered using open source software and hardware solutions.

A wireless networking approach was chosen, where multiple measurement nodes can be deployed in a factory as required.

The CSIR project team is currently in the process of installing the system at a factory in Babelegi, north of Pretoria, where it will be closely monitored to determine its effectiveness.

### Bringing satellite imagery to life for geography learners

Geography learners will soon have their map work skills enhanced with the inclusion of satellite imagery as part of their curriculum. The CSIR SAC provided selected satellite images to educators responsible for the composition of the future map work atlases.

The atlases, which are specifically aimed at Grade Eight learners and above, will give learners the opportunity to view the Earth from a distant vantage point, thereby allowing them to interpret, analyse and make

sense of the physical attributes of the landscape.

### Mapping settlement growth in South African cities

The CSIR SAC recently completed an intensive study that focused on accessing the urban spatial growth using relevant satellite imagery. This project represented a unique opportunity for the CSIR to contribute to a prototype development study that utilises historic data from an earth observation perspective to gauge the rate of urban development.

The central objective was to depict spatially the nature, form and extent of the physical or spatial growth pattern of nine South African towns between the years 1994 to 2004. The land-use classes under investigation included, amongst others, informal settlements, open spaces, industrial and commercial land-use.

The results showed significant urban development in each city during the prescribed years of investigation. Of particular interest to urban planners was the spatial development of specific land-use classes such as informal settlements and industrial areas. The mapped layers were later combined with census data and municipal reports to validate the observed trends and patterns.

The project provides a useful platform on which other specific studies can be conducted, using higher resolution satellite imagery. The historic perspective of each city is paramount as it enables spatial planners to gauge previous trends of development.



Members of the NAP team include (back row, left to right): Dikeledi Moche, Tricia Horne, Elaine Olivier, Ilse Viviers, Rosalie de Villiers, Harriet Easton, Dr Michaella Janse van Vuuren and Ronell Alberts. Front row (left to right): Dr Ennio Macagnano, Hina Patel, Kagiso Chikane, Martin Pistorius, Willem van der Walt and Dr Louis Coetzee



## National Accessibility Portal

### ICT supporting independent living for persons with disabilities

The National Accessibility Portal (NAP) is a five-year R&D project conceptualised and developed by the CSIR's Information Society Technologies Centre, (now part of the Meraka Institute), in partnership with a representative group of disabled persons' organisations and the Office on the Status of Disabled Persons in the Presidency.

According to project manager Hina Patel, NAP aims to enhance the development and independence of persons with disabilities. "This will be achieved through the creation of a highly innovative and efficient information and communication system. NAP will enable people with different disabilities to access information and appropriate services, and to interact and communicate irrespective of age, gender, language and level of literacy," Patel explains. The system will be based on internet

technologies, using pen source software to provide affordable alternatives. The initiative is aligned with the NEPAD strategy and with the goal of the Africa Decade of Persons with Disabilities (1999 to 2009) to empower persons with disabilities.

In addition to the services provided by the deployed portal, focused R&D will be undertaken to develop technology solutions that specifically target the needs of persons with disabilities in South Africa and on the African continent. "Our research aims are to contribute to and facilitate the development of localised assistive devices, applications and technologies that will be incorporated in the system once they have reached a sufficient maturity level," Patel says. "As one of the biggest challenges in the procurement of assistive technologies is affordability, the focus during development will be to encourage the use of open source technologies and also release NAP developments as open source."

NAP's influence, relevance and impact are envisioned to last longer than the five-year R&D timeframe. To achieve this, NAP needs to be sustainable. These sustainability challenges will be

addressed through a diverse set of activities, including learning gained through the pilot deployments; research on ICT-related human factors and cultural issues; research aimed at quantifying and qualifying the extent and nature of disability, including geographical aspects; and researching and implementing organisational and business models that effectively support and promote economic empowerment of people with disabilities.

To date, NAP has achieved a number of successes, including the implementation of a technology prototype demonstrator and the construction of a highly configurable application allowing for speech generation in localised languages. "We have also identified and appointed specialists and influential roleplayers to the NAP technical team, and obtained buy-in from a large number of organisations and government departments," Patel comments.

NAP is an example of the Meraka Institute's innovation activities aimed at improved quality of life through R&D in ICT.



# Infrastructure Technology







A well-functioning built environment and the supporting physical infrastructure are fundamental to a country's socio-economic development, and underpins the competitive performance of every facet of a country's industrial and commercial base. As such, the South African government is committed to increasing levels of infrastructure investment at national, provincial and local government levels as a foundation for service delivery, economic growth and social development.

Specifically, the built environment accounts for up to 70% of a nation's capital stock. In South Africa, this amounts to approximately R1.2 trillion. The total cost of transport and logistics to the economy is in excess of 15% of GDP. The construction industry is the third largest employer in South Africa, providing employment to about 600 000 people, and underpins the working environment of almost every industrial sector. The environmental challenges for the built environment, transport and construction industries are greater than those facing any other industrial sector, accounting for about 40% of raw materials, waste, greenhouse gas emissions, etc.

The snapshots included in this section of the Annual Report illustrate the CSIR's continued contribution to infrastructure development in South Africa during the past year, through research and technological innovation. Projects featured range from the development of decision-support tools for low-income housing location and the application of architectural engineering processes in support of more effective healthcare facilities, to the development and application of intelligent transport systems, research in support of improved traffic safety and initiatives to support rural transport accessibility.



**The Youth Skills Development Programme teaches young people the basic life skills required in a work environment**



**The CSIR provides knowledge-intensive solutions to support all spheres of government in managing housing development**

## Boosting youth skills development in South Africa

The Youth Skills Development Programme (YSDP), a joint initiative by the Department of Defence and the Department of Public Works, with the CSIR as lead agency, was launched in 2003 in response to President Thabo Mbeki's call to government departments to initiate skills development programmes for South Africa's youth.

The programme, presented at the Naval Training Unit SAS Saldanha, aims to teach young people the basic life skills required in a work environment. The military environment is used as a platform to instil discipline, routine and work ethic. The programme provides a sound foundation of learning with practical application of several skills.

## Creating a more sustainable built environment

The Sustainable Building 2004 – Africa conference, hosted in September 2004 by the CSIR, the Development Bank of Southern Africa, the Construction Industry Development Board and the South African Institute of Architects, is part of an international conference series on sustainable building that has become the pre-eminent international forum for mapping the process towards creating a more sustainable built environment.

Launched in 1998, this series of conferences is co-sponsored by the International Council for Research and Innovation in Building and Construction, the United Nation Environment Programme and the International

Initiative for a Sustainable Built Environment. The next international conference in the series will take place in Tokyo in September 2005.

One of the outcomes of the conference was an action plan for achieving sustainable building and construction on the continent. The aim of this plan is to coordinate and make more efficient use of Africa's intellectual resources, the innovation of its entrepreneurs and the commitment of its institutions to ensure that the development of Africa's cities and settlements, as envisioned by NEPAD and the member states of the African Union, happens according to the principles of sustainable development. The action plan will be presented to the various development agencies operating in Africa and the governments of all participating countries, at the international conference in Tokyo.

The conference also assisted in establishing a network of African experts on sustainable building and built environments, which will facilitate future cooperation on R&D initiatives on the continent.

## Supporting housing strategies in South Africa

The CSIR provides knowledge-intensive solutions to support all three spheres of government in managing housing development. Recent contributions include:

- Developing eHouse, a planning decision-support tool, to assist Gauteng Housing in the development of municipal and provincial housing development

## Architectural engineering for more effective healthcare facilities

The CSIR supports public and private sector clients towards more effective and sustainable facilities planning, design and management, through all stages of a facility's life cycle. Research activities in this field are mainly focused in the health and education sectors.

CSIR researcher Sidney Parsons, a mechanical engineer with some 30 years of experience in the design of environmental control systems, specialises in indoor air quality and building related illnesses. According to Parsons, the design of healthcare facilities has in many cases not kept pace with the tremendous advances in medical technology over the past 50 years.

Parsons believes that architectural engineering processes can play a crucial role in designing healthcare facilities that are fit-for-purpose, especially in areas related to infection control. Recently elected as chair of the Environmental Health Committee of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Parsons has a special interest in architectural engineering interventions to prevent hospital-acquired (nosocomial) infection in healthcare facilities, including the protection of healthcare workers

plans and a longer term provincial housing strategy. eHouse facilitates the formulation and testing of various housing development scenarios and makes explicit the implications of the various scenarios on land resources, meeting the need,

### Sidney Parsons

against the spread of airborne diseases.

"Combining microbiology with architectural engineering can result in a better understanding of the spread of airborne diseases," Parsons explains. The Airborne Infection Research (AIR) Facility, launched in February 2005 at the HJE Schultz SANTA Centre in Witbank, Mpumalanga, is a case in point.

This unique research facility is a joint research venture between the CSIR, the MRC, the US Centres for Disease Control and Prevention, the Harvard School of Public Health in the USA and the Mpumalanga Department of Health and Social Services. It aims to address some of the unanswered questions around multidrug-resistant tuberculosis (MDR-TB) transmission.

South Africa faces one of the most devastating TB epidemics in the world, with 30 000 TB deaths expected in 2005. Currently, the World Health Organisation ranks South Africa second in the world in terms of TB incidence (or the number of cases per capita) and ninth in terms of the actual number of TB cases.

Patients receiving TB treatment usually become non-infectious in a few days; however, if treatment is interrupted

financial and human resource requirements and also infrastructure and amenity requirements.

- An investigation, funded by USAID, into the infrastructural and energy consumption implications of alternative locations for low-

income housing development in South African urban areas. During the first stage of the study, which focused on Johannesburg, a comparative development cost-benefit assessment of a central location (Alexandra) versus a more peripheral location



prematurely, MDR-TB, a particularly serious form of the disease, may emerge. MDR-TB is much more difficult to treat and has also been associated with extraordinarily high mortality in HIV-infected patients.

"The AIR facility involves extraction of infectious air from patient wards to exposure chambers housing guinea pigs, which serve as living quantitative samplers of human-generated TB," Parsons explains. The CSIR and its partners have developed state-of-the-art systems for ventilation, heating and cooling, and electronic monitoring, which enable the study of MDR-TB transmission under a variety of environmental conditions.

"The engineering sophistication of the facility will allow the development of scientific blueprints for design of safer healthcare facilities," says Parsons.





**New school designs for the Limpopo Department of Public Works are aimed at accommodating the changing educational environment**



**The CSIR-developed heavy vehicle simulator plays an important role in road design and maintenance, both locally and internationally**

(Diepsloot) was undertaken. The second phase of the study involved an expansion of the research into Ethekekwini, where six low-income housing settlements were analysed. A number of papers with different perspectives have emanated from this empirical, multi-disciplinary research and have been presented at conferences, both locally and abroad.

- Developing a cost-benefit assessment model to guide decision-makers in Gauteng to direct low-income housing delivery to localities that are least costly to develop, maintain and operate over the longer term, while at the same time yielding the greatest benefit in terms of sustainable livelihood capitals or assets.

### Exploring new school designs for Limpopo

In a project for the Limpopo Department of Public Works (LDPW), the CSIR revisited the existing classroom design employed by the provincial authorities (a standard four-classroom block and pit latrine) and developed new designs to accommodate the changing educational environment. The new classroom designs, piloted by the LDPW, will eventually lead to recommended designs and guidelines for schools in the province.

The six schools identified by the LDPW to participate in the project are Kgatla Primary School and Setlopong Primary School near Polokwane; Fofeza Primary School near Tzaneen; Masungulo Primary School near Louis Trichardt;

Chrome Mine Primary near Thabazimbi; and Diwiti Secondary School in the Bohlabela District.

The new designs were developed in a number of stages, ranging from the assessment and review of the current designs to the design, development and assessment of the proposed classroom blocks, using indicators such as teaching and learning; environmental control; buildability and maintenance; access and health; community and school participation; and adaptability and flexibility.

### Study on energy efficiency in buildings

The South African government, through the Department of Minerals and Energy (DME), has recognised that improving the energy performance of buildings is an important part of the strategy to reduce greenhouse gas emissions, and so assist in securing ecologically – sustainable development and use of the country's natural resources.

As part of this process, the CSIR has been mandated by Standards South Africa to develop a working document for the proposed Energy Efficiency Standard for Air-Conditioned Buildings (SANS 0204).

A CSIR study was implemented to assess the suitability of overseas regulatory approaches and assist in the development and implementation of the proposed South African energy-related building standard SANS 0204: Energy Standard for Buildings with Mechanically Assisted Ventilation Systems.

In particular, the study aimed to determine what energy efficiency, greenhouse gas reduction or fuel conservation measures exist, and which of these are being considered for inclusion in international regulations and standards (codes). It was intended that the conclusions of this report be used as an information source when determining what should be considered for inclusion in the SANS 0204 document, after considering the standardisation process in South Africa.

### First State of Logistics Survey

The first survey to measure intrinsic logistics costs for the South African economy was released by the CSIR early in 2005. Sponsored by the CSIR and Spoornet, the survey is the first of a planned annual initiative to evolve a comprehensive picture of the state of logistics in South Africa. The University of Stellenbosch contributed to the research on which the survey is based.

The survey incorporates a macro-economic viewpoint (top-down), an industry-level perspective (bottom-up), and a small business development perspective, dealing with logistics as a developmental constraint for SMMEs and isolated rural environments.

A number of actions are identified as critical in addressing the current problems, including assigning national accountability and responsibility for supply chain, investment and maintenance policy and strategies; continuous and visible measurement of South Africa's macro-economic state of transport and logistics; investing in

multimodality; and support and logistics access to SMMEs and smaller industries. The survey will assist the country in developing strategically relevant policies and making strategic infrastructure investment and maintenance decisions, which in turn will facilitate sustainable industry and small business development.

### Building better roads

The CSIR provides practical, innovative, knowledge-based solutions addressing the infrastructure needs of the transport sector. Projects in this field include:

- A leading role in the development of the SADC guidelines for low-volume sealed roads, which are being applied in projects under the Expanded Public Works Programme (EPWP) to optimise designs for cost-efficient upgrading of existing, lightly-trafficked unsealed roads. The CSIR also provides technical assistance to the International Labour Organisation in the execution of the EPWP in Limpopo. Under the auspices of the Roads Agency Limpopo (Pty) Ltd, 15 projects will be executed during the 2005/6 financial year, with the CSIR providing technical advice to the selected consultants in the application of the SADC guidelines in the design of the projects.
- A study to investigate the effect of variables (e.g. joint and aggregate type) in concrete on load transfer at a crack, over time. As part of this study, heavy

vehicle simulator (HVS) tests are being carried out on two experimental concrete sections near Hilton, approximately mid-way between Pietermaritzburg and Howick, adjacent to the N3.

- A study to determine the strength of test sections constructed 30 years ago on the N12, using the HVS owned by the Gauteng Department of Public Transport, Roads and Works. The test sections on the N12 are unique in that they have been monitored for performance since being constructed, making them probably the oldest such sections with a monitoring history in the country.

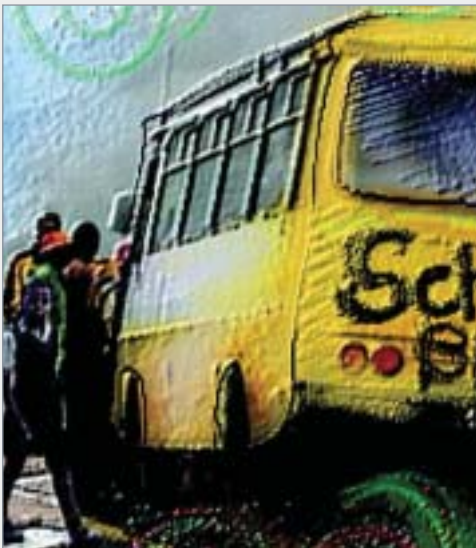
### Improved transport accessibility for people with disabilities

The CSIR participated in a three-year research programme aimed at developing guidelines and best practice for improving access and mobility of disabled people in developing countries. Funded by the United Kingdom's Department for International Development (DFID), the guidelines proposed in the study are based on local conditions in developing countries where financial constraints limit resources.

The multinational DFID research team capitalised on the learning that has taken place across a range of countries by drawing on best practices from Africa, Europe, North and South America, and Asia. The primary output of the project – a compendium of guidelines entitled 'Enhancing the



**Rural transport and accessibility issues are addressed by a number of CSIR research initiatives**



*(Picture painted by one of the learners in Leroro)*

**As part of a community education project in Leroro, Mpumalanga, more than 500 learners were trained on the impact of alcohol and drugs on pedestrian safety**

Mobility of Disabled People: Guidelines for Practitioners' - has been completed and is being disseminated by DFID.

### Improving the safety of vulnerable road users

Recent CSIR initiatives in the area of road safety include community education projects in Leroro, Mpumalanga, and Eldorado Park in Gauteng.

The initiative in Leroro formed part of an international project including four countries (South Africa, Ghana, Bangladesh and India). The project was funded by the UK DFID and initiated by the Transport Research Laboratory in the UK, with the CSIR acting as South African project leader, partnered by the Mpumalanga provincial government. The issue of pedestrian safety related to alcohol and drugs was selected as the focus of the implementation of the community education programme in Leroro. During implementation, the CSIR trained more than 500 learners from the two high schools in the area on the impact of alcohol and drugs on pedestrian safety. In addition, a set of guidelines for community road safety education programmes, based on the results of these international studies, was published.

The Eldorado Park initiative, funded by the South African National Roads Agency Ltd (SANRAL), addressed the unacceptable number of traffic-related deaths and injuries in the area. The CSIR used a range of quantitative and qualitative methods to obtain information regarding traffic safety perspectives and opinions in the community. Following this, a

programme was designed to address the needs of the community and implement traffic engineering changes, such as raised pedestrian crossings, sidewalks medians and road markings. A phased approach was followed to implement new measures and simultaneously run an education programme involving teachers, learners and members of the community.

### Supporting rural transportation managers

Rural transportation managers in South Africa face increasing challenges in a rapidly changing environment. To build capacity in the transportation management sector at the district municipality level and support managers in meeting these challenges, the CSIR, together with the Department of Provincial and Local Government (DPLG), developed a rural transport accessibility portal.

Supported by funding from the Dutch government, the portal aims to enhance awareness of the provision of rural transport infrastructure and services, as well as wider rural access issues and solutions. The portal will also enhance the knowledge-base of good practices and uniquely South African problems and solutions by complementing and providing links to other knowledge-bases on rural transport, accessibility, sustainable livelihoods and general rural development issues.



## Intelligent transport systems: Promoting technology applications

The CSIR assists the transport industry in southern Africa in addressing a host of transport challenges. Current projects in the field of intelligent transport systems include:

- Electronic Vehicle Identification (EVI), a national infrastructure that provides high-integrity vehicle identification for control, monitoring, crime prevention and logistics.
- Development of technology to assess the condition of road signs and markings while on the move, allowing more efficient maintenance management and better evidence for liability cases.
- Assistance to major metropolitan councils to assess the effects of funds spent on traffic management improvements.
- A maritime video monitoring and warning system.
- Development of technology to assist sector and community policing, including biometrics, tracking and communications systems; assessment of CCTV and perimeter security large installations; and development of a vehicle identification and verification system to combat fraud during licensing.

New technologies being developed include three-dimensional models of human motion for synthesis and tracking; video-based solutions, including asset tracking and computer-assisted vision for visually-impaired people; cellphone-based technologies, including a number plate reader used to identify stolen vehicles; and wireless communications technologies.

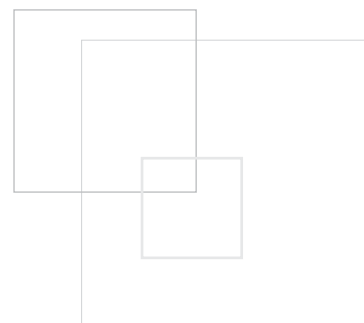
## Rural transport and access planning boosted

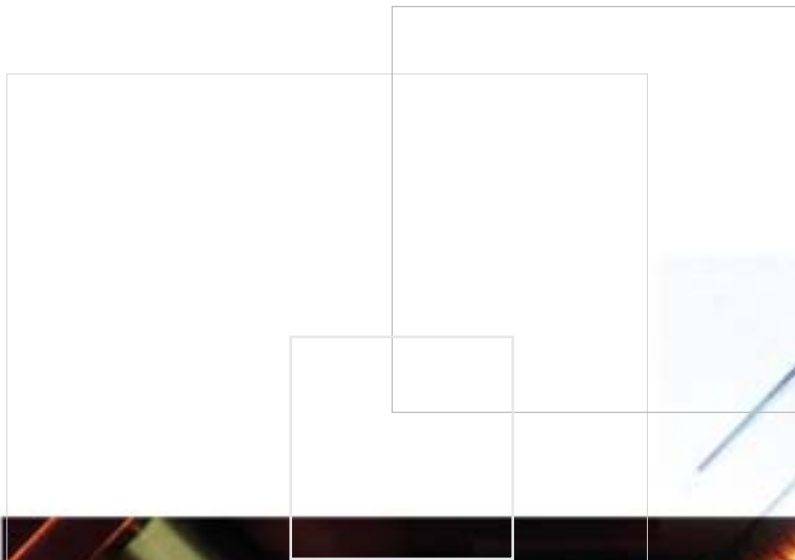
Rural communities in South Africa face significant constraints in terms of access to economic opportunities, health and educational facilities, largely due to their geographical isolation, coupled with poor transport infrastructure and services. The CSIR is involved in a number of research projects and initiatives aimed at promoting holistic developmental approaches to rural transport and accessibility issues. Activities during the past year include:

- Development of a rural transport strategy for the Eastern Cape.
- A study on community responses to HIV/AIDS along transit corridors and areas of intense transport operations in eastern and southern Africa, funded by DFID.

- A review of the current status of child mobility research in South Africa, which in turn underpinned a pilot study in which children from Port St John's in the Eastern Cape conducted their own research on rural children's transport issues.
- A study investigating the impact of the community-based, labour-intensive construction of the Amadiba road on local residents of the OR Tambo District in the Eastern Cape.

Initiatives related specifically to mainstreaming gender in transport sector activities include literature reviews, gender-sensitive appraisal of existing projects, and the publication of literature addressing gender issues in rural transport. At the invitation of the South African Bureau of Standards, the CSIR also participated in Interdesign 2005, an international event aimed at designing and disseminating affordable and practical intermediate modes of transport for rural communities in the North-West Province.





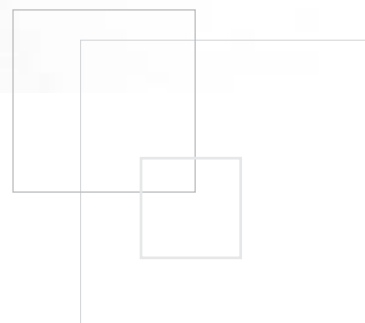
# Manufacturing and Materials Technology

South Africa has all the resources it needs to shape its own future, but these resources need to be developed to their full potential for the country to become a globally competitive player in the manufacturing arena. In response to this challenge, Government has identified research and innovation, including the application of advanced manufacturing technologies, as key drivers of economic and social transformation.

Two strategies at national level, the National R&D Strategy and the Integrated Manufacturing Strategy, recognise that the future competitiveness of this country will, *inter alia*, depend on the ability of the local manufacturing sector to master advanced technology domains and to move increasingly from raw material-intensive manufacturing towards knowledge-intensive goods and services. Between 1980 and 2000, global markets, rather than domestic markets, have been the principal driver of manufacturing growth for developing countries, and within manufacturing, the highest export growth rates have occurred in medium and high-technology products.

A national Advanced Manufacturing Technology Strategy (AMTS) was launched by the DST, with the CSIR as project manager, late in 2003 to strengthen existing industries through enhanced technology utilisation and to create new industries based on new technologies. To implement the strategy, the DST established an AMTS implementation unit at the CSIR. The success of the strategy depends largely on the implementation of initiatives and projects that meet the diversified manufacturing technology needs of the geographically independent manufacturing nodes throughout South Africa.

This section of the Annual Report offers a selection of recent research and innovation projects and initiatives in the field of manufacturing and materials.







**The CSIR's EDC focuses on the creation and support of small manufacturing enterprises**



**The CSIR has developed a barrier technology for plastics that results in barrier properties 45 times better than those of polyethylene**

## Supporting enterprise development

The CSIR's Enterprise Development Centre (EDC) focuses on the creation and support of small manufacturing enterprises. Working with national, provincial and local bodies, the automotive, metal and agricultural industries, and training and educational institutions, the Centre is involved in enterprise-related economic development initiatives and collaborates with donor agencies, big business organisations, individual entrepreneurs and inventors, and rural communities.

The dti, the DST and the Department of Arts and Culture (DAC) are among the key stakeholders of the EDC.

Specific activities include rapid assessments and industry analysis to identify potential enterprise-related economic activities; establishment of sustainable manufacturing enterprises; implementation of a comprehensive range of competitiveness improvement services, and implementation of national SMME support programmes, in collaboration with relevant stakeholders.

Recent EDC projects include:

- A feasibility study for the DST into the establishment of a wheelchair manufacturing facility in South Africa.
- The establishment and interim management of the National Technology Transfer Centre on behalf of the dti.
- Implementation of various rural economic interventions in the Western Cape.

- A feasibility study into the establishment of a technology incubator at the Botswana Technology Centre.
- A leather and footwear sector study in KwaZulu-Natal to identify opportunities for new enterprise creation.

## Intellectual Property

Manufacturing and materials technologies recently patented by the CSIR include:

- A barrier technology for plastics, which results in barrier properties 45 times better than those of polyethylene. The technology is based on a two-layer outside coating using conventional spray- or dip-coating and drying equipment after surface activation. The barrier bottles meet all the technical requirements for beverage packaging, including adhesion testing, scuffing, oxygen permeability and expansion testing.
- A novel oral-controlled release drug delivery system. Drug controlled release rates close to zero-order were achieved for systems that incorporated uncoated polymer matrix systems. The technology is highly versatile in that it can incorporate both alkaline and acidic drugs, as well as both water-insoluble and highly water-soluble drug molecules, thus enabling the development of a controlled release system tailor-made for a specific drug.
- a semi-solid slurry-making system in support of the aluminium high-

pressure die-casting industry. The current phase of development is commercially focused, with the key activities being the final validation of the technology in an industrial environment. While the initial project was based on traditional aluminium casting alloys, fundamental research on other alloys, such as magnesium, aluminium wrought alloys and copper alloys, is being undertaken to prove the flexibility of the technology.

### Sensor technology to support global competitiveness

Advances in integrated electronic sensor technologies offer advantages to both the manufacturing and the defence sectors through improved flexibility, miniaturisation, increased efficiencies and lowered production costs.

The CSIR supports South Africa's global competitiveness through the innovative application of sensing and control technologies, and the design and development of novel products and solutions. Examples of current initiatives include:

- Solid state actuator systems that replace conventional electro-magnetics. This technology has several advantages, ranging from the elimination of conventional moving parts to lower mass and increased performance. Applications include novel optical scanners and active stabilisation systems, with one such system already in use internationally.



*Present at the launch of the AMTL for Robotics and Mechatronics in February 2005 were (left to right) Arthur Booï (AMTS), Sushil Borde (CSIR), Pontsho Maruping (DST), Dr HOFFIE MAREE (CSIR), Estelle Gathercole (AIDC), Prof Irene Moutlana (Nelson Mandela Metropolitan University), Stone Phumelele Sizani (Eastern Cape community representative) and Derek Hanekom (Deputy Minister of Science and Technology)*

## Towards advanced production and beneficiation

### Advanced Manufacturing Technology Laboratories

As part of the CSIR's responsibility to implement the AMTS, a number of production technology-related programmes have been identified and developed. One of these programmes, the result of collaboration between industry, academia and government, is the establishment of four Advanced Manufacturing Technology Laboratories (AMTLs).

The AMTL for Robotics and Mechatronics, housed at Nelson Mandela Metropolitan University in the Eastern Cape, was the first of these laboratories to be launched. Funded by the Innovation Fund, in partnership with the AIDC, the CSIR, the Eastern Cape Development Corporation and LN Manufacturing, this world-class robotics and mechatronics laboratory will stimulate innovation through design, development and prototyping. The laboratory will also develop and facilitate the transfer of relevant skills to support the Eastern Cape automotive industry and related SMMEs.

### Light Metals Development Centre

The Light Metals Development Centre (LMDC) was initiated by the CSIR and the Automotive Industry Development Centre (AIDC) to provide active support for the growth and sustainability of an internationally competitive downstream South African light metals industry. The centre forms part of the Advanced Metals Initiative initiated by the CSIR, Mintek and Necsa.

The LMDC focuses on aluminium, titanium and magnesium, taking into consideration both global and local demands and trends relating to all three metals and related alloys. To function as an industry-support centre, the LMDC relies on support and involvement from industry, industry associations, science councils, TEIs and government. Its industry focus areas are the automotive, aerospace, construction, medical and electronics industries. Research is guided by an advisory council presenting industry needs and priorities. The inclusive nature of the LMDC promotes joint R&D within its network.



**The CSIR and Eskom have developed novel, camera-based inspection tools for the energy distribution field**



**The CSIR supplies sensor technology solutions to a range of clients, including the South African Navy**



**The Aerospace Industry Support Initiative aims to create an institutional support structure for the South African aerospace industry**

- Novel, camera-based inspection tools for the energy distribution field, developed in cooperation with Eskom. These unique systems allow for simultaneous imaging across several different wavelengths of light, as well as the detection and imaging of a greenhouse gas specific to the energy distribution field.
- Using wireless technologies and open source software, the CSIR implements low-cost automation solutions to support small and medium-sized manufacturing enterprises in enhancing the efficiency and competitiveness of its operations.
- Building on the CSIR's long-standing role of providing technology support to the South African Navy, the organisation, in cooperation with international partners, has delivered underwater sonar systems for both the Corvette and 209 Submarines.

Areas to be investigated for growth stimulation in the aerospace industry include:

- Support and promotion of the high standards and quality required in the industry.
- Cooperation with universities and science councils to promote research and to stimulate interest in the aerospace industry as a career option. This cooperation should culminate in the establishment of an Aerospace Centre of Excellence to support the development of skills, research and technology.
- Support for the growth of the space and defence industries.
- Partnering with Brazil in the development of defence and other products.
- Utilisation of synergies between Brazil, India, the EU and South Africa.

### Supporting South Africa's aerospace industry

The Aerospace Industry Support Initiative, announced by the Minister of Trade and Industry, Mandisi Mpahlwa, in September 2004, is a partnership between government, industry and the CSIR to create an institutional support structure for the South African aerospace industry.

A high-level advisory committee, comprising a number of domestic and international stakeholders, business people and industrialists, will be appointed to oversee work being done through the initiative.

### Manufacturing sector strengthened in Western Cape

One of the main focus areas of the CSIR and the AMTS is to support provincial manufacturing sectors to elevate the role of technology. Tailored strategies and focused interventions resulted in the first provincial-specific implementation of the AMTS in the Western Cape in October 2004.

The provincial AMTS aims to support seven key growth sectors through high-impact, integrated innovation-led strategies that promote manufacturing sector growth, employment creation and wealth generation.

*(cont. p 42)*



*Right: The CSIR develops measurement technologies to support nanoscience*

*Far right: Synthesis of single-walled carbon nanotubes through laser ablation*



## Nanotechnology in manufacturing

### ■ Carbon nanotubes: super-strong material of the future

Carbon nanotubes are the world's strongest material in terms of tensile strength, yet they are lightweight and flexible. This material conducts electricity and heat remarkably well and possesses remarkable physical and electronic properties, making it suitable for a multitude of high-volume applications. The CSIR National Laser Centre (NLC) is conducting research to understand and optimise the growth process of carbon nanotubes.

Laser ablation is used to control the length, structure and electrical properties of carbon nanotubes. The aim of the CSIR study is to learn about the laser ablation and re-combination processes as well as how the laser can be used to control the growth and physical properties of the nanotubes.

### ■ Measurement technologies to support nanoscience

Metrologists face the challenge of devising measurement techniques that will keep abreast of developments in nanotechnology. These will ensure reliable, comparable reference measurements with results traceable to an agreed metrology scale, helping to ensure products that are interchangeable.

The CSIR National Metrology Laboratory (NML) has developed high-precision measurement techniques (nanometrology) and commissioned a comprehensive suite of analytical tools, such as 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.

### ■ Innovative textiles with nanotechnology

The application of nanotechnology in the textile industry will improve the characteristics and functions of fibres, finishes, dyes, colouration systems and textile composites. The CSIR heads up a number of projects in this area, including the South Africa/Hungary Science and Technology Programme, comprising the development of nanocomposites; a project aimed at nanofibre-based non-woven formation, which could also find application in the medical field; and a project to improve the multi-functionality of cotton, specifically by imparting flame retardancy to the cotton, using various techniques.

### ■ Nanodrug delivery systems

The drawbacks of conventional TB treatment necessitate the development of a delivery or carrier system to release drugs slowly over extended periods of time. The CSIR, in collaboration with relevant stakeholders, is investigating the use of nanotechnology to facilitate precise delivery of a drug to a specific compartment in the target cell through intracellular delivery.

The main objective of the CSIR study is to address patient non-compliance in TB control programmes. The project seeks to develop a system whereby anti-TB drugs can be administered in a reduced dose frequency, i.e. once every 10 days, as opposed to the current regimen of four antibiotics taken daily for six to nine months. By shortening the duration of the treatment from six months to less than two months, patient compliance will improve substantially.

The slow release treatment will minimise MDR-TB (through improved compliance) and hopefully contribute meaningfully to total elimination of TB.

This delivery process has huge potential to be used in pharmaceuticals once optimised, not only in the case of TB, but also malaria and HIV treatment.

### ■ Using quantum-dot science to replace conventional lighting

Research into quantum dots and their unique properties and applications is rapidly increasing internationally. In cooperation with the University of Zululand and the University of the Free State, the CSIR is initiating a research project on solid-state lighting utilising nanophosphors to understand the current and potential impact of quantum dots as an emerging technology field within nanotechnology.

The objective of the study is the utilisation of quantum dots and other nanophosphors, pumped either electrically or by laser to produce low energy consumption and high-efficiency illumination. The research project aims to develop a platform in quantum-dot science and technology, and in the longer term, to develop cost-effective nanophosphor-based light sources that can be used in our daily lives. The low energy consumption and high efficiency of this technology promise impressive economic and environmental savings and could potentially impact on quality of life.



**Dr Paulo Fernandes, AIDC Managing Director, and Daimler Chrysler MD Christoph Köpke, at the launch of the AIDC office in Port Elizabeth**



**The AIDC aims to grow South Africa's share of the international automotive export market**

The provincial sectors targeted are electronics, clothing and textiles, cultural industries, food, metals and engineering, furniture, boatbuilding, and packaging, which cuts across all sectors. The sponsors of the initiative are the DST, the Western Cape provincial government, and the City of Cape Town.

Similar manufacturing technology programmes, in collaboration with stakeholders, are in various stages of planning for the key manufacturing provinces of South Africa.

### **Boosting the automotive sector in Eastern Cape**

The AIDC established an office in Port Elizabeth in 2004 as part of the drive to grow South Africa's international share of the automotive export market. Established nationally through seed funding raised by government agencies, the Eastern Cape Development Corporation and Blue IQ, along with the CSIR, the AIDC operates as a commercially-driven entity, whose services are dedicated to the automotive sector.

The Eastern Cape is home to four of Africa's largest vehicle manufacturers and over 150 component manufacturers, which contribute significantly to South Africa's 0,9% share of total world vehicle output and 83% of Africa's vehicle output. The AIDC is expected to contribute significantly to the competitiveness of the industry.

The AIDC is already involved in several key projects, including the feasibility study and project management of an automotive logistics and light industrial

assembly park in Uitenhage - a multi-million rand investment in the local industry. The Centre is mandated by government to help entrench the region as a hub of manufacturing quality by providing cutting-edge consulting services in the areas of logistics, production and process engineering, working towards shop floor improvement and human resource development.

### **Promoting cleaner production**

The CSIR-based National Cleaner Production Centre (NCPC) is an initiative to enhance the competitiveness and productive capacity of national industry through the adoption of cleaner production techniques, and the transfer and development of environmentally acceptable technologies. Financed jointly by the dti and the Swiss and Austrian governments through UNIDO, the centre gives priority to small and medium-sized enterprises in the food, chemical and textiles industries, and subcontractors in the supply chain.

The NCPC also acts as a launch pad for the implementation of activities relating to international environment conventions such as the UN's Kyoto Protocol and the Stockholm Convention on the Reduction and Elimination of Persistent Organic Pollutants. Cleaner production technologies have been identified as a priority in both the national Integrated Pollution and Waste Management Policy and the national Waste Management Strategy. The National Cleaner Production Strategy for South Africa is being developed under the leadership of the Department of Environmental Affairs and Tourism (DEAT).

*Dr Andre Germishuizen  
and Lukas le Roux,  
pictured with solar cells  
produced by the CSIR*



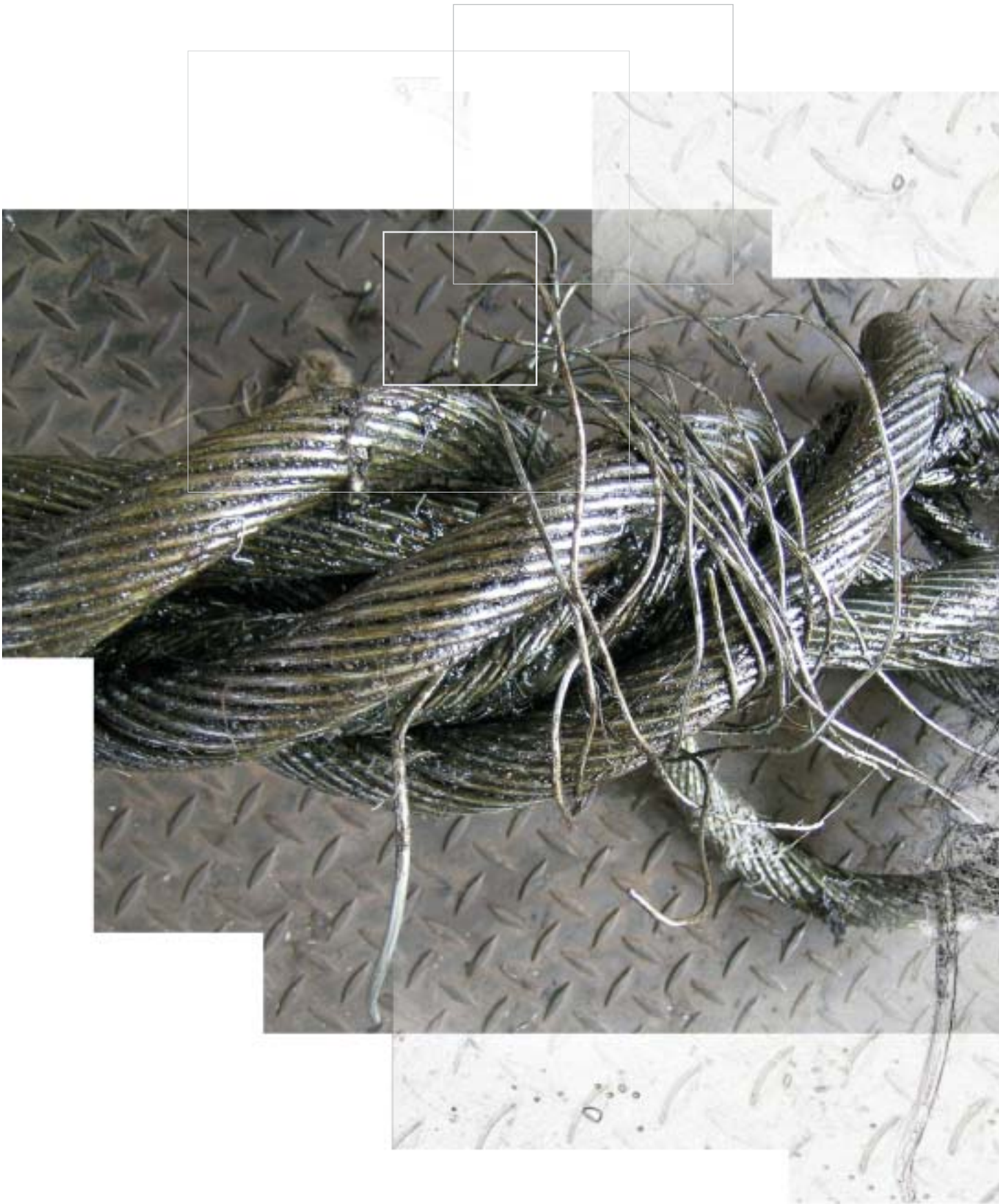
## Research to support new energy technologies

- As fuel sources become depleted, alternative sources of energy are becoming increasingly important. One such novel system 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 towards DSC niche applications, which include alternative energy devices to be used in cellphone chargers, laptops and radio batteries. Initial research results look promising and further developments are in the pipeline.
- The DST has identified the hydrogen economy and related fuel cell technologies as a Frontier Science and Technology initiative that would allow proactive development of innovation and human resources, while leveraging key natural resources. To support this

process, the CSIR, a number of private sector companies, universities and semi-government organisations have formed a local fuel cell initiative. The DST provided support for this initiative by financing a South African fuel cell baseline study. The CSIR is building capacity in the field of fuel cells with the intent of collaborating both locally and internationally to develop some of the technologies required in this field.

- Challenges such as the depletion of the Witbank coalfields, the escalation of the cost of coal from other coalfields, increased demands on South Africa's scarce water resources and concerns about damage to the environment, are contributing to the need to develop new, more efficient, clean coal technologies in South Africa. To support this process, the CSIR is reviewing and investigating technologies such as oxy-coal combustion, integrated gasification-combined cycle and carbon sequestration.





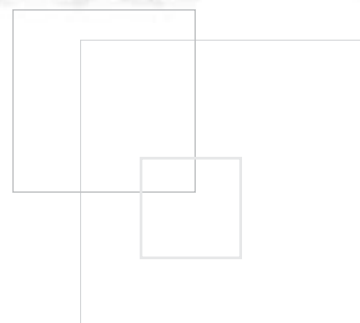
# Mining Technology



The CSIR supports the efforts of the mining sector to improve health and safety, reduce mining costs, maintain and restore a sound biophysical environment and optimise the value realised from South Africa's rich suite of mineral resources. The over-arching objective of work in this sector is to attain sustainable socio-economic development through mining.

The CSIR's activities encompass generation and application of knowledge, development and transfer of technology and provision of specialised knowledge services addressing the requirements of the wide spectrum of mining operations in South Africa. Through participation in the African Mining Partnership, CSIR support for mining development on the African continent is growing.

This section of the Annual Report showcases several of the significant research findings and services offered in the area of mining technology.







**The CSIR has produced methodologies for assessing hazardous ground conditions on the UG2 when mining in the vicinity of Merensky Reef remnants**



**A decision-support system developed by the CSIR assists with the selection of personal protective equipment**



**The innovative stepping pump concentrator modified by the CSIR for use by small-scale miners in Africa**

## Optimising safe mineral extraction

- A study undertaken by the CSIR and industry collaborators (PlatMine) has provided insight into the factors affecting the stability of workings beneath the partially mined Merensky Reef (MR) in the Bushveld Complex.

The influence of overlying remnants significantly alters the stress environment for mining operations on the underlying Upper Group second chromitite band (UG2). The extent of the influence of the high stress environment on the prevailing ground conditions was assessed via underground observations and numerical modelling simulations. The results from these exercises were used to develop updated mine layout and support design methodologies.

This research has provided invaluable insight into the anticipated rockmass response when mining in the proximity of MR remnants, facilitating improved safety and greater productivity on many of South Africa's platinum mines.

- The use of continuous mining machines to mine platinum ore bodies in future will not allow in-stope pillars to be left in the mine face to ensure stability of the workings. With the support of PlatMine, the CSIR undertook a project to investigate the design of alternative support systems to replace the pillars.

The current residual pillar strengths were determined by back-analysis of two case studies, and by underground stress measurements. The results indicated that a support resistance of (at most) 1.1 MPa was required to stabilise stopes and prevent 'backbreak' failure of the stope hangingwall. Backfill and grout pack support units were considered as alternative support; backfill was found to satisfy the support criterion consistently, while the applicability of grout packs was found to be a function of the individual pack strength, pack spacing and the thickness of the discontinuous hangingwall beam. Design charts were produced for determining the required spacing for different pack strengths and beam thicknesses.

This project has not only provided valuable information in terms of current crush pillar support capacity, but has also paved the way for mining long faces at very high extraction. This knowledge will greatly assist in designing and optimising layouts for mechanised mining operations.

- Under the auspices of the Coaltech 2020 collaborative research programme, the coal pillar design formula developed by Salamon and Munro in the 1960s has been reviewed in the light of data gathered over the last 20 years.

Prof Miklos Salamon participated in this study, which culminated in a modified version of the original Salamon and Munro formula. The



resultant formula indicates that the application of a single strength for coal is inappropriate when designing pillars to be left in different seams for differing localities. In particular, the No 2 Seam in the Witbank coalfield is much stronger than the other seams in the region, resulting in the development of a No 2 Seam-specific pillar design formula. Implementation of this formula in mine design will result in the formation of smaller pillars, thereby increasing the percentage extraction on the No 2 Seam and the underlying No 4 Seam.

Optimisation of export coal reserves will play a significant role in maintaining the long-term contribution of mineral exports to the South African economy.

### Protecting the health and safety of mine workers

- In terms of the Mine Health and Safety Act, managers must ensure that sufficient quantities of all necessary personal protective equipment (PPE) are available for use by employees. In a project sponsored by the Mine Health and Safety Council (MHSC), the CSIR has incorporated available data on PPE, hazards and mining occupations into a decision-support system. This system enables mine management to select the most effective PPE for the mine's conditions.
- The CSIR is actively engaged in a strategic partnership with the

MHSC to proactively address occupational hygiene stressors that affect mining operations in South Africa. Substantial investment has already been made in understanding the science of occupational hygiene stressors and their manifestations which include silicosis, noise-induced hearing loss, hand-arm vibration syndrome, and musculo-skeletal disorders. Fundamental to the success of investigating solutions to these issues is the need to address sub-sets of these stressors in a holistic manner to create the appropriate environment, both occupational and social, for a mine's workforce to operate at optimal levels of productivity.

### Technology for small-scale mining

Small-scale mining has become increasingly prolific in South Africa and is widely practised on the rest of the continent, where it is often a subsistence activity for community survival. Various initiatives undertaken by the CSIR during the past year have provided support for this sector, including:

- Development and technical testing of an innovative stepping pump concentrator (SPC), which is set to play an important role in both a purely pumping environment, such as in rural agricultural settings, and in the small-scale mining sector, where low-technology applications are required to concentrate minerals

through gravity separation. The result of a strategic alliance between the CSIR, Ecologics (a New Zealand company) and a South African partner, Skill-makers, the SPC will be especially useful in supporting rural communities to improve their livelihoods, and to enhance sustainable community development.

On-site technical testing of the SPC took place in various localities in South Africa, Ghana and Mali. Collaboration with Mintek, the Minerals Commission of Ghana and UNOMIN in Mali, as well as the support of the mining ministries in the three countries, were critical to the success of the project.

- Development of Junior Mining Simulation, a board-based, hands-on mining simulation showcasing a holistic approach to the entire mining value chain. Developed as a capacity-building tool, the simulation is primarily aimed at providing the emerging mining sector with a working knowledge of mining business and to raise the business understanding of those involved at different levels of mining.

## Achieving a balance between environmental, social and economic factors



**The CSIR, through the Sustainable Development through Mining project, is assisting the DME with the development of national and regional mining, closure and post-closure strategies**

### Sustainable development through mining

In keeping with the 2002 WSSD's Johannesburg Plan of Implementation, which provides specific actions and targets for mining ministries and industries throughout the world, the DME will be audited in 2010/11 to determine environmental compliance and performance of the industry in South Africa. The DME has contracted the CSIR to assist the department in meeting these objectives.

According to Dr Hlombe Makuluma, manager of the CSIR's programme for Sustainable Development through Mining, the vision of the DME is to ensure sustainable development and growth through mining for the benefit of all South Africans, while at the same time preventing or minimising negative impacts of prospecting and mining through the development and implementation of policies, legislation, strategies and programmes that adhere to the principles of sustainable development.

A management committee comprising the DME and the CSIR is providing guidance in terms of the activities required to conduct the research programme. Representatives from other stakeholders such as the Department of Water Affairs and Forestry (DWAF), the Chamber of Mines, the mining industry, labour organisations and TEIs, may be co-opted as and when required. Other science councils such as Mintek are also participating, while discussions with the Council for Geosciences are ongoing to secure its participation.

Four main projects have been planned to address the objectives identified by the DME. A scoping study, to be completed by the end of August 2005, will be followed by specialist studies to support the development of a sustainable development framework for the South African mining industry. "The framework will provide guidelines to the mining industry and government about how best to ensure that South Africa benefits in a sustainable manner from the mining of its mineral wealth," says Makuluma.



**The CSIR's rope database reflects more than 1 150 hoist ropes in use**

### 100 Years of hoist rope testing

The CSIR's hoist rope test facility at Cottesloe, one of only two such facilities approved by the DME in South Africa, celebrated its centenary in November 2004.

South African mines hoist about 280 000 workers up and down mine shafts each day. The CSIR's rope database reflects more than 1 150

hoist ropes in use, illustrating the responsibility that rests with the organisation to provide mine engineers with accurate test results. The CSIR maintains the only such database in Africa, to ensure traceability.

The hoist rope tests evaluate a rope's absolute breaking force, mechanical properties, modes of wire and strand failure, extent of corrosive and abrasive damage, and the state of lubrication.

The second project focuses on the development of regional closure/rehabilitation strategies for derelict and abandoned mines. "A key component of this project is to address the socio-economic impacts of mine closure," comments Makuluma. Best practice rehabilitation methods and regional rehabilitation strategies will be developed for each mining sector and region, in partnership with local governments and communities, and a ranking system has been developed to prioritise the identified mines for rehabilitation.

The third research project entails the development of a decision-support system that will enable government and other parties to monitor the compliance of the mining industry with the sustainable development framework for mines. The system will support data storage and retrieval and reporting per mine, mine sector and region. A system will also be developed to facilitate mine audits by the DME.

The focus of the fourth project is skills and human resource development. The

appointment of between 10 and 15 interns has been finalised, and the interns will be assigned mentors for the duration of the DME project.

"The projects identified require a tremendous amount of research, and in some cases this will be pioneering research," comments Makuluma. "We are drawing on a wide range of expertise from across the CSIR. We envisage that this collaborative initiative will enable South African mining stakeholders to address the legacies of the past effectively, while ensuring a sustainable contribution to our country's development."



*Dr Hlombe Makuluma, manager of the CSIR's programme for Sustainable Development through Mining*





# Peace, Safety and

celebrating **60** years of excellence in science and technology

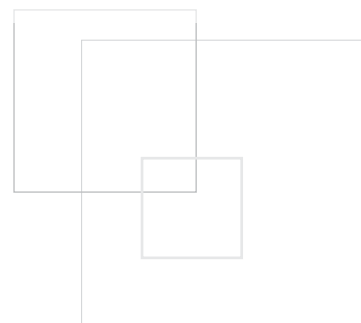


# nd Security



The CSIR operates as a strategic, impartial and independent systems technology partner to the Department of Defence (the South African National Defence Force (SANDF), the Defence Secretariat and Armscor) specifically in the fields of aeronautics, landwards operations, electronics and information and special operations. The organisation also provides highly specialised technology support to the local defence industry and international defence organisations and laboratories.

As a contributor to state and human security, the CSIR also provides technology support to the crime-combating and prevention establishment in South Africa. In the area of peace support, the organisation leverages its competencies and technologies in support of international peace missions, as carried out by the SANDF. Specific projects and initiatives highlighted in this section range from the development of a unique flutter exciter and a helicopter mission planning tool to the design of a rough-terrain quad trailer.





**The CSIR has developed novel technology to excite aircraft during flutter flight testing**



**The Oryx Mission Planning Tool assists in the safe navigation of the SAAF's Oryx helicopter beyond hostile radar detection**

### Improving helicopter safety

The Oryx Mission Planning Tool (OMPT), developed by the CSIR in close cooperation with the South African Air Force (SAAF), aims to ensure the safety of the SAAF's Oryx helicopter during jamming missions. During peace-keeping missions, SAAF personnel and equipment might be endangered by radar-guided missiles. The OMPT increases jamming effectiveness and assists in the safe navigation of the helicopter beyond enemy radar detection.

According to the SAAF electronic warfare experts, a mission planning tool is essential to determine the altitude and distance from threat radars in which a helicopter can safely operate while jamming the enemy radars, thereby protecting other aircraft when entering the threat radar area. The OMPT uses terrain features to determine this safe position and altitude for proper operation.

The OMPT provides a mission printout with all the relevant information for the mission, including parameters such as the radar position, waypoints of the flight paths and other aircraft to be protected, burn-through distances and altitudes.

The mission is also displayed on a map and can be printed for navigational purposes.

### Unique technology to excite aircraft

The CSIR has developed novel technology to excite aircraft during flutter flight testing. Flutter, a self-sustaining oscillation that can lead to structural failure and the loss of an aircraft, should be avoided at all costs. Flutter flight testing is aimed at demonstrating that the aircraft flight envelope is flutter free.

Response measurements from deliberate excitation of the structure are used to identify and track frequency and damping values against velocity, and to identify flutter conditions without actually encountering flutter.

The flutter exciter has been marketed internationally at exhibitions such as the Aerospace Testing Exposition 2004 in Hamburg, where it generated considerable interest.

This new development strengthens the CSIR's capabilities in flutter prediction, aeroelastic analysis, ground vibration testing, finite element modelling-based structural dynamic analysis, unsteady aerodynamic analysis, flutter calculations and support of flutter flight tests through near real-time data analysis.



## Supporting the fight against cyber crime

In a first for South Africa, the CSIR has established a cyber security science centre to support the fight against cyber crime and cyber terrorism. The centre's primary mandates are research and human resource development. It also provides quick reaction support countrywide, as well as technical support in the full spectrum of cyber forensics investigations, including pre-investigation planning, search and seizure, analysis, data recovery and expert testimony when needed. Work includes research into new technologies and trends in the field of high-tech crime as well as providing guidance to government agencies on technologically-strategic decisions. Prominent clients include the National Prosecuting Authority and the South African Banking Risk Intelligence Centre.

Research activities are not limited to the field of cyber security, but also cover aspects such as cyber terrorism and vulnerability assessments for government organisations.

Taking into account the highly labour-intensive nature of cyber security, the CSIR's long-term role is not to carry out the actual security processes, but to gain knowledge through research, thus enabling the organisation to train and support experts in the public sector.

## In brief

- In a world first, the CSIR has developed a revolutionary Digital Radio Frequency Memory (DRFM) technology module. Sampling at 1.2 GHz, with 10 bit resolution, this module surpasses any DRFM in the world market, providing defence R&D institutes with an advanced radar testing and evaluation capability.
- The Fynmeet radar facility has been enhanced with a new tracking capability that will expand and improve its key support to the SANDF. With the new tracking capability, Fynmeet can now be autonomously deployed for radar cross-section measurements of aircraft and naval vessels.
- The CSIR, working with the South African Police Service's Criminal Record Centre, has developed a fully integrated blood spatter analysis system with three-dimensional crime event representation capabilities.
- A unique modular armoured vehicle developed by the CSIR is addressing the need for an upgradeable, protected vehicle to safely transfer money.
- An Individual Soldier Simulation Tool has been developed to assist in the selection of soldiers' combat equipment and to support acquisition, procurement, evaluation, compilation of doctrine, and training.
- Commissioned by the SANDF, the CSIR has designed a trailer specifically for African conditions. The trailer, for use on land with a quad motorcycle, has features that will make life significantly easier for soldiers in African operations. Apart from facilitating the transport of water, fuel and equipment needed for the operation, the trailer is equipped with a stretcher for casualty evacuations. The trailer can be transported by air or on land, and is designed to be hooked up with a swivel tow bar to a four-wheel motorcycle.



***The CSIR has designed a trailer specifically for African conditions***

# Awards and Ac



*Dr Mark Hildyard*



*Khungeka Njobe*



*Freda van Wyngaardt*



*Tanya du Toit*



*Steve van Huyssteen*



*Angelique Botha*

## **Fifth Rocha Award for CSIR**

The CSIR's **Dr Mark Hildyard** was awarded the 2005 Rocha Medal by the International Society for Rock Mechanics for the world's best PhD thesis in this field. Hildyard's thesis, entitled 'Wave interaction with underground openings in fractured rock', implemented novel numerical and theoretical developments to address the problem of rockbursts in mining and the interpretation of fracturing in rock. Awarded annually, the Rocha Medal is intended to inspire young researchers in the field of rock mechanics. This is the fourth time in eight years that a CSIR scientist has received this prestigious award, making it a unique achievement.

## **Njobe to serve as chair of forum**

**Khungeka Njobe**, Director of CSIR Water, Environment and Forestry Technology, has been appointed chairperson of the National Environmental Advisory Forum, established earlier this year by the Minister of Environmental Affairs and Tourism, Marthinus van Schalkwyk. It will be the responsibility of the Forum to inform the Minister of the views of stakeholders regarding the application of the principles of the National Environmental Management Act.

## **Women in Science Awards**

CSIR NML researcher **Freda van Wyngaardt** and **Tanya du Toit**, technology manager at CSIR Water,

Environment and Forestry Technology, were the proud recipients of 2004 Women in Science Awards. Created by the DST, the awards celebrate the achievements of women in science, in direct response to the vision encapsulated in the National R&D Strategy of ultimate improvement in the quality of life of South Africans.

Du Toit's post-graduate grant for a PhD in technology will enable her to pursue her studies through the Da Vinci Institute of Technology.

Van Wyngaardt will use her postgraduate fellowship (for a woman scientist studying in an area where participation by women is traditionally low) to further her PhD project, which focuses on the absolute activity measurement of radionuclides using liquid scintillation counting techniques.

## **CSIR represented on Kilimo Trust**

**Felicity Blakeway** of CSIR Water, Environment and Forestry Technology has been appointed to the board of trustees of the Kilimo Trust, based in Kampala. The trust is responsible for managing some of the projects and activities of the UK-based Gatsby Charitable Foundation, established in 1967, which has developed a series of grant-making programmes both in the UK and abroad. The programme supports initiatives in selected African countries in the areas of microfinance; the dissemination of agricultural and

forestry research; and the enhancement of science and technical education.

## **CSIR contribution to construction industry recognised**

**Steve van Huyssteen** from CSIR Building and Construction Technology was awarded the 2004 JD Roberts Award in recognition of his outstanding contribution to construction industry development in South Africa, over a number of years. In particular, he played a leading role in the development of construction industry indicators (CIIs) in 2002, under contract to the Department of Public Works. He was also involved in the development of the CIIs for 2003 (including the development of empowerment indicators) under contract to the Construction Industry Development Board.

Instituted in the late 1970s in remembrance of one of its founders, and to encourage excellence in scientific and technological research, the JD Roberts Award is made annually, embracing the promotion of competitiveness in seeking environmentally sustainable solutions to human dilemmas.

## **Award for CSIR metrology paper**

**Angelique Botha** of the CSIR NML won the award for best published technical paper at the national 2004 Test & Measurement Conference in



*Johan Eksteen*

*Dr Amit Rawal*

*Dr Geoff Meese*

*Dr Rodney Milford*

*Petro du Pisani*

Johannesburg. Botha's paper, 'Progress report on the establishment of measurement traceability and measurement equivalence for ambient air monitoring for Southern Africa', discussed the CSIR NML's gas metrology laboratory facility for the gravimetric preparation of gaseous reference materials.

### **International award for CSIR researcher**

**Dr Amit Rawal**, a post-doctoral researcher at the CSIR National Fibre, Textile and Clothing Centre in Port Elizabeth, has been awarded a Young Researcher Fellowship by the prestigious Massachusetts Institute of Technology. He presented a short paper at the Institute's third conference on Computational Fluid and Solid Mechanics, held in Cambridge in June 2005. The paper, entitled 'Simulation of Polymer Flow in a Rotating Die-Slot', involves Rawal's PhD research and explores the idea of analysis of polymeric fluids in complex rotating die slots using a computational fluid dynamics package.

### **EU FP6 appointments**

The DST appointed **Dr Geoff Meese** of CSIR Food, Biological and Chemical Technologies in March 2004 as South Africa's National Contact Point (NCP) for the Food Quality and Safety theme of the EU FP6, one of the biggest research funding mechanisms globally. Johan Eksteen, CSIR ICT coordinator, was appointed NCP for the Information Society Technologies theme.

As NCPs, Meese and Eksteen are responsible for rendering technical advice on FP6 proposal preparation and contract negotiation; providing assistance in finding European partners for FP6 consortia; and informing the DST of FP6-related concerns within the South African research community.

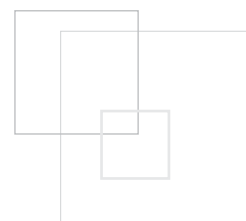
### **Milford elected president of CIB**

**Dr Rodney Milford**, Director of CSIR Building and Construction Technology, was elected president of the International Council for Research and Innovation in Building and Construction (CIB) for the 2004/07 triennium. Milford previously served as a member of the CIB Board and chaired the CIB

Programme Committee. Since its establishment in 1953 with the support of the UN, the CIB has developed into a worldwide network of over 5 000 experts from about 500 member organisations active in the research community, industry and education.

### **CSIR geophysicist wins award**

**Petro du Pisani**, a geophysicist at CSIR Mining Technology, won the award for best paper at the 15th Geophysical Conference of the Australian Society of Exploration Geophysicists in 2004. The paper, co-authored by Dr Declan Vogt, is entitled 'The use of Borehole Radar for the Delineation of Thin Tabular Orebodies ahead of Mining', and was chosen from 235 papers covering exploration case histories, technical innovations, environmental and near surface applications, business aspects of exploration and research.



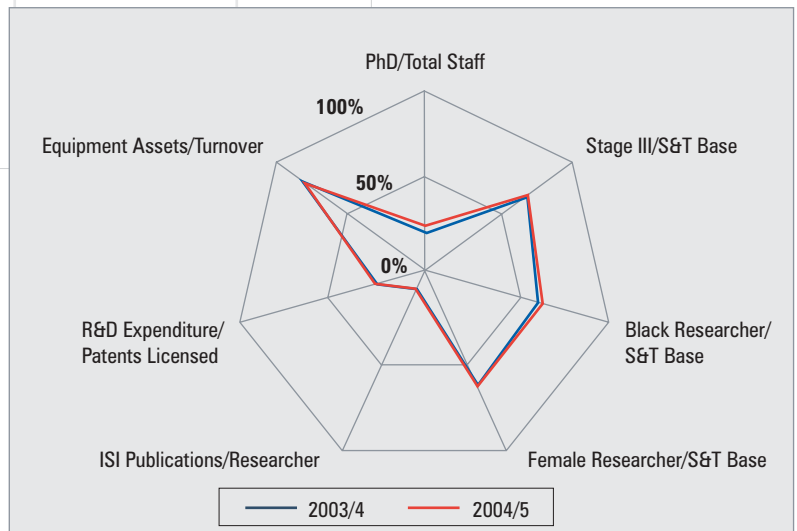


# The State of Science and Technology at the CSIR

The State of Science and Technology (SoST) report evaluates the CSIR's intellectual assets and their performance. It is repeated annually, using a standard set of indicators developed by the CSIR.

The indicators for the year 2004/5 show some improvement from a low base in most areas (refer to the radar plot to the right, which shows a selection of the main indicators, normalised against the desired targets or benchmark values).

However, in most cases, the changes are small and in some cases the indicators are receding; during the financial year 2005/6, the CSIR will be implementing a number of organisational changes in response to this clear message and other surveys of its S&T base.



## Science and technology human resources

The purpose of this section is to reflect on whether the qualification profile of the CSIR is adequate, rising or falling. The data are for 31 March 2005, as

reflected in the CSIR Human Resources database.

The total number of employees at this date was 2 379, slightly down from 2 431 in 2004 and 2 458 in 2003. The qualification and experience breakdown is as follows:

	Qualification levels					Totals	Percent
	0-2 year Diplomas, Matriculation or less	3 year BSc, BA, BTech	4 year BEng, BSc (Hons)	5-6 year Masters	> 6 year Doctorate		
<30 Years	154	143	117	56	12	482	20.3%
30-39 Years	221	135	146	200	54	756	31.8%
40-49 Years	248	101	70	120	59	598	25.1%
>49 Years	280	70	45	80	68	543	22.8%
All ages	903	449	378	456	193 <sup>1</sup>	2 379	
% of total employees	38.0%	18.9%	15.9%	19.2%	8.1%		100.0%

Note:

The difference between the number of employees in this table and the later table under "transformation" is due to bursars, students and staff on extended leave. See note (d) to that table.

The low fraction of employees with advanced post-graduate qualifications is still a matter of concern for the CSIR. Comparable research organisations in Australia, Europe and North America have on average 36% of their staff with PhD-equivalent qualifications. The CSIR value of 8.4% is an improvement over the equivalent figure of 7.7% in 2004, 7.5% in 2003 and 7.3% in 2002, and for the first time since 2002 represents a real increase in the total number of PhDs employed (from 186 in 2001). In particular, the CSIR is

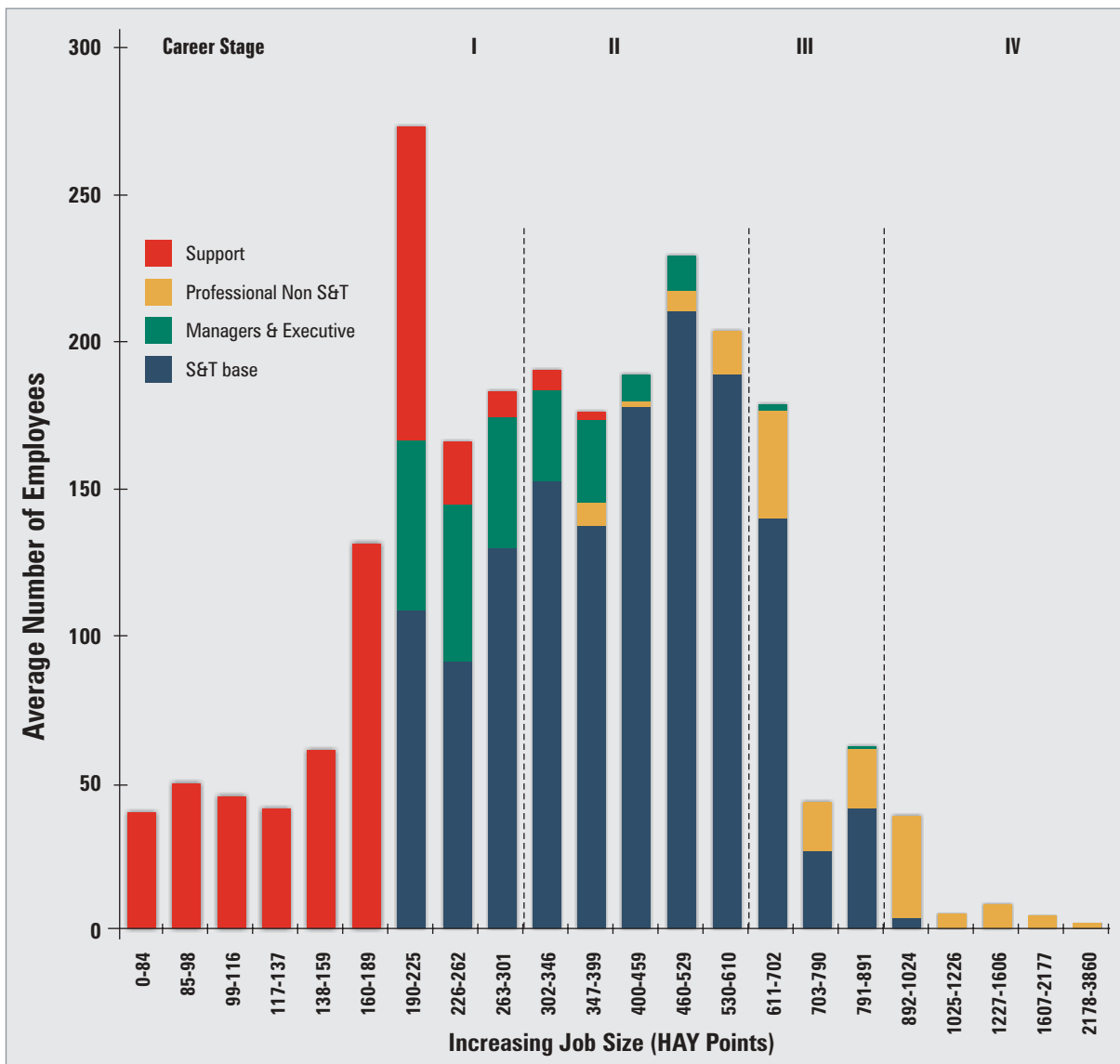
beginning to attract larger numbers of younger researchers (from 49 to 66 in the last financial year) at PhD level. The overall CSIR age profile is essentially unchanged, and is not cause for concern.

### The profile of the research team

This analysis shows the distribution of employees in the CSIR in terms of various functional job categories and

job sizes. The job size is based on employee scores in the widely-applied and well-calibrated Hay system, which forms the basis of remuneration in the CSIR. The Hay bands have been further categorised in terms of the CSIR four-stage career model<sup>2</sup>. The data used are for the end of the financial year, 31 March 2005.

The diagram below shows the functional categories of employees in the CSIR:



1 Some PhD-level employees do not appear in the data on qualification levels, hence the figure of 193 employees within the table on science and technology human resources.

2 The CSIR follows the scheme proposed by GW Dalton & PH Thomson (1986) Novations. Stage I consists of researchers who are learning to do the job, and work under supervision; Stage II is competent individual contributors within a field; Stage III is supervisors, mentors and integrators across fields and Stage IV provides direction to the organisation and represents it.

- The core researcher<sup>3</sup> group, here denoted as 'S&T base'
- Managers and executive
- Professionally-qualified staff who do not work either in research or in top management, such as HR practitioners and information specialists
- Support staff, including secretarial, clerical and grounds staff.

### Science and technology profile

Researchers make up 60.3% of CSIR employees (excluding staff on special leave, bursars and students), reflecting a slight decrease from the equivalent figure in 2003/4. Although this number is acceptable, there is concern about the cost of management and support services, and the proportion of CSIR activities that is not connected directly to research. Data from the 2001/2 and 2003/4 R&D surveys indicate that only 63% and 69% respectively of the

CSIR's work is directly connected to research; the remainder is allocated to technology transfer, commercialisation, management and routine knowledge-based services.

Changes are now being made in the organisation to increase the overall research content and to strengthen its research base. In particular, the organisation will be attempting to streamline its management and support services in order to ensure a greater proportion of its financial resources is applied in research.

The low proportion of research staff in Career Stages III and IV (supervisors and leaders) is again reflected in the above graph. During the 2004/5 financial year, the organisation addressed the issue of research, as opposed to management career paths and the benefits of this programme are expected to become evident in

subsequent years. In particular, it is anticipated that the proportion of staff in Career Stages III and IV will reach 20% and 5% respectively (presently 14% and 0.4%).

The "management ratio", which is a measure of the deployment of CSIR resources into management relative to the S&T base, has been steady over the past five years<sup>4</sup> at around 0.12. Similarly, the "support ratio", which reflects the deployment of resources to support functions relative to the S&T base, has also remained steady at about 0.55.

### 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 2005, are shown in the table and the figure below.

		Managers and Executive	S&T Base Career Stage <sup>c</sup>				Non S&T Professionals	Support Staff	Total <sup>d</sup>
			I	II	III	IV			
Female	Black <sup>a</sup>	13	86	94	3	56	140	392	
	White <sup>b</sup>	38	47	199	20	110	119	533	
Male	Black <sup>a</sup>	31	144	154	20	41	242	632	
	White <sup>b</sup>	76	55	408	156	37	13	750	
<b>Total</b>		<b>158</b>	<b>332</b>	<b>855</b>	<b>199</b>	<b>5</b>	<b>244</b>	<b>514</b>	<b>2 307</b>

**Notes:**

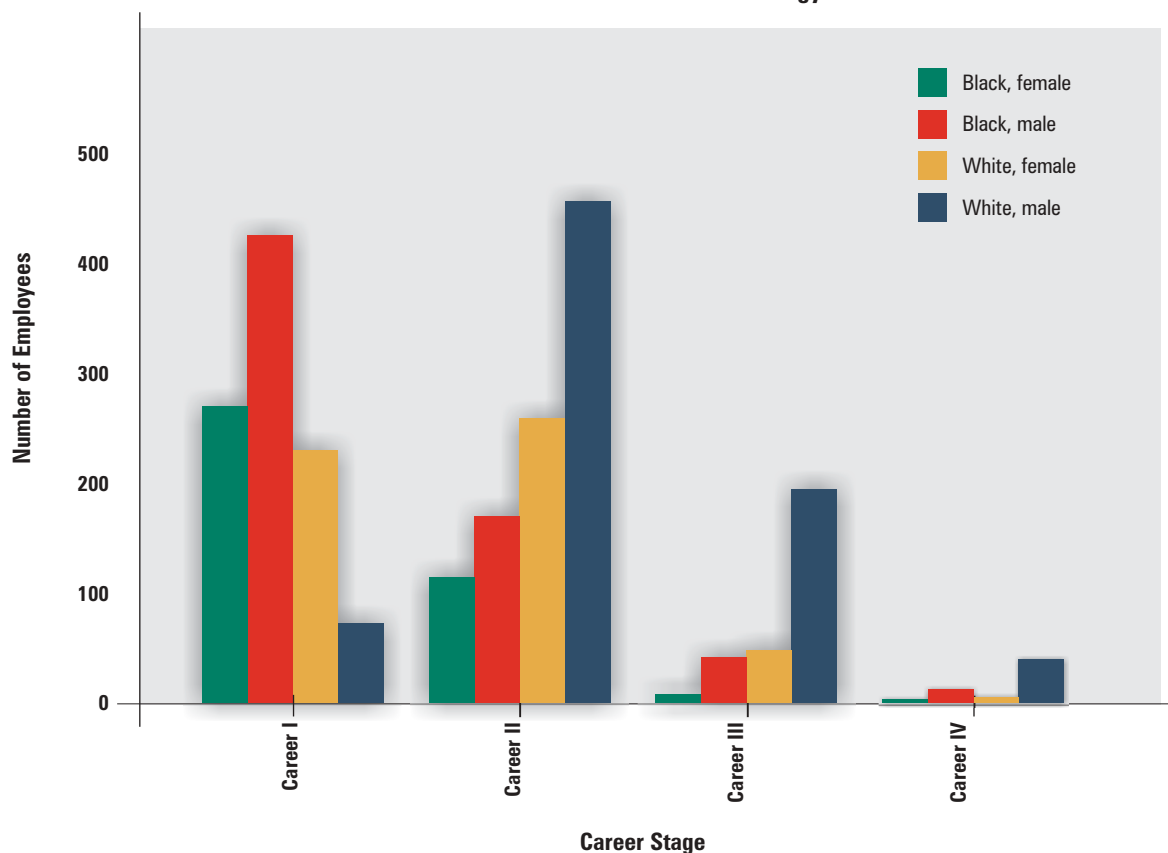
- a. 'Black' includes people who were disadvantageded under the apartheid system, i.e. those formerly known as Africans, Coloureds and Indians.
- b. 'White' includes any person not legislatively discriminated against under the apartheid system.
- c. The CSIR applies a four-stage career model, particularly to its research staff. It is described in footnote 2.
- d. The totals differ slightly from those in the breakdown of employees by age and qualification given in a previous table because the following groups are excluded in this table: CSIR undergraduate bursars, staff on special study leave for more than six months; full-time post-graduate students and students undergoing in-service training.

<sup>3</sup> 'Researcher' in this report means any scientist (including social and economic sciences), engineer, technologist or technician whose main function is conducting research or technology development.

<sup>4</sup> The actual values have changed since the last SoST report due to changes in the structure of the underlying database, leading to a recalculation of the historical values.



## Transformation in Science and Technology Base



It is noted that there is only a gradual improvement in the representivity of black male and female researchers in the total S&T base of the CSIR. For instance, the proportion of black female staff in the S&T base has risen from 9.5% in 2001/2 to 13.2% in 2004/5; black male staff in the base has similarly risen from 21.7% to 22.9% over the same period. In terms of gender equity, the proportion of female researchers in the S&T base has risen only from 30% to 32% over this period.

It is clear that this transformation is neither fast enough nor anywhere close to the desired end-point. Career Stages II, III and IV remain disproportionately white and male. To some extent, the CSIR's potential progress in this regard is limited by the availability of suitably qualified and experienced S&T personnel. The statistics on

matriculants who obtain good grades in mathematics and science at higher-grade level are well known; similarly, the numbers of university graduates who leave their institutions with research qualifications, and wish to continue a career in research, are also small. However, the CSIR will continue to make sustained efforts to address this important aspect of its human resource base.

### Technical outputs

The purpose of these indicators is to measure the volume of research output of the CSIR. The peer-reviewed publication data refer to outputs published in the calendar year 2004; all other information pertains to the 2004/5 financial year. As for previous SoST reports, a range of output types is covered.

The total number of peer-reviewed CSIR publications has remained static over the last five years and is way below the benchmark of one publication per researcher per year, as obtained from the baseline study undertaken in 2002. A separate study of the CSIR has recently revealed that the research core of the organisation consists of 583 persons, implying that the current publication rate is about 0.1 publication per researcher per year. This figure is unchanged over the period 2001/2 to 2004/5 and is highly non-homogeneous within the organisation. For instance, 70% of the CSIR's total peer-reviewed publications are derived from a single unit (CSIR Water, Environment and Forestry Technology). While it can be argued that the concept of publications per researcher is not a suitable metric for some units, peer review remains the

CSIR Unit	Number of outputs		
	Research Papers (ToDB) <sup>a</sup>	CSIR Reports <sup>b</sup>	Other Published Items <sup>c</sup>
Food, Biological and Chemical Technologies	18	507	1
Building and Construction Technology	0	64	28
Defence Technology	5	299	17
Water, Environment and Forestry Technology	41	229	50
Mining Technology	8	217	14
Manufacturing and Materials Technology	2	158	20
Roads and Transport Technology	0	141	24
ISTC/AAIICT/SAC	2	23	13
NLC	0	4	0
Corporate	0	2	1
<b>All CSIR</b>	<b>76</b>	<b>1 644</b>	<b>168</b>

**Notes:**

- a. Research papers (obtained from the CSIR's technical outputs database (ToDB)), refer to peer-reviewed journal articles only.
- b. Internal and client reports, in any medium, provided they are lodged in the library and issued a CSIR number. Many of these are peer reviewed, and the majority are available in the public domain.
- c. Includes chapters in books, entire books, conference proceedings and monographs.

most reliable approach to measuring the quality of research output and it is important that the other units improve this aspect of their R&D output.

For the first time, we also report the total citations, and the citation

frequency of CSIR publications (refer to the table below).

Interestingly, the frequency curve shows a similar profile to the average citation frequency of all SCI-listed publications (across all disciplines),

suggesting that the CSIR has an impact factor perhaps slightly below the SCI average. Further work on this aspect of CSIR metrics will be undertaken in the forthcoming financial year.

Year	Peer Reviewed Publications (SCI)	Total Citations	Citation Frequency	Average Citation Frequency (SCI)
1995	62	1 049	17	15
1996	74	795	11	13
1997	66	397	6	12
1998	71	666	9	11
1999	77	216	3	10
2000	63	361	6	8
2001	73	378	5	6
2002	72	128	2	4
2003	73	112	2	2
2004	73	72	1	0.3

**Note:**

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.

The 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. Although the CSIR has previously used

a benchmark of 0.017 patent per researcher per year, 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 are R217 million and 1.1% respectively.

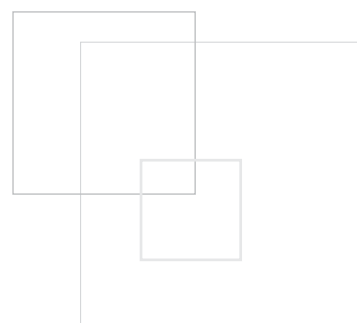
CSIR Unit	Number of Patents				Licensed	Royalty Income (Rm)
	RSA Applications	International & PCT Applications	RSA Granted	International Granted		
Food, Biological and Chemical Technologies	7	1	0	0	1	5.012
Building and Construction Technology	0	0	0	0	1	0.016
Defence Technology	3	4	2	0	0	0.006
Water, Environment and Forestry Technology	1	0	1	1	1	0.061
Mining Technology	0	2	1	0	0	0.349
Manufacturing and Materials Technology	2	1	3	1	0	1.299
Roads and Transport Technology	0	0	0	0	0	0.300
ISTC/AIICT/SAC	1	1	1	1	0	0.113
NLC	0	0	0	0	0	0.000
Corporate	0	0	0	0	0	0.002
<b>All CSIR</b>	<b>14</b>	<b>9</b>	<b>8</b>	<b>3</b>	<b>3</b>	<b>7.158</b>

**Notes:**

Patent applications refer to new applications only; repeat filings of previous provisional applications are not included.

One invention filed or granted in X countries is reported as X applications or patents granted.

Data exclude CSIR subsidiaries.





### Investment in scientific infrastructure

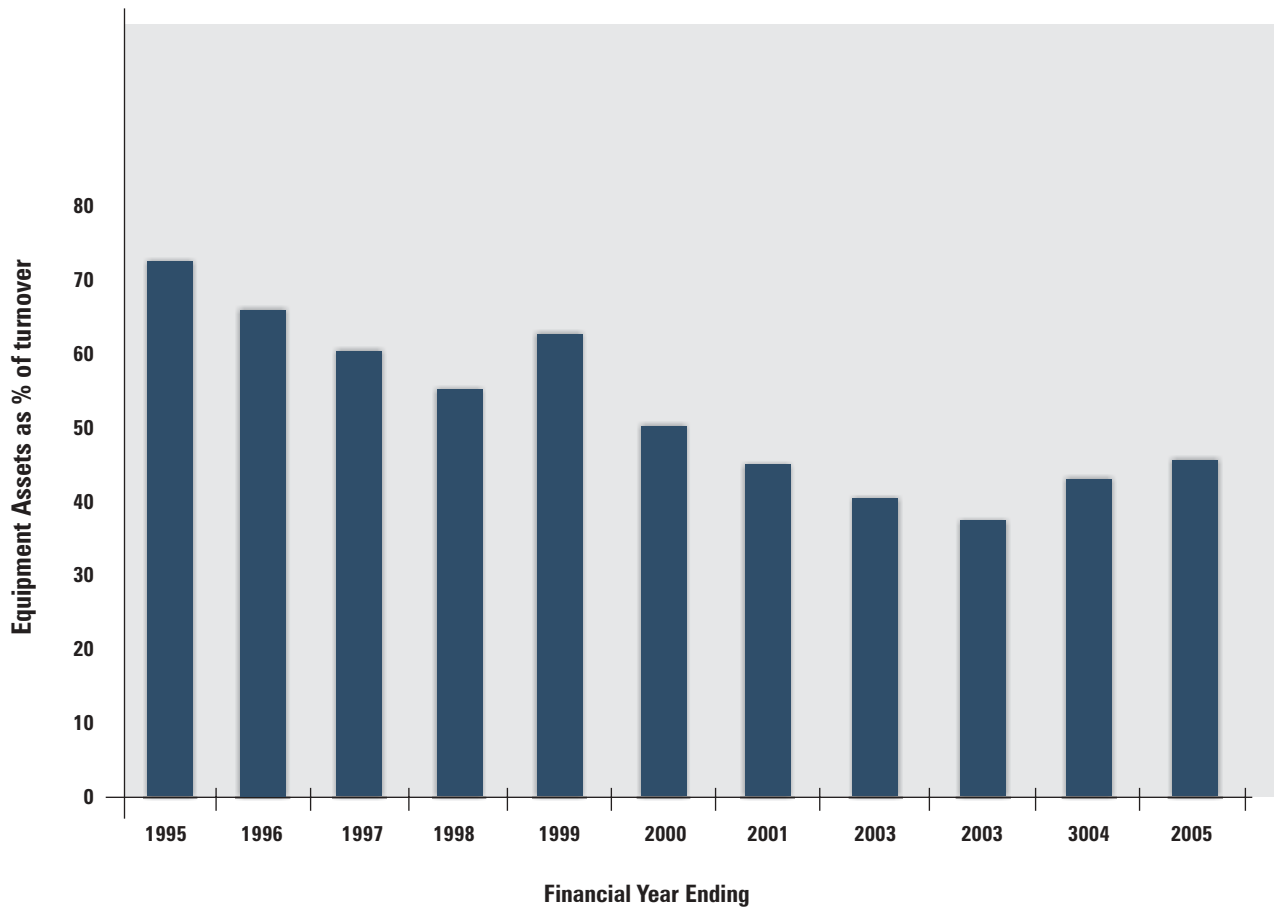
The purpose of this indicator is to determine whether the investment in research infrastructure is sufficient to allow CSIR researchers to remain competitive. As for the previous years, two indicators have been used. These are the value of the equipment assets

at cost expressed as a percentage of the CSIR's financial turnover for the same year (the benchmark is 55%), and the investment in scientific equipment<sup>5</sup> during the financial year. This is also expressed as a percentage of the total financial turnover for the same year (the benchmark is 10%).

The latter value is R42.57 million or 4.2% of turnover; this compares to

R41.94 million or 4.0% of turnover in 2003/4. The former indicator has increased for the second year in succession (from 42.0% to 43.8%) and is a welcome turnaround from the steep decline during the period 1995 to 2003 (see the figure below). However, further improvements are still required to meet the benchmarks.

Investment in Scientific Infrastructure



Office of the CSIR Group Research Manager  
May 2005

<sup>5</sup> 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 interests of these stakeholders. It is about leadership with integrity, responsibility and transparency.

The CSIR is committed to principles and practices that will provide stakeholders with the assurance that the organisation is managed soundly and ethically. The organisation has established a management model that governs and guides the way all employees, not just the leaders, interact with various stakeholder groups.

The core 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 the management model, which is regularly reviewed and updated.

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 South African Statements of Generally Accepted 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 South African Auditing Standards. These terms of reference do not allow for any non-audit work.

#### 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 units and group companies. This has been in place for the year under review through to the approval of the Annual Report and Financial Statements. 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 in areas such as skills development, technology, contracting, HIV/AIDS, reputation, the Parliamentary Grant, 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 organisation 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,



**The CSIR's 40-foot antenna celebrated 40 years in operation in 2004. Commissioned in August 1964, it is one of three such antennae constructed by NASA spaced roughly at 120° longitude around the world**



**The CSIR's medium-speed wind-tunnel is a world-class facility capable of testing up to 1.5 times the speed of sound. There are seven wind-tunnels on the CSIR's premises, the earliest facility dating back to 1958**

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.

### 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 2006 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, which governs the authorisation processes in the CSIR. It deals with, *inter alia*, the development 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 position.

There are appropriate controls to ensure compliance with this 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 the 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 in conjunction with the internal and external auditors. Close cooperation between the external auditors and internal auditors ensures adequate and efficient audit reviews of the proper functioning of these key controls.

The annual audit plan focuses on the key financial risks to the organisation. The work programme that gives effect to the plan was reviewed by the Audit Committee in February 2005 and ratified or modified as necessary.

### Employee participation

The CSIR 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, transformation action groups, union representation, a leadership development programme, technical and strategic focus groups and task teams, and employee satisfaction measurement processes.

### Charter of Ethics and organisational values

The CSIR Board and CSIR Executive Board have approved and adopted a Charter of Ethics, which reflects their commitment to a policy of fair dealings and integrity in conducting CSIR 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 the unit level and transgressions are addressed by means of procedures detailed in the CSIR's Conditions of Service and the requirements of the Public Finance Management Act (PFMA), Act 1 of 1999, as amended by Act 29 of 1999. The employees' survey includes, by design, questions formulated to determine the organisational climate as it relates to values and ethics. The results from the survey are used to inform and adapt, as necessary, internal processes linked to those issues, such as the ongoing values entrenchment process.

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 to conform in its operations to safety, health and environmental laws and the internationally accepted standards and practices. Its commitment to provide a safe and healthy workplace for its employees is demonstrated by the CSIR's implementation of the OHSAS standard as a management system for occupational health and safety during 2003. Certification against this standard was obtained during 2004. The audit was executed by the SABS's Global Conformity Services.

In 1997, the CSIR commenced with the implementation of the internationally recognised Environmental Management System, ISO 14001, which included the development, publication and adoption in 1998 of an environmental policy for application throughout the organisation at all its sites. In 2001, the CSIR obtained ISO 14001 certification for all sites and retained it during 2004, provisionally valid for the following three years.

### Governance Structure

#### CSIR Board

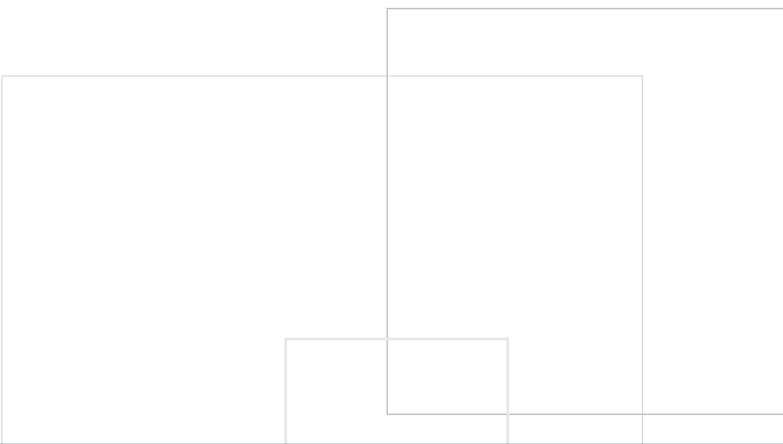
The responsibilities of the Board are governed by the Scientific Research Council Act 46 of 1988, as amended

by Act 71 of 1990 and the requirements of the Public Finance Management Act (PFMA), Act 1 of 1999, as amended by Act 29 of 1999.

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 Trade and Industry. 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. A system is in place to evaluate Board member participation and performance. 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, 25 August and 9 November 2004 and 24 February 2005.

The CSIR Board has the following committees: the Human Resources and Remuneration Committee, the Audit Committee, and the Strategic Review Committee (see page 68 and 69). These committees are selected according to the skills sets required so that they are able to fulfil their functions. The committees have complied with the 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.



### Schedule of Attendance at CSIR Board and CSIR Board Committee Meetings:

Board Member	Board Meetings (4)	Audit Committee (2)	Human Resources & Remuneration Committee (2)	Strategic Review Committee (2)
Roger Jardine	3	*	2	*
Prof Cheryl de la Rey	4	*	*	1
Llew Jones	♦	♦	♦	♦
Dr Sibusiso Sibisi	4	2	2	2
Imogen Mkhize	4	*	1	*
Dr Nhlanhla Msomi	3	*	2	*
Dr Zavareh Rustomjee	3	2	*	2
Kymus Ginwala	4	*	*	*
Lionel October	1	0	*	0
Nobusi Shikwane	4	2	2	*
Prof Mike Wingfield	4	*	*	2

\* not applicable

♦ resigned from the Board in 2004 before the meetings took place

### Executive Management Board

The Executive Management Board has executive responsibility for the CSIR and consists of the Chief Executive Officer (CEO) and three Executive members responsible for the portfolios of Finance and Commercialisation; Organisational Development and Communications; Technology for Development and Policy; Operations, Business Development and Technology Management. The Executive Board meets weekly.

The Executive Management Board is currently undergoing changes and will in future comprise the following portfolios: CEO and three Executive members responsible for Research, Development and Strategic Human Capital; Institutional Planning and Operations; Services and Finance.

### Changes to the Management Board

In terms of the new CSIR operational model, Dr Phil Mjwara was appointed as Group Executive responsible for Research and Development and Human Capital Development, which is the knowledge generation pillar of the organisation, and includes strategic research, contract R&D, science and technology (S&T) management, and strategic partnerships, as well as HRD.

Dr Anthos Yannakou, Executive member responsible for Operations, Business Development and Technology Management, resigned after 12 years of service at the CSIR. Tina Eboka, Executive Member responsible for Organisational Development and Communications, resigned after seven years of service at the CSIR.

### CSIR Leadership Team

The Chief Executive Officer 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 units in accordance with the policies and objectives approved by the CSIR Board. This team comprises the members of the CSIR's Executive Board, together with the unit Directors. The Leadership Team meets twice a month.

### Changes to the Leadership Team

The CSIR welcomed Vishnu Pillay as Director of CSIR Mining Technology in July 2004, and bade farewell to Dr Petro Terblanche, who resigned as Director of CSIR Food, Biological and Chemical Technologies. Dr Terry Watson has been appointed in an acting capacity as Director of the latter.

## 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 65 of the Corporate Governance Report. The membership and terms of reference of each Board Committee are further described on page 68 and 69 of the Corporate Governance Report.

Remuneration to Board Members and Executive Management is set out in Note 21 to the Annual Financial Statements.

## General

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

The CSIR 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.

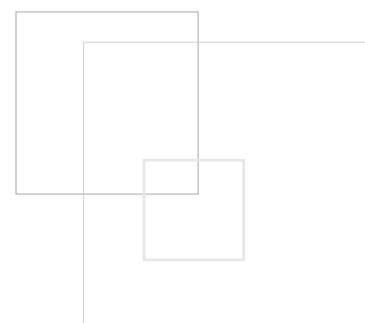
## Public Finance Management Act

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, is in place and has been 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.





**Roger Jardine**  
 (Chairperson of the  
 CSIR Board)  
 Chief Executive  
 Kagiso Media



**Dr Sibusiso Sibisi**  
 CSIR President and CEO



**Prof Cheryl de la Rey**  
 Deputy Vice-Chancellor  
 Research and Innovation  
 University of Cape Town



## CSIR Board Members

### CSIR Board committees 2004/5

**COMMITTEE: AUDIT**

**Members:** Nobusi Shikwane (Chairperson)  
 Dr Zavareh Rustomjee  
 Llew Jones (resigned)  
 Lionel October  
 Dr Sibusiso Sibisi

**Meetings:** 15/06/04  
 16/02/05

**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 of and reviews the annual external audit plan and the work of the CSIR corporate 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.

**Kymus Ginwala**  
 Northern Research and  
 Engineering Corporation  
 USA



**Llew Jones**  
 Chief Executive  
 Tellumat (Pty) Ltd  
 (resigned from the Board  
 in 2004)



**Imogen Mkhize**  
 CEO  
 World Petroleum Congress  
 2005



**Dr Nhlanhla Msomi**  
 Director  
 Biopath Laboratories (Pty)  
 Ltd



**COMMITTEE: HUMAN RESOURCES AND REMUNERATION**

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

**Meetings:** 20/05/04  
24/08/04

**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.

**COMMITTEE: STRATEGIC REVIEW COMMITTEE**

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

**Meetings:** 08/07/04  
10/02/05

**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 organisation.

**Lionel October**  
Deputy Director-General  
Enterprise and Industry  
Development Division  
the dti

**Dr Zavareh Rustomjee**  
Director  
Lwando Trading and  
Investments

**Nobusi Shikwane**  
CEO  
B2B Africa Holdings

**Prof Mike Wingfield**  
Director  
Forestry and Agricultural  
Biotechnology Institute (FABI)  
University of Pretoria



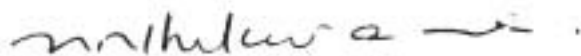
# Report of the Audit Committee

## 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 than eliminate, the risk of failure and to maximise opportunities to achieve business objectives. This can only provide reasonable, but not absolute, assurance.

The Audit Committee has evaluated the annual financial statements of the CSIR group for the year ended 31 March 2005 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

**9 June 2005**





AUDITOR - GENERAL

# Report of the Auditor-General

## REPORT OF THE AUDITOR-GENERAL TO PARLIAMENT ON THE FINANCIAL STATEMENTS AND GROUP FINANCIAL STATEMENTS OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH FOR THE YEAR ENDED 31 MARCH 2005

### 1. AUDIT ASSIGNMENT

The financial statements and group financial statements as set out on pages 63 to 127, for the year ended 31 March 2005, have been audited in terms of section 188 of the Constitution of the Republic of South Africa, 1996 (Act 108 of 1996), read with sections 4 and 20 of the Public Audit Act, 2004 (Act 25 of 2004) and section 14(1) of the Scientific Research Council Act, 1988 (Act 46 of 1988). These financial statements, the maintenance of effective control measures and compliance with the relevant laws and regulations are the responsibility of the accounting authority. My responsibility is to express an opinion on these financial statements, based on the audit.

### 2. NATURE AND SCOPE

The audit was conducted in accordance with Statements of South African Auditing Standards. Those 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, and
- evaluating the overall financial statement presentation.

Furthermore, an audit includes an examination, on a test basis, of evidence supporting compliance in all material respects with the relevant laws and regulations which came to my attention and are applicable to financial matters.

The audit was completed in accordance with Auditor-General Directive No. 1 of 2005.

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

### 3. AUDIT OPINION

In my opinion, the financial statements fairly present, in all material respects, the financial position of the CSIR and

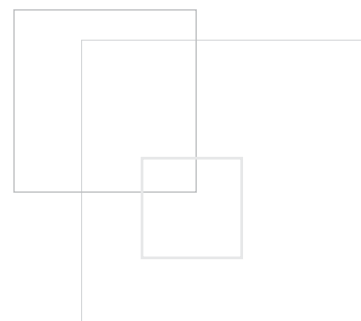
the group at 31 March 2005 and the results of its operations and cash flows for the year then ended, in accordance with South African Statements of Generally Accepted Accounting Practice and in the manner required by the Public Finance Management Act, 1999 (Act 1 of 1999).

### 4. APPRECIATION

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

**C S Benjamin**  
for Auditor-General  
Pretoria

15 July 2005





**Dr Sibusiso Sibisi**  
CSIR President and CEO



**Albert Jordaan**  
Executive Vice-President  
Finance and Commercialisation



**Dr Anthos Yannakou**  
Executive Vice-President  
Operations  
(resigned December 2004)



**Phil Mjwara**  
Group Executive R&D and  
Human Capital Development  
(appointed March 2005)



**Tina Eboka**  
Executive Vice-President  
Organisational Development and  
Communications  
(resigned January 2005)

# Executive Report

## Introduction

On behalf of the CSIR Board, the CSIR takes pleasure in submitting to Parliament, through the Minister of Trade and Industry, this report and the audited financial statements of the CSIR group for the year ended 31 March 2005.

In the opinion of the CSIR Board, who fulfils the role of 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 2005 and the results of its operations for the year then ended.

## 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.

## 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 cooperation 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."

## Nature of business

Within the framework of its mandate, the CSIR undertakes research and develops knowledge and technology that enables it to contribute to the public domain knowledge on important issues, provide technology solutions and information, establish ventures and license intellectual property. It supports sustainable development and economic growth in the context of the country's national priorities and global challenges.

The focus of the Parliamentary Grant investment remains centred around the key initiatives of the National System of Innovation, and the complementary priorities of the government.

## Strategy

The CSIR mandate clearly projects a dual role to foster industrial and scientific development and to contribute to the improved quality of life of the people of South Africa, through appropriate partnerships. As such, the CSIR takes into account the needs of society, government and business. Whilst participating on global, regional and international platforms, the CSIR, at the same time, undertakes to make a positive contribution to our country's national imperatives. 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.

One of the key challenges for the CSIR is to increase scientific excellence, while continuing to grow its external income through focused business development, taking cognisance of the demographic profile of South Africa.

Building excellence in science and technology happens in tandem with good business practices and commercial investment, taking into account that benefits must filter to the people of South Africa.

Activities in the year under review reflect the CSIR's commitment to the upliftment of South Africa and the African continent, the imperative to be a research organisation and its progress in building the CSIR's science and technology base.

## Strategic priorities

The CSIR's strategic context is continually changing through local influences and international trends, shifts and developments. This necessitates regular review of the CSIR strategy to adapt to emerging challenges and opportunities. Its strategic planning, initiated in 2002, explores the environmental issues that may affect the outcome, while remaining consistent with the organisation's mandate and values.

South Africa's national imperatives and global challenges provide the macro-strategic framework within which the CSIR conducts its business and achieves its goals. Taking into account its knowledge-intensive business and the South African environment, the CSIR identified five strategic priorities, which were approved by the Board.

A re-evaluation of these strategic priorities during the year under review resulted in some minor modifications. However, a process is under way to review the essence of the CSIR's strategy so as to ensure greater balance between business effectiveness and a strong replenished base of S&T expertise.

The CSIR's strategy for 2004/5 translates into organisational priorities, informed by the DST Key Performance Indicators, against which performance, both quantitatively and qualitatively, is measured. These priorities in turn provide the organisation's business goals.

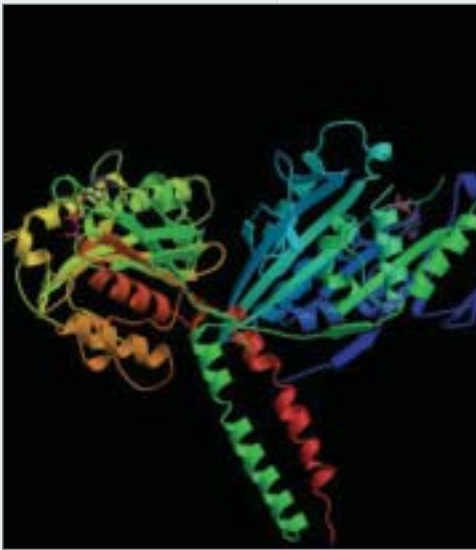
## Goals

For this reporting period the CSIR's specific business goals have been:

- Alignment with government initiatives.
- Consolidating excellence in science, engineering and technology.
- Enhanced professionalism in innovation and business excellence.
- Contributing to sustainable development
- Accessing and developing the best minds.



**Poverty alleviation initiatives have led to the implementation of more than 60 projects in all provinces**



**Nanotechnology is one of the areas prioritised by the AMTS**



**The AMTS will support growth and competitiveness of the manufacturing sector**

In the quest to ensure that the CSIR continues to grow in the spirit of its mandate, it is imperative that the organisation reviews its activities against its goals. In this way, the CSIR can build on the foundations already laid to advance towards a desired future in which the organisation will continue to have relevance and impact. The following pages outline, in broad details, the parameters within which the CSIR focuses its operations to the benefit of our people.

**Goal 1:  
Alignment with government initiatives**

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

The dti/CSIR Institutional Framework has continued to align and enhance joint interactions between the two organisations in support of national goals. Three additional strategic line items of national importance were successfully established in the past financial year: logistics, geographic spread and an aerospace initiative.

**Continued development of Manufacturing Strategy**

The National AMTS aims to support the growth and competitiveness of the South African manufacturing sector through the advancement of technological innovation. An AMTS Implementation Unit has been established on the CSIR site to implement the strategy and facilitate

the partnership between industry, academia and science institutions, through the establishment of technology centres and networks. These centres and networks facilitate the execution of high-impact initiatives in areas such as industry development, world-class manufacturing, innovation and R&D, as well as the development of human resources.

In consultation with the DST, sectors and technology areas were prioritised for the first year of implementation. Thus production technologies, nanotechnology, the aerospace, textile, chemical and automotive sectors have received directed attention, in collaboration with various partners. This includes the launch of a robotics and mechatronics laboratory; rapid upgrading of human resources; creating an impact in the capital goods sector; and focusing on the application of advanced manufacturing technology to make things better, cheaper and more reliable. Refer to the R&D highlights section for further detail. (page 38-43).

**Supporting biotechnology through Regional Innovation Centres**

Through funding from the Biotechnology Regional Innovation Centres (BRICs), a number of CSIR projects continue to produce new biotechnology-related intellectual property. In the industrial biotechnology domain, CSIR core expertise is applied in the improvement of microorganisms and enzymes through genetic engineering, optimising yield in fermentation processes and bioproduct formulation. With the support of the BioPAD



regional innovation centre, the CSIR and its research partners have developed processes and products to be applied in the pharmaceutical, aquaculture, cosmetic and agri-processing industry. The LIFElab ECoBio Regional Innovation Centre, which aims to stimulate the biotechnology economy in the east coast region, contracted the CSIR and its partners to set up a pectin production plant using enzymes in the production of pectins from citrus waste. Read more about these projects in the R&D highlights section of this report (page 10-13).

#### Role of CSIR in the ICT mission

The CSIR's involvement in developing ICT for the benefit of the nation includes providing guidance to the national ICT R&D strategy process, as well as the development of a national earth observation strategy. The industry phase of the national ICT Roadmap initiative, coordinated by the CSIR on behalf of the DST, aims to increase the R&D intensity in the South African ICT industry and foster collaborative relationships. The CSIR is also supporting the DST's effort to capitalise on opportunities provided by programmes such as the EU's FP6, with the CSIR being a participant in two of the first FP6 ICT projects awarded to South African institutions. International initiatives receiving the support of the CSIR include the implementation plan for the GEOSS, support for the SKA project and the linkage to the EU high-speed research network, GéANT.

The CSIR has also been preparing for the launch of the Meraka Institute (formerly the AAICT) to take place in

May 2005. The Institute will play a key role in equipping people with world-class ICT skills and intellectual capital. The Open Source Centre (OSC), which is part of this Institute, plays an enabling role aimed at stimulating the adoption of open source software technologies on the African continent, and in doing so, empowering people to contribute to the economic development of the country. The OSC focuses on three main project areas, i.e. the Open Computer Drivers' Licence, the CSIR's own Open Source Software (OSS) migration and the Go-OpenSource Campaign. The R&D highlights section of this report provides further detail on the CSIR's ICT initiatives (page 22-27).

#### Increasing R&D investment by working with the private sector

The CSIR continued its long-standing involvement with the private sector in line with national, provincial and sector-specific strategies. The interactions were structured in direct customer projects and large integrated projects through partnerships between industry, academia, government and science councils, both locally and internationally. Examples of such projects are described in the R&D highlights section of this report. The income derived from private sector activities was R191,5 million.

The CSIR continues to increase its strategic interaction with the private sector through the development of a cluster and industry sector approach, and invited lectures from leaders in the private sector, increasing its focus on improving relationships based on feedback. Initiatives such as the

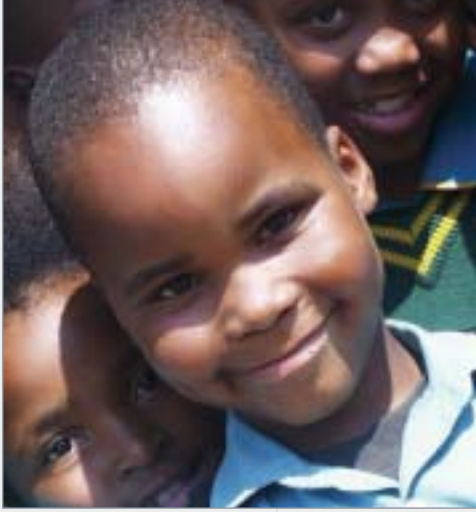
development and implementation of the National AMTS also ensure a high level of private sector involvement in technology-driven sector initiatives.

#### Supporting the poverty alleviation mission

In the past year, the CSIR's activities in poverty alleviation initiatives, funded by the DST and the DAC, have led to the implementation of more than 60 projects in all the provinces with a direct impact on the lives of more than 1 200 South Africans.

The CSIR has also been involved in poverty alleviation initiatives with the dti's Small Enterprise Development Unit, Trade Investment South Africa and the Trade Enterprise Promotion Agency. In the coming year, this will be extended to the national departments of Environmental Affairs, Labour, Social Development as well as Public Works and Local Government. Strategic marketing has also been done at provincial and local government levels. The review of the Integrated Sustainable Rural Development and Integrated Development Programmes in the Western Cape has also been part of the CSIR's portfolio.

The CSIR has also been involved in an indigenous knowledge systems (IKS) pilot study to raise the awareness of IKS amongst South African youth as well as a household survey and skills audit in nine wards of the City of Tshwane to identify projects that will create opportunities for sustainable income generation.



**CSIR crime prevention projects include initiatives in support of the Child Justice Bill**



**Establishing small-scale sustainable mining operations**



**Partnerships have been forged to facilitate development in the manufacturing industry**

The Greater Giyani Natural Resource Programme, a CSIR and UP initiative, received R11,6 million during the past year from the Development Bank of Southern Africa; implementation is due to start in the new financial year.

**Supporting the dti's strategic initiatives in manufacturing**

**Strategic contribution**

The National R&D Strategy, initiated by the DST, and the Integrated Manufacturing Strategy (IMS) driven by the dti, have been generated in part through the efforts of the CSIR. Both strategies recognise that if South Africa is to achieve sustainable global competitiveness, the manufacturing sector will have to master advanced technology domains and move away from raw material-intensive manufacturing goods towards knowledge-intensive products.

Recognising this, the thrust of the AMTS is to strengthen the competitiveness of identified manufacturing sectors through the establishment of technology centres, networks and projects, as described on pages 38 to 43 of this report. Partnerships have been forged on various levels to facilitate development in the aerospace industry and skills development in the manufacturing sector.

**Streamlining the National Logistics System**

The CSIR has produced a new strategy for South Africa to streamline the national freight logistics system so that it operates efficiently and

effectively. The CSIR is now assisting the Department of Transport in drafting a Green Paper, including a situational analysis. The first State of Logistics Survey has been undertaken by the CSIR, containing three different perspectives on logistics in the country, namely a macro-economic, an industrial and a small business development perspective. Further details are provided in the R&D highlights on page 33.

The CSIR is currently collaborating with various provincial governments to develop logistics strategies within those environments. In addition, the CSIR has been involved in assisting a number of large private companies with supply chain management problems. In collaboration with Joburg Metro, the CSIR has taken on an EU-funded project to improve the competitiveness of the freight logistics sector of the Metro. Links are being strengthened with local and international logistics institutions with the aim of strengthening the R&D base in logistics/supply chain management.

**ICT for manufacturing**

In an effort to apply ICT in improving industrial competitiveness, the market need for low-cost automation technologies was independently identified through Competitiveness Fund Assessments and a Technology Roadmap for the automotive industry. The latter led to the establishment of four AMTLs in South Africa.

As a result, the CSIR partnered with the AIDC to launch a project known as SmartFactory, which aims to establish a low-cost technological infrastructure for the smaller manufacturing

companies to tackle aspects such as quality and efficiency. The CSIR project team is currently in the process of installing the system at a factory in Babelegi, north of Pretoria, where it will be closely monitored to determine its effectiveness. The Research and Development Highlights section of this report provides further detail on this initiative on page 26.

Supporting the dti's strategy for broad-based black economic empowerment (BEE) and associated initiatives

#### Empowerment charter for mining industry

The CSIR's contribution to the development of black economic empowerment (BEE) in the mining and minerals industry includes generating guidelines for accelerated development of historically disadvantaged South Africans as junior managers in coal mining, the integration of women into the coal mining workforce, more effective transformation of the procurement supply chain to collieries and licensing technological innovations to be supplied by BEE companies to the mining industry.

The CSIR has undertaken research to determine future prospects for communities that have historically been dependent on mining, focusing on sustainable socio-economic activities outside mining and to secure a more effective contribution from small-scale mining in terms of poverty alleviation, community development and establishment of sustainable mining

operations. Learning opportunities have been provided for aspirant small-scale and junior miners to gain insight into the business aspect of mining, using a small-scale mine simulation, while interventions have been designed to mitigate the prevalence and societal damage caused through HIV/AIDS in the coal and platinum sectors.

#### CSIR BEE policy and strategy

The CSIR is currently in the process of developing its BEE policy and strategy in line with the dti balanced scorecard. A working group has been appointed by the CSIR Executive to evaluate the current status with regard to the support to BEE and indirect empowerment at the CSIR. The group is evaluating the procurement policies, systems and processes in place at the CSIR and making recommendations on changes to the current systems and processes. The process is at an advanced stage, and is due to be completed during the 2005/6 financial year. Once the policy and strategy have been approved by the CSIR Executive and the Board, it will be communicated to all stakeholders.

Supporting challenges and opportunities emerging from government's 10-year review by focusing on high impact areas

#### CSIR support to small-scale mining sector

The past year has proved very successful for CSIR small-scale mining endeavours. Through concerted effort the CSIR has improved the level of

involvement and visibility in the sector and has provided assistance in various critical areas, (refer to the R&D highlights, page 47). Examples include:

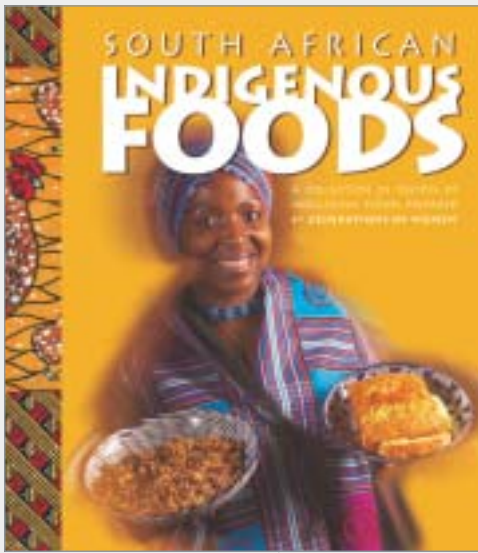
- Providing support to the DME's Small-scale Mining Directorate in evaluating applications for financial and technical assistance.
- Involvement in the African Mining Partnership (AMP) to provide support to five knowledge areas within the mining sector, in order to develop the sector in individual countries and on the continent.
- Technology transfer for poverty reduction in various priority sectors, one of which is small-scale mining.
- Support for aspirant small-scale miners for more meaningful involvement in the mining sector, critical capacity-building and advancing understanding of the mine value chain.

#### Crime prevention

During the course of 2004/5, the CSIR continued to support government in its effort to make South Africa a safer place by applying technological resources in social crime prevention and crime combating efforts. Partnerships with law enforcement agencies, government and other stakeholders are central to its effectiveness. CSIR projects focusing on crime prevention include:

- enhancement of cyber forensics capacity through the Cyber Security Science Centre
- development of crime scene management technologies
- assessment and demonstration of border control solutions





**Promoting and commercialising South African indigenous foods**



**Addressing the challenge of producing enough food from limited arable land**



**Dr Dave Walwyn, CSIR Group Research Manager**

- Development of vehicle identification and anti-corruption solutions.
- Support to criminal justice departments.
- Preventive approach to sustainable local safety using the Local Crime Prevention Toolkit.
- Drafting of a Victim Empowerment Policy for the Department of Social Development.
- Completion of a study for the Interdepartmental Management Team on Rape.
- Development of management templates in support of the Johannesburg Safety Strategy.
- Development of a curriculum for SAPS members dealing with young people in conflict with the law, in support of the Child Justice Bill.

**Food security chain**

Various projects relating to food security centred around reducing waste. It is estimated that up to 40% of agricultural produce in developing countries is wasted. Researchers at the CSIR worked with their counterparts in Europe and Africa to create high-quality shelf-stable fruit products and new edible, biodegradable fruit coatings to extend shelf-life. The CSIR also investigated the use of food-processing waste as an alternative ingredient in animal feed and developing new microwave technologies to eliminate pests in processing.

The CSIR employed genetic engineering in the domain of African cereals to address the challenge of producing enough food from a limited source of arable land. Work on

enhancing the nutritional quality of sorghum continues as well as on the enhancement of resistance to ear and stalk rot in elite varieties of maize.

During this year, the CSIR completed a project for the DST to promote and commercialise South African indigenous foods to help alleviate poverty, and started work on a mapping and information system with various partners to determine the degree of food insecurity and vulnerability in South Africa. The tool will also help determine trends in food insecurity, the influence of seasonality, and assess whether situations are improving or deteriorating.

**Goal 2:  
Consolidating excellence in science, engineering and technology (SET)**

The strengthening of the CSIR's SET core through improved processes for the allocation and management of the Parliamentary Grant has been completed successfully during the course of the 2004/5 financial year.

The major focus of activities within this goal has been the establishment of the Strategic Research Panel and the appointment of the CSIR Group Research Manager. Their combined activities have resulted in a number of changes in the organisation including:

- A more transparent and strategic process for the allocation of the Parliamentary Grant, particularly in respect of the performance-based block funding that is transferred directly to the line functions.



- The preparation of a draft S&T Strategy in order to guide the selection of desirable investment areas during the CSIR's annual planning cycle.
- The introduction of a competitive, theme-based funding mechanism that supports Type A research in the organisation.
- The establishment of Research Advisory Panels within 75% of the organisation to advise the line functions on proposal selection and investment strategy.
- The appointment of a Research Development Officer to assist in locating and securing funding streams to support Type A research in the CSIR.
- The formation of the Regional Expensive Equipment Forum in order to improve the utilisation of scientific equipment within regional institutions and to coordinate the procurement and funding of high-cost items.
- The finalisation of the Young Researchers Development Programme, which includes the development of a CSIR Innovation, Learning and Leadership Academy (CiLLA) training programme to address the needs of young researchers and the establishment of a dedicated fund to support young researchers in developing their own areas of expertise.
- The improvement of CSIR procedures for monitoring its research outputs, including the upgrading of the Technical Outputs

Database, which provides on-line information about the publications of the CSIR.

- The development of suitable output, outcome and impact measures in order to improve the monitoring of research productivity, in particular those portfolios funded through the Parliamentary Grant.
- The launch of the Strategic Innovation Management System (SIMS), which will facilitate the portfolio management of the Parliamentary Grant and the rapid extraction of data for surveys such as the annual R&D Survey.

### Goal 3: Enhanced professionalism in innovation and business excellence

Implementation of structures, processes and systems for effective strategic management of innovation and implementation of CSIR's growth strategy to increase relevance, impact and sustainability

#### Parliamentary Grant

The Parliamentary Grant allocated to the CSIR, the key investment resource of the CSIR for the 2004/5 financial year, amounted to R366,3 million (2004:R323 million) which represents an increase of 13.4%. The increase is

largely due to the incorporation of R18 million for 2004/5 allocated to the National Laser Centre (NLC). The NLC was incorporated into the CSIR in November 2003.

Suitable impact measures have been put in place to monitor productivity and results of the Parliamentary Grant.

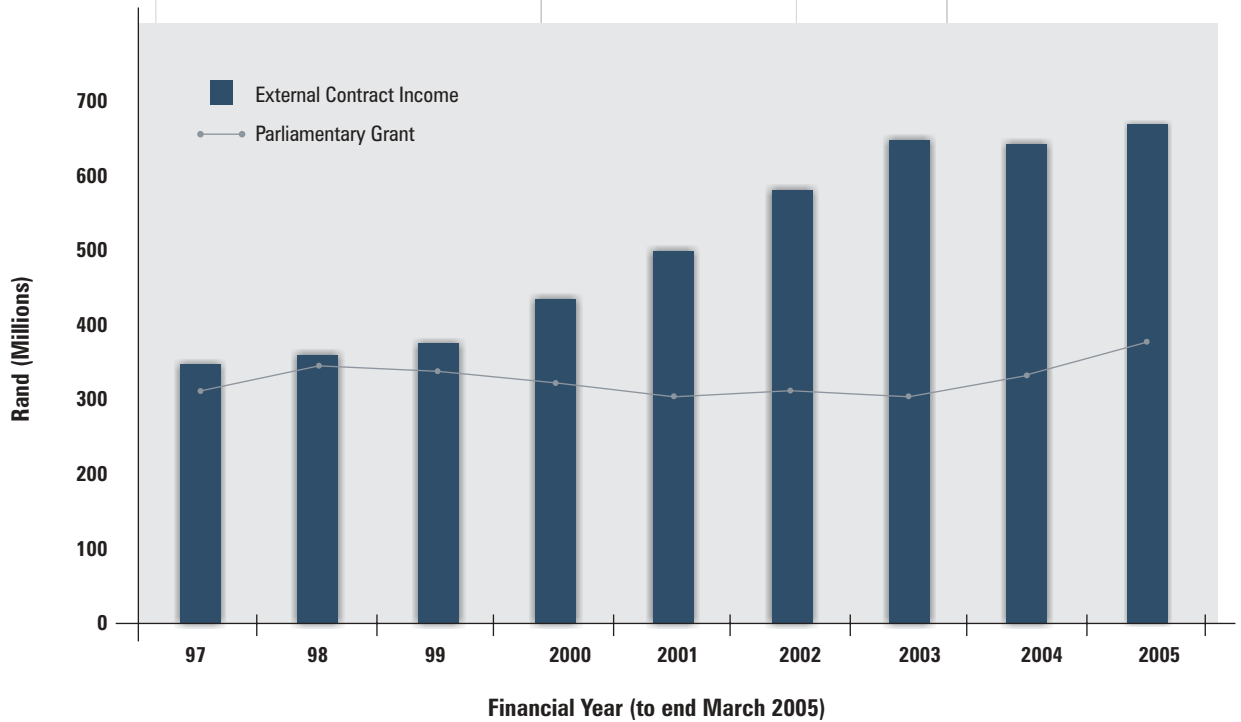
#### Financial performance overview

The external operating revenue of R639,8 million is 2.6% higher than the previous year. The year-on-year growth for the past four years since 2001 reflects a growth of 12.4%. The most significant year-on-year growth (17.2%) was achieved in the public sector. In addition, good growth has occurred in the national safety and security sector (9,2%) and the international sector (8,8%).

Achieving sustainable real growth in external income, at an acceptable level of margin, remains a critical requirement. A number of growth initiatives for improved market penetration and development in the private and public sectors, both locally and internationally, have been implemented through focused action plans.

The total operating revenue for the year of R1 004,2 million is 5.7% higher than the 2004 income. The Parliamentary Grant was 13.4% higher than in 2004 mainly due to the incorporation of the NLC into the CSIR. The results show a surplus of R76,3 million (2004: R40,7 million). R40,9 million (2004: R22,4 million) of the surplus is as a result of a decrease in the post-retirement medical benefit shortfall (see Note 20.4 to the financial statements). The net margin

### CSIR Parliamentary Grant and External Contract Income



excluding the post-retirement medical benefit gain amounts to R35,3 million.

Cash flow generated from operating activities for the year being reported on was R131,9 million (2004: R106,4 million). The cash and cash equivalent holdings increased to R295,4 million (2004: R208,7 million).

The CSIR's international income increased to R96,3 million in 2005 (2004: R80,5 million), or 19.5%. 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 was formulated to integrate and manage CSIR business interactions in Africa within the context of NEPAD.

#### Competitive funding mechanisms and integrated projects

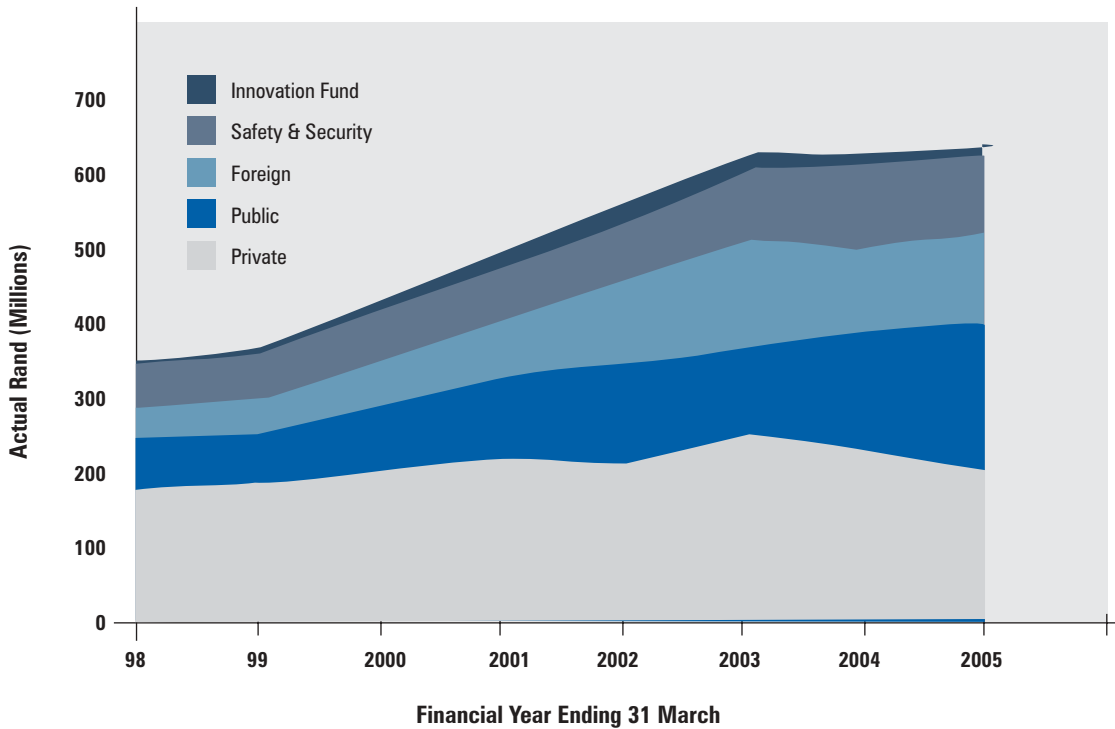
The CSIR networks extensively to optimise opportunities for growth through competitive funding mechanisms. These include the Innovation Fund and poverty alleviation projects introduced by the DST, a variety of funding schemes of the dti and others administered by the NRF, such as THRIP and the Indigenous Knowledge Systems Fund. During the year under review, the CSIR participated as a partner in 43 Innovation Fund projects.

The group revenue increased by R53,7 million (2004: decrease of R1,2 million) to R1 023,3 million (2004: R969,7 million) reflecting an increase of 5.5% (2004: decrease of less than 1%). The group revenue increased by R247,5 million since 31 March 2000. The group's net surplus, excluding the post-retirement benefit and the AC133 adjustment, increased by R23,5 million (2004: R2,5 million) to R37,0 million (2004: R13,5 million), reflecting a growth of 174% (2004: 22.6%).

The CSIR has progressed well with the implementation of an integrated enterprise resource planning (ERP) system that supports and links business intelligence, customer relationship, finance and human resource management. In addition, the development of a strategic investment management system culminated in the implementation of the first phase, which expands the portfolio management of the Parliamentary Grant already used at the CSIR and supported by technology management. The ERP system provides management information for the seamless integration of economic, sector, technology, customer, competence and human resources in support of innovation. The Customer Relationship Module was also effectively rolled out and implemented.

Reviews were conducted on the CSIR's bioscience competence, the Corporate Policy Group, the CSIR Sports Technology Centre as well as the CSIR Crime Prevention Centre. A strategic decision was made by the CSIR Executive to discontinue the activities of the Corporate Policy Group, while

### Sources of External Contract Income



the findings and recommendations of other reviews were included in the business plans of relevant units. These were used as input into the CSIR Beyond 60 process, a formal process launched in the past year to investigate future options for the organisation.

Development of CSIR's commercialisation activities to effectively manage intellectual property, creation of ventures and spin-offs and management of venture funds

The CSIR's intellectual property and commercialisation office provides a range of support services to the various units within the organisation. During the year under review this has included:

- seven invention disclosures
- the registration of 36 patents consisting of 21 provisional patents
- seven Patent Cooperation Treaty (PCT) applications and seven national patents

- advice and guidance on more than 130 projects where CSIR and UP inventions have been advanced in collaboration with the inventors.

Commercialisation and technology transfer activities in the past year are as follows:

- The CSIR sold the business component of Agrimage (Pty) Ltd, a start-up company based on CSIR-developed technology, to a company listed on the JSE.
- Proven CSIR technology to treat acid mine water was successfully licensed on a non-exclusive basis to South African mines as well as a large mining company in western Australia.
- The CSIR has developed a synthetic low-calorie sweetener from properties found in a wild shrub; the rights to develop and commercialise the sweetener have been licensed to a multinational company.

The revenues generated from the above-mentioned transactions are included in the CSIR group results.

Appropriate key account management, strategic positioning and increased communication and interaction with customers and stakeholders in response to growth strategy, and customer and stakeholder surveys

Considerable effort was put into strategic positioning and increased communication and interaction with customers and stakeholders during this reporting period. This took the form of an independent customer loyalty survey amongst a representative group of CSIR clients. A total of 275 interviews were conducted representing clients from all units. The majority (88%) are current clients of the CSIR and 94% have dealt with the CSIR within the past year. Action plans have been compiled to address the findings,



**Dr Colin Kenyon, Chair of the GRA Health Group**



**Participating in the development of natural resources**



**Building much needed capacity in water resource management**

and implementation plans will be monitored at regular intervals during the year.

Interactions with key stakeholders and partners were closely monitored, maintained and refined throughout the year. This included improving the management of the organisational plethora of memoranda of understanding with several key agencies. Significant improvements were also made to management of institutional cooperation agreements, which entailed capturing of organisational learning and successes, and organisation-wide processes and integration across CSIR unit activities.

**Customer satisfaction**

The Moment of Truth (MOT) customer feedback system, which measures on brief, on budget, on time and quality of deliverables, provides ongoing feedback on customer satisfaction. A target of 80% satisfaction was set for the organisation; in total 541 clients returned satisfaction forms and an overall satisfaction level of 84% was achieved.

**International and regional growth**

The year under review has brought several breakthroughs to the CSIR. Following extensive consultation and a workshop with senior representatives of the Technology Centre of Botswana (BOTECH) and the Scientific and Industrial Research and Development Centre (SIRDC) of Zimbabwe, the Regional Research Alliance came into being in October 2004. This Alliance will pool its resources to strengthen its impact on regional challenges in the

areas of water resources management, energy and infrastructure. This initiative sparked considerable interest in the three countries involved and presently enjoys strong support of all three respective governments.

The following developments have taken place in the international arena involving the CSIR:

- Appointment of the CSIR as lead agency in the activities of the Global Research Alliance (GRA) in the health domain, represented by Dr Colin Kenyon of the CSIR as Chair of the GRA Health Group.
- Involvement in the GRA study for the World Bank and the Global Environmental Facility (GEF), due for completion in 2005.
- Organisation of an international workshop on indigenous knowledge by the CSIR and various partners, featuring about 40 traditional healers and scientists from five continents, as well as representatives of international agencies.
- Agreements with Nokia Corporation and Volvo Aero Corporation on joint activities, with various collaborative ventures pending with several other corporations, including The Boeing Company.
- Contribution to the successful WAITRO Biennial Conference on Technologies for Sustainable Development in Nairobi, Kenya in September 2004.
- Contribution to two successful workshops on rapid prototyping held in Cairo and Bloemfontein.



### Collaboration with stakeholders in academia

SERA, the Southern Education and Research Alliance is an inclusive, strategic partnership between the CSIR and the UP to create a world-class consortium with significant infrastructure and competence. It has continued to strengthen the ability of both organisations to contribute to national priorities in science and technology. During the reporting period, cross-organisational and multidisciplinary task teams have been involved in various projects including:

- Establish infrastructure to support transport modelling.
- Build much-needed capacity in water resource management.
- Establish a maize and banana improvement biotechnology laboratory at the UP.
- Introduce stress protection of African crops together with various roleplayers.
- Harness local ICT research capabilities through digital@SERA.
- Find environmentally friendly packaging solutions for southern Africa's fruit and nut exports.
- Participate in the development of natural resources in the Giyani area.
- Combine plant propagation and cultivation technology research to address challenges in a variety of crops.

### Improving operational effectiveness

#### CSIR quality policy

The CSIR Quality Steering Committee continues to monitor operational activities to ensure that these meet the highest standards of quality and ensures that the implementation of quality systems is consistent and effective throughout the organisation.

Various milestones in this area were achieved in the past year:

- The CSIR web-based information tool (known as CSIR InfoWeb) was redesigned to make it more accessible and user-friendly.
- A protocol for the management of organisational policies and procedures was developed.
- A plan was introduced to ensure that quality principles form the basis of all CSIR corporate functions and operational support activities.
- With the emphasis on SET excellence, the CSIR ISO 17025 Forum was set up to ensure good laboratory practices throughout CSIR laboratories and to develop a coordinated plan for ISO 17025 laboratory accreditations.

The CSIR is firmly on the road to achieving the highest standards of quality and operational excellence in all its activities and continuously improves its processes for the benefit of its stakeholders and clients.

### Safety, occupational health and environmental management

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. Its commitment to provide a safe and healthy workplace is demonstrated by the CSIR's implementation of the OHSAS standard as a management system for Occupational Health and Safety during 2003.

Certification against this standard was obtained during March 2004. In 1997, the CSIR implemented the internationally recognised Environmental Management System, ISO 14001, which included the development, publication and adoption of an Environmental Policy for application throughout the organisation. In 2001, the CSIR obtained ISO 14001 certification for all sites and retained it during 2004, provisionally valid for the next three years.

#### Risk management

CSIR Risk Management is geared to ensuring that the CSIR is aware of its risks and adopts measures to reduce the impact on the organisation. A risk is anything that would prevent or hamper the CSIR in accomplishing its goals. More detail on this is given in the Corporate Governance section of this report on page 63.



**Dr Alex Weaver, Chairperson of the CSIR Sustainable Development Liaison Committee**



**S&T will play a critical role in the process of sustainable development**



**The growth of human capital at the CSIR is crucial for sustaining a strong skills base**

### Entrenching IT to support business processes

The primary achievement of the CSIR's internal IT initiatives was the migration at the end of October 2004 from a legacy assortment of purchased in-house developed financial applications to a portfolio of PeopleSoft packaged applications. This involved the deployment of the new PeopleSoft general ledger, billing, accounts receivable, contract management and project management modules.

These are in-house developments aligned with the PeopleSoft initiative to entrench IT within the CSIR. These support business processes and include the introduction of applications aimed at improving decision-making pertaining to those science and technology domains that merit further research investment, and the investigation of open source technologies to extend freedom of choice and reduce ICT application and licensing structures.

### Goal 4: Contributing to sustainable development

Implementation of CSIR's Sustainable Development Plan generated in consultation with stakeholders after WSSD, both in South Africa, and the broader region, through aligning and contributing to NEPAD

The CSIR mandate specifically recognises the fact that the organisation exists to support sustainable development. This recognition resonates with the National R&D Strategy for South Africa, which emphasises that S&T will play a critical role in the process of sustainable development.

A number of recent international policies such as the Millennium Development Goals, the Johannesburg Plan of Implementation (a product of the 2002 WSSD) and NEPAD have emphasised the need to convert sustainable development rhetoric into action. With this in mind, the CSIR 2008 Strategy was amended to raise sustainable development as an overarching ethos or framework for the organisation. The CSIR business plan states the organisation's intention to move forward in supporting sustainable development more proactively and includes a number of objectives to achieve this goal.

The CSIR Sustainable Development Liaison Committee (CSDLIC), led by Dr Alex Weaver of CSIR Water, Environment and Forestry Technology, was formed at the request of the CSIR Board and leadership team. The core mandate of the CSDLIC is to ensure that sustainable development becomes a priority in the CSIR's daily functioning. This Committee, with time, should grow into a community of practice and develop into the key agent for the infusion of the ethos of sustainable development into the CSIR.

The CSDLIC has embarked on a project to develop sustainability indicators for an R&D environment. The aim of this project is to determine the best way to

measure the contribution of an R&D organisation, such as the CSIR, to sustainable development in Africa. This will be crucial in future in terms of determining whether the CSIR is actually making a contribution to development in Africa. Phase 1 of the project will be completed by the end of the next financial year.

Implementation of programmes to empower disadvantaged groups through appropriate technology-driven, sustainable, socio-economic development

The CSIR's contribution to rural development, urban renewal, poverty alleviation, food security, SMMEs, community development, indigenous knowledge systems and small-scale mining is outlined in Goal 1 (refer to pages 74 to 78). Sustainable socio-economic development is a key aspect embedded in all projects undertaken to ensure long-term viability and a sustained impact on quality of life and economic development.

## Goal 5: Assessing and developing the best minds

Profile of CSIR staff and report on progress with transformation, particularly the targets achieved on recruitment of women, blacks and disabled people

### Encouraging progress in transformation

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.

The total staff complement of the CSIR as at 31 March 2005 was 2 379, of which 45.8% were black people. In March 2004, the staff numbers amounted to 2 431, reflecting a decrease in staff of 52, while the percentage of black staff amounted to 44.1%. This represents an increase of 1.7% in black staff, which meets the March 2005 target of 44.7%. Refer to the CSIR SoST report on page 56 of this Annual Report for supporting figures pertaining to transformation at the organisation.

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 the increase in numbers in total black staff and black professionals. See the CSIR SoST report on page 56 for a qualifications breakdown.

Implementation of actions arising from employee satisfaction monitor

The last employee satisfaction survey was undertaken in 2003 and produced

a result of 68.6% in relation to a target of 75%, as reported in the CSIR Annual Report of 2003/4. Areas of satisfaction were management and communication, while personal and professional development, performance and reward, policies and practices remained at the same level. In an effort to address these issues, a substantial amount of attention and energy has been invested in the Economic Value Added (EVA) initiative in relation to performance and reward; many of the policies and practices have been streamlined and, with regard to professional development, the focus in the past financial year has been on the development of young researchers.

As part of the efforts to understand the outcomes of the 2003 survey and address the issues that require improvement, a culture survey will be undertaken in the new financial year, which will be linked to the 2005/6 staff satisfaction measurement.

Continued implementation of performance management, career development, reward/recognition in line with CSIR's strategic plan

The CSIR aligns its internal financial measures with stakeholder value through Value-based Performance Measure. This measure combines the concept of economic performance and non-financial performance using key result areas (KRA). It ensures that the CSIR is sustainable and the KRA measure ensures delivery on the CSIR mandate.

Value-based Performance Management seeks to reward good and exceptional performance in line with the CSIR mandate, strategy and objectives; to measure and reward individuals transparently and objectively; and to manage continuous improvement. The past financial year was the first year of performance linked to the Value-based Performance Measure, thus outcomes will be evident only in the year to come.

An internal drive investigating future options for the CSIR has highlighted more appropriate measures to motivate the pool of human talent in the organisation, including reward and recognition and appropriate career development plans, which should be put in place in the coming year.

Attraction, retention and development of key staff, including a focus on young scientists, mentorship, bursary schemes, succession planning, training and development with CiLLA's support

### Training and development

CiLLA continued to provide knowledge sharing and learning platforms that are designed and presented to equip staff with the knowledge, attitude and skills for success in the context of the CSIR mandate. Training programmes for the development of staff included:

- 35 regular events presented by over 50 internal and external associates.
- The capture of knowledge, insights and experiences of teams

- and individuals in video interviews.
- Initiation of a process to investigate accreditation of a national level qualification in research and innovation management.
- Establishment of a range of learning and development initiatives for scientists, including the development of a Young Researcher Development Programme.

Since 1999, a total of 3 661 course registrations have been processed with the past year totaling 724, which is significantly above the average of 611 attendees per year. This excludes workshops, customised learning interventions, strategy sessions and task team activities.

With the successful introduction of mentorship programmes in 2003, a total of 179 mentors and mentees have joined the programme. The demographic profile to date is as follows:

Categories	White male	White female	Black male	Black female
Mentors	19	27	8	8
Mentees	22	22	32	41
<b>Total = 179</b>	<b>41</b>	<b>49</b>	<b>40</b>	<b>49</b>

### Bursary schemes

The focus of the CSIR bursary scheme remains the attraction and retention of skills required by a knowledge intensive technology organisation in a global context, particularly in those areas where a scarcity of human capacity is evident. Thus, the organisation continues to pursue the

development of strategic alliances with tertiary academic institutions in order to increase and strengthen its scientific base through access to the best minds in the country. Coupled to this requirement is the emerging challenge of creating an appropriate learning and sharing culture.

### CSIR response to HIV/AIDS

The CSIR HIV/AIDS programme, now in its second year, has a budget committed towards raising awareness of the pandemic within the organisation.

The CSIR HIV/AIDS policy has been adopted throughout the organisation and a committee has been established with HR representatives from throughout the organisation responsible for raising awareness, providing information and communicating all HIV-related issues. Employees are encouraged to undergo voluntary counselling and testing.

Various measures are available to provide the necessary support to

people living with HIV/ AIDS, such as the confidential Employee Assistance Programme while the HIV/AIDS benefits on the CSIR Medical Scheme are highlighted by the committee representatives. The HIV committee representatives also provide assistance to employees who are not on medical aid.

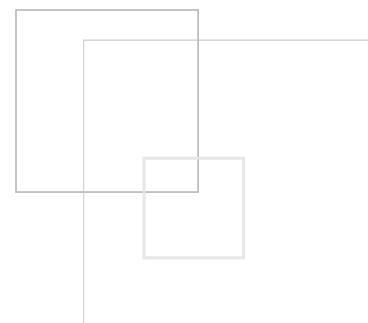


# Performance against goals

Goal	DST KPI	Key Performance Indicators	Target	Performance Results
<b>Goal 1</b>  <b>Alignment with government initiatives</b>	Stakeholder perspective	Supporting the National R&D Strategy through technology missions		
		Implement action plan in sector and technology areas of AMTS	Automotive sector	Launch of robotics and mechatronics laboratory for Gauteng auto industry
			Textile sector	Identification of human resource capacity and capability needs
			Chemical sector	Identification of needs with chemical sector summit task team
		Participation in BRIC projects	Continued participation in six existing and one new project	New project: citrus pectin production plant (east coast Region) through the EcoBio Regional Innovation Centre
		Novel products/processes arising from participation in BRIC projects	Develop four products/processes	Achieved <ul style="list-style-type: none"> <li>■ Natural food flavourants from microbial sources</li> <li>■ Aloe product for cosmetics industry</li> <li>■ Converted food process waste in animal feeds</li> <li>■ Enhancement of water quality for fish health</li> </ul>
		Active support of national ICT-related activities	National ICT Roadmap coordination	Achieved
			Progress on implementation of Meraka Institute	Significant progress to achieve launch in May 2005
		Private sector	Increased strategic interactions with private sector	Development of cluster and industry sector approach  Invited lectures from industry leaders
		Poverty alleviation	Support poverty alleviation mission through projects	60 projects implemented in all nine provinces  Direct impact on more than 1 200 people

Goal	DST KPI	Key Performance Indicators	Target	Performance Results
<b>Supporting the dti's initiatives in the manufacturing sector</b>				
		Support IMS through SCM, logistics and ICT	Provide inputs and information to national activities:	Development of national freight logistics strategy  Undertake first State of Logistics Survey
		CSIR/dti institutional framework for cooperation	Effective management and increased cooperation	Three additional strategic line items successfully established: logistics, geographic spread and aerospace
<b>Supporting BEE initiatives</b>				
		Support charter for mining industry	Develop guidelines and policies to support charter in coal and small-scale mining	Achieved
		CSIR BEE policy and strategy development	Evaluate CSIR's procurement policies, processes and systems	Recommendations being finalised
<b>Supporting government's challenges by focusing on high-impact areas</b>				
		Contribute to high-impact areas	Significant progress in mining, food security and crime prevention	Involvement in policy development; projects and products; and creation of Cyber Security Science Centre

Goal	DST KPI	Key Performance Indicators	Target	Performance Results
<b>Goal 2</b>  <b>Consolidating SET excellence</b>	Learning and growth perspective	Improve allocation of Parliamentary Grant	Establish SRP to improve allocation and management of the Parliamentary Grant	Panel makes recommendations to Executive
		Establish Research Advisory Panels (RAPS)	RAPs established in 75% of line functions within the R&D core	Good progress; RAPS will also issue portfolio audits to SRP
		Establish young researchers programme	Scope for programme defined; consists of CiLLA training and establishment funds	Completed; programme will be launched in 2005/6
		Undertake impact assessments of scientific quality, HR development and outcomes	Impact assessment metrics defined; data yet to be collected	Under development; SoST report partially addresses this area
		Develop CSIR-wide research strategy and plan	Draft CSIR S&T strategy developed	Incomplete (pending outcome of Beyond 60 process)
		Identify and implement technology themes	Themes defined and funded	Complete (five themes, funded through thematic programme)
		Implement structures and processes for SET excellence	Revise KPIs and performance metrics for R&D core	Incomplete; part of Beyond 60 process



Goal	DST KPI	Key Performance Indicators	Target	Performance Results
<b>Goal 3</b>  <b>Enhanced professionalism in innovation and business excellence</b>	Financial and investment perspective	Implementation of structures, processes and systems for the effective strategic management of innovation and the implementation of the CSIR's growth strategy to increase relevance, impact and sustainability		
		Implement structures, processes and systems to support management of innovation in:	Provide relevant support systems to increase business effectiveness	Business development forum active; Technology Management Forum converted to S&T Technology Management Forum and running effectively; Marketing and business systems effectively providing access to competitive funding streams, key stakeholder management and marketing information
		- Marketing		
		- Business development		
		- Technology management		
		- Business intelligence		
		Total income	12%	5.7%
		Net margin (R)	R44,3 m	R35,3 m
		Net margin (% ext income)	6.7%	5%
		Ratio of external: total revenue	65.8%	64.4%
Revenue from IP (royalties, etc)	R7 m	R7,2 m		
Improved investment of Parliamentary Grant	7%	13.4% (due to NLC)		
<b>Effective management of intellectual property, new ventures and venture funds, and spin-offs</b>				
		Eight invention disclosures	Seven inventions disclosures	
		47 patent registrations (provisional and final)	35 patent registrations 21 provisional Seven PCT applications Seven international	
<b>Key account management</b>				
	Increase interaction with customers and stakeholders	Effective organisational management with identified key institutions	Reviewed and achieved	
	Partnerships with TEIs	Develop three new relationships	Achieved	
		Maintain existing relationships	Achieved	
	Other key stakeholders	Develop appropriate research alliances	Excellent progress achieved; Reviewed key relationships and improved stakeholder management processes considerably	



Goal	DST KPI	Key Performance Indicators	Target	Performance Results
		GRA		Excellent progress with regard to GRA and formation of Regional Research Alliance
		Increase international collaboration	Develop meaningful relationships with multi-national corporations (MNCs)	Excellent progress with the development of research relationships with various MNCs in aerospace and ICT domains
			Develop appropriate relationships with international research institutions	Concluded cooperation agreements with several institutions of international repute, such as Battelle, USA
		Customer satisfaction	80%	84%
<b>Operational effectiveness</b>				
			Effective management of systems and processes	Reviewed, improved and achieved
		CSIR Quality Policy	Operationalise policy	Achieved
		SHE audit	Retain OHSAS certification	Retained
		Disability injury frequency rate	<1	Achieved
		ISO 14001	Retain certification	Retained
		Risk management plan	Ongoing management of all known risks as contained in Risk Management Plan	Accomplishment of organisational goals through controls/measures that mitigate these risks
		Peer reviews	Performance at least comparable to industry and international norms	Reviews of Sports Technology Centre, Crime Prevention Centre, biosciences area, Policy Development group completed and all recommendations will be implemented as appropriate
		IT for business processes	Migration from portfolio of legacy systems to PeopleSoft suite	Achieved

Goal	DST KPI	Key Performance Indicators	Target	Performance Results
<b>Goal 4</b> <b>Contributing to sustainable development</b>	Stakeholder perspective	Implementation of CSIR Sustainable Development Plan	Develop sustainability indicators for CSIR	Phase 1 completed
		Implementation of sustainable programmes to empower disadvantaged	Participation in programmes for sustainable socio-economic development	Projects implemented in fields of rural development, urban renewal, poverty alleviation, food security, IKS and small-scale mining
<b>Goal 5</b> <b>Accessing and developing the best minds</b>	Stakeholder perspective	Staff satisfaction (%)	75%	68.6%
		Staff diversity		2 379
		Total staff complement	2 512	(133 employees short of target)
		Professional staff (% of total staff)	52.7%	52.8% (2004/5 target was met)
		Black professional staff (% of total professional staff)	35.2%	33.5%
		Female professional staff (% of total professional staff)	35.8%	34.4%
		Total black staff (% of total)	44.7%	45.8% (2004/5 target was met)
		Total female staff (% of total)	40.8%	40.6%
		Disabled employees	-	15
		Bursaries and internships		100% (employee bursars) 73.1% (non-employee bursars)
		Black bursars (% of total) Female bursars (% of total)	80% 50%	0% (employee bursars), 38.5% (non-employee bursars)
		Interns (% of total)	80% black people, 50% female	87.5% black people, 55.7% female (2004/5 target was met)
		Staff training		Develop programme for young researchers
HIV/AIDS		Establish CSIR HIV/AIDS committee	Achieved	

## Acquisitions and disposals

There were no business acquisitions within the CSIR during the 2004/5 financial year. The CSIR disposed of its interest in the Snowden Mining Industry Consultant joint venture in December 2004.

## 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. The aggregated surplus of the subsidiaries, before dividends paid, amounted to R7,8 million (2004: R1,2 million).

## Post Balance Sheet events

No material facts or circumstances have arisen between the dates of the balance sheet and this report, which affect the financial position of the organisation, as reflected in these financial statements.

## Board approval

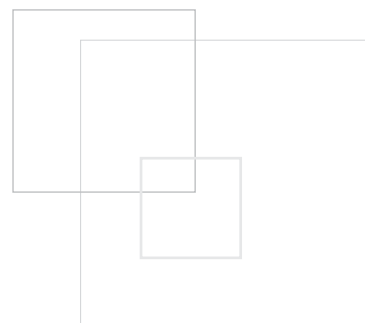
The annual financial statements of the CSIR for the year ended 31 March 2005, as set out in this report, have been approved by the CSIR Board at its meeting on 22 June 2005. The Board is of the opinion that the CSIR is financially sound and operates a going concern.



**Roger Jardine**  
Chairperson of the CSIR Board



**Dr Sibusiso Sibisi**  
CSIR President and CEO



# Five-year Financial Review

31 March 2005

	2005 R'000	2004 R'000	2003 R'000	2002 R'000	2001 R'000
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## FINANCIAL INDICATORS

### BALANCE SHEET

Total reserves	384 491	342 709	326 472	308 986	376 253
Long-term liabilities	-	-	-	-	4 000
Total assets	754 390	650 334	576 479	551 001	550 853
Net assets	384 491	340 889	326 472	310 360	322 429

### INCOME AND EXPENSE INDICATORS

Parliamentary Grant recognised as income	356 992	321 996	295 429	296 883	296 332
External operating revenue including royalties and other income	647 188	627 714	642 590	580 113	495 056
Expenditure	987 348	948 481	934 368	899 661	798 752
Investment income	25 752	15 008	13 835	14 778	12 753
Net surplus/(deficit)	42 584	16 237	17 486	(7 887)	5 389

### CASH FLOW

Net cash from operating activities	129 575	110 937	70 278	18 937	84 227
Net cash used in investing activities	(45 229)	(33 944)	(42 358)	(15 114)	(56 632)
Net cash used in financing activities	-	-	(1 374)	(4 182)	(3 444)
Cash and cash equivalents at beginning of year	182 705	105 712	79 166	79 525	55 374
Cash and cash equivalents at end of year	267 050	182 705	105 712	79 166	79 525

### RATIO ANALYSIS

#### Asset management

Net asset turn	2.7	2.8	2.9	2.9	2.5
Return on net assets	11.1%	4.8%	5.4%	(2.5%)	1.7%
Current ratio	1.2	1.2	1.3	1.3	1.2

#### Performance

Total revenue (excl. investment income) per employee	422.1	390.7	381.6	343.8	312.3
Total external operating revenue per employee	272.0	258.2	261.4	227.4	195.4
Total revenue (excl. investment income) per R1 operating expenditure	2.6	2.5	2.2	2.1	2.3
Remuneration as a % of total expenditure	56.5%	55.6%	51.7%	49.2%	51.7%
Net cash generated from operating activities per employee	54.5	45.6	28.6	33.2	19.6
Independence ratio	65.3%	66.6%	69.0%	66.7%	63.1%
Number of employees	2 379	2 431	2 458	2 551	2 534

### DEFINITIONS

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

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

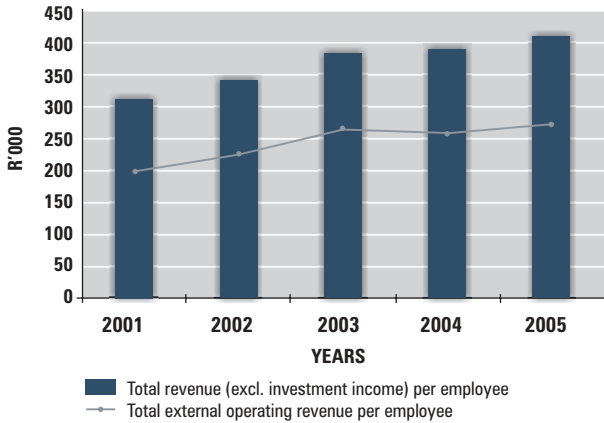
Current ratio - Current assets divided by current liabilities

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, effects of the adoption of SA GAAP, AC133: Financial instruments - recognition and measurement and cash balances relating to specific projects where the CSIR only acts as an agent have been excluded for comparison of financial indicators.

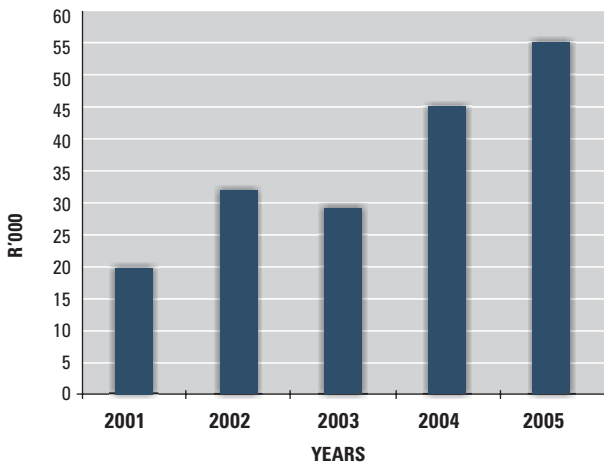


**REVENUE PER CAPITA**



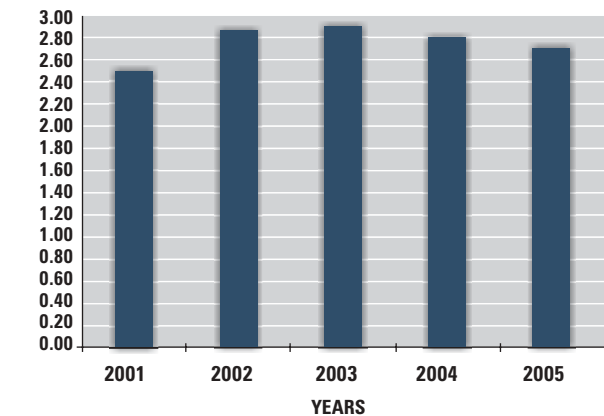
The improvement in revenue per employee is due to the increase in external income and Parliamentary Grant as well as the decrease in number of employees.

**NET CASH GENERATED FROM OPERATING ACTIVITIES PER EMPLOYEE**



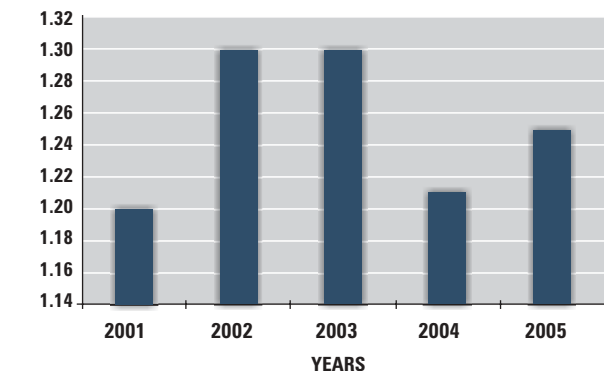
The net cash generated per employee increased due to the increase in advances received and increase in trade and other payables.

**NET ASSET TURN**



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

**CURRENT RATIO**



The increase in the current ratio is due to the increase in cash and contracts in progress.

# Income Statements

## for the year ended 31 March 2005

	Notes	GROUP		CSIR	
		2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>Revenue</b>	2	<b>1 023 391</b>	969 693	<b>1 003 969</b>	949 708
Other income		<b>2 034</b>	3 610	<b>211</b>	2
Profit on disposal of property, plant and equipment		<b>22</b>	48	-	-
Profit on disposal of interest in subsidiary	29	-	5	-	-
<b>Total operating revenue</b>		<b>1 025 447</b>	973 356	<b>1 004 180</b>	949 710
<b>Expenditure</b>					
Employees' remuneration		<b>567 621</b>	539 741	<b>557 593</b>	527 722
Depreciation and amortisation	6 & 7	<b>42 272</b>	37 788	<b>41 163</b>	36 068
Operating expenses		<b>385 298</b>	391 996	<b>388 161</b>	382 457
Loss on disposal of property, plant and equipment		<b>523</b>	2 242	<b>431</b>	2 234
Loss on disposal of interest in joint ventures and associates		<b>1 704</b>	-	-	-
Loss on disposal and deregistration of interest in subsidiaries	29 & 30	-	1 772	-	-
<b>Total expenditure</b>		<b>997 418</b>	973 539	<b>987 348</b>	948 481
<b>Net operating surplus/(deficit)</b>	3	<b>28 029</b>	(183)	<b>16 832</b>	1 229
Distribution from NLC Trust	28	-	999	-	999
Post-retirement medical benefits	20.4	<b>40 917</b>	22 423	<b>40 917</b>	22 423
Net income from investments	4	<b>7 423</b>	15 659	<b>18 502</b>	16 026
Net post acquisition income/(deficit) of joint ventures and associates		<b>1 086</b>	(799)	-	-
<b>Net operating surplus for the year before taxation</b>		<b>77 455</b>	38 099	<b>76 251</b>	40 677
Income tax expense	5	<b>(3)</b>	(155)	-	-
Minority interest	13	<b>805</b>	-	-	-
<b>Net surplus for the year</b>		<b>78 257</b>	37 944	<b>76 251</b>	40 677

# Balance Sheets

## 31 March 2005

	Notes	GROUP		CSIR	
		2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>ASSETS</b>					
<b>Non-current assets</b>					
Property, plant and equipment	6	258 845	258 034	274 222	270 740
Intangible assets	7	2 986	3 140	225 604	215 179
Interest in joint ventures and associates	8	20 825	19 145	-	-
Interest in subsidiaries	9	-	-	15 000	1
Investments	10	9 070	20 005	24 553	35 560
				9 065	20 000
<b>Current assets</b>					
Trade and other receivables	11	512 870	413 652	501 283	406 644
Inventory and contracts in progress	12	143 157	149 512	140 518	148 056
Bank balances and cash	27	65 504	50 032	65 348	49 851
		304 209	214 108	295 417	208 737
<b>TOTAL ASSETS</b>		<b>771 715</b>	<b>671 686</b>	<b>775 505</b>	<b>677 384</b>
<b>EQUITY AND LIABILITIES</b>					
<b>Reserves</b>					
Accumulated funds		262 385	183 132	269 934	193 683
Self insurance reserve		250 071	171 814	259 184	182 933
Non-distributable reserve: Foreign currency translation reserve		10 750	10 750	10 750	10 750
		1 564	568	-	-
<b>Minority interest</b>	13	<b>3</b>	<b>843</b>	<b>-</b>	<b>-</b>
<b>Non-current liabilities</b>					
Long-term liabilities	14	107 331	148 257	107 307	148 224
Post-retirement benefit obligation	20.4	-	-	-	-
Deferred tax liabilities	15	107 307	148 224	107 307	148 224
		24	33	-	-
<b>Current liabilities</b>					
Advances received	16	401 996	339 454	398 264	335 477
Trade and other payables	17	114 160	90 522	114 160	90 522
Tax liabilities		214 984	177 691	211 347	173 937
Provisions	18	-	-	-	-
		72 852	71 241	72 757	71 018
<b>TOTAL EQUITY AND LIABILITIES</b>		<b>771 715</b>	<b>671 686</b>	<b>775 505</b>	<b>677 384</b>

# Statements of Changes in Equity

## for the year ended 31 March 2005

	Accumulated funds R'000	Self insurance reserve R'000	Non-distributable reserve R'000	Total R'000
<b>GROUP</b>				
<b>Balance at 31 March 2003</b>	136 689	10 750	460	147 899
Opening balance adjustment: AC133 adoption	(2 819)	-	-	(2 819)
Net surplus for the year	37 944	-	-	37 944
Exchange differences arising on translations of overseas operations	-	-	108	108
<b>Balance at 31 March 2004</b>	<b>171 814</b>	<b>10 750</b>	<b>568</b>	<b>183 132</b>
Net surplus for the year	78 257	-	-	78 257
Exchange differences arising on translations of overseas operations	-	-	996	996
<b>Balance at 31 March 2005</b>	<b>250 071</b>	<b>10 750</b>	<b>1 564</b>	<b>262 385</b>
<b>CSIR</b>				
<b>Balance at 31 March 2003</b>	145 075	10 750	-	155 825
Opening balance adjustment: AC133 adoption	(2 819)	-	-	(2 819)
Net surplus for the year	40 677	-	-	40 677
<b>Balance at 31 March 2004</b>	<b>182 933</b>	<b>10 750</b>	<b>-</b>	<b>193 683</b>
Net surplus for the year	76 251	-	-	76 251
<b>Balance at 31 March 2005</b>	<b>259 184</b>	<b>10 750</b>	<b>-</b>	<b>269 934</b>



# Cash Flow Statements

## for the year ended 31 March 2005

	Notes	GROUP		CSIR	
		2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>Operating activities</b>					
Cash receipts from external customers		669 327	650 037	650 503	619 692
Parliamentary Grant received		366 326	323 014	366 326	323 014
Cash paid to suppliers and employees		(925 938)	(870 548)	(910 672)	(851 320)
<b>Cash generated by operations</b>	26	<b>109 715</b>	102 503	<b>106 157</b>	91 386
Net investment income received	4	14 673	14 641	25 752	15 008
Income taxes paid		(12)	(519)	-	-
<b>Net cash from operating activities</b>		<b>124 376</b>	116 625	<b>131 909</b>	106 394
<b>Investing activities</b>					
Property, plant and equipment acquired		(54 056)	(42 559)	(53 868)	(42 080)
Proceeds on disposal of property, plant and equipment		1 896	2 352	1 849	892
Decrease in net interest in subsidiaries		-	-	6 000	6 756
Proceeds on disposal of interest in joint ventures		16 912	-	-	-
Distribution from NLC Trust	28	-	5 618	-	5 618
Deregistration of subsidiary	30	-	(5)	-	-
Disposal of interest in subsidiaries	29	-	(255)	-	-
(Increase)/decrease in interest in joint ventures and associates		(19 210)	(2 020)	(19 210)	4 870
Decrease/(increase) in investments		20 000	(10 000)	20 000	(10 000)
Net acquisition of long-term patents		(674)	(520)	-	-
<b>Net cash used in investing activities</b>		<b>(35 132)</b>	(47 389)	<b>(45 229)</b>	(33 944)
<b>Financing activities</b>					
Decrease in long-term liabilities		(98)	(35)	-	-
Decrease in minority interest		(35)	(40)	-	-
<b>Net cash used in financing activities</b>		<b>(133)</b>	(75)	-	-
<b>NET INCREASE IN CASH AND CASH EQUIVALENTS</b>		<b>89 111</b>	69 161	<b>86 680</b>	72 450
<b>Cash and cash equivalents at beginning of the year</b>					
Bank balances and cash		214 108	144 828	208 737	136 287
Effect of foreign exchange rate changes		990	119	-	-
<b>CASH AND CASH EQUIVALENTS AT END OF THE YEAR</b>					
Bank balances and cash	27	304 209	214 108	295 417	208 737

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 1. PRINCIPAL ACCOUNTING POLICIES

The annual financial statements are prepared on the historical cost basis except for certain financial instruments stated at fair value or amortised cost, in accordance with South African Statements of Generally Accepted Accounting Practice (SA GAAP) and incorporated the following principal accounting policies, which have been consistently applied in all material respects.

The financial statements are expressed in South African rands (R).

The following are approximate values in rands at 31 March for selected currencies:

	2005	2004
Pound sterling	11.86	11.60
US dollar	6.31	6.35
Australian dollar	4.86	4.79
Canadian dollar	5.19	4.86

#### Basis of consolidation

The consolidated annual financial statements incorporate the annual financial statements of the CSIR and entities under its control. 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 transactions and balances between group entities have been eliminated on consolidation.

Premiums arising on the acquisition of subsidiaries and any excess of net assets of a subsidiary over the cost of a acquisition are 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 results, assets and liabilities of associates are incorporated in the consolidated financial statements using the equity method of accounting from their most recently audited financial statements or unaudited management information as at financial year end. The carrying amount of such interests is reduced to recognise any decline, other than a temporary decline, in the value of individual investments.

Where a group enterprise transacts with an associate company, unrealised profits 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.

Premiums arising on the acquisition of associates and any excess of net assets of an associate over the cost of a acquisition are 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 that is subject to joint control.

Interests in jointly-controlled entities are accounted for by means of the equity method from their most recently audited financial statements or unaudited management information as at financial year end. The carrying amount of such interests is reduced to recognise any decline, other than a temporary decline, in the value of individual investments.

Where a group enterprise transacts with a joint venture, unrealised profits 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.

Premiums arising on the acquisition of joint ventures and any excess of net assets of a joint venture over the cost of an acquisition are treated in terms of the group's accounting policy on goodwill.

#### Research and development

Research costs are charged against income 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.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 1. PRINCIPAL ACCOUNTING POLICIES (continued)

#### Foreign currencies

#### Foreign entities

All foreign subsidiaries of the CSIR are classified as foreign entities.

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

- Assets and liabilities at rates of exchange ruling at the reporting entities' financial year end;
- Income, 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; 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.

#### Property, plant and equipment

#### Land and buildings

Land is stated at cost and buildings are stated at cost less accumulated depreciation.

#### Plant, equipment and vehicles

Plant, equipment and vehicles are stated at cost less accumulated depreciation.

#### Leasing

Leases are classified as finance leases whenever the terms of the lease transfer substantially all the risks and rewards of ownership to the lessee. All other leases are classified as operating leases.

Assets acquired under finance lease agreements are capitalised at their cash cost equivalent and a corresponding liability is raised. Lease payments are allocated between the lease finance cost and the capital repayment using the effective interest rate method. 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.

#### Depreciation

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

- Assets costing R5 000 or less, which are written-off in the year of acquisition;
- 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 book 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 income.

#### Intangible assets

#### Investment in technology

Investment in technology licensing projects and dividend producing rights is capitalised at cost and amortised over their expected useful lives or written-off based on their viability, whichever is the shorter. Investment in technology with indefinite useful lives is tested annually for impairment.

#### 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*). Capitalised development cost with indefinite useful lives is tested annually for impairment.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 1. PRINCIPAL ACCOUNTING POLICIES (continued)

#### Intangible assets (continued)

##### 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).

Goodwill arising on 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 on a subsidiary is presented separately in the balance sheet and tested for impairment. On disposal of a subsidiary, joint venture or associated company, the attributable amount of impaired goodwill is included in determination of the profit or loss on disposal.

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

##### Amortisation

Amortisation is based on cost and calculated on the straight-line method at rates considered appropriate to write-off book values over the estimated useful lives of the intangible assets with definite useful lives.

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

##### Impairment

The recorded value of assets is periodically compared to the anticipated recoverable amount if the assets were to be sold. Where an asset's recorded value has declined below the recoverable amount, and the decline is expected to be of a permanent nature, the decline is recognised as an expense. To determine the recoverable amount, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects current market assessment of the time value of money and the risks specific to the asset.

##### Retirement benefits

###### Pension fund

The CSIR 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 CSIR's contribution to the plan are charged to the income statement when incurred.

###### Post-retirement benefits other than pensions

The CSIR 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 CSIR.

Actuarial gains and losses are recognised in full in the income statement in the year when actuarially determined and not only if it exceeds 10% of the greater of the present value of the post-retirement medical obligation and the fair value of the plan assets as reported in prior years. The amount recognised in the balance sheet represents the present value of the post-retirement medical aid contribution as adjusted for unrecognised actuarial gains and losses and reduced by the fair value of the plan assets. Any asset resulting from this calculation is limited to unrecognised 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 at net realisable value. Net realisable value is calculated 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. The percentage of sales value of work completed is often based on estimates by management.



# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 1. PRINCIPAL ACCOUNTING POLICIES (continued)

#### Taxation

The charge for taxation is based on the results for the year as adjusted for items that are non-assessable or disallowed. It is calculated using tax rates that have been 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 amount 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 income 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, or a business combination that is an acquisition. 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 recorded as income when it becomes receivable and is then recognised as income on a systematic basis over periods necessary to match the assistance with the related costs it is intended to compensate. Revenue recognised for projects started before year end but not completed is based on estimates by management.

#### Revenue recognition

Revenue comprises:

- The net invoiced value of research, development and implementation contracts, excluding Value Added Tax;
- Income acknowledged on contracts in progress recognised as detailed above;
- The annual Parliamentary Grant adjusted for the grant received for projects started before year end but not completed as detailed above;
- Royalties are accrued based on the stipulations of the applicable contracts;
- Interest income is accrued on a time basis, by reference to the principle outstanding and at the interest rate applicable;
- Dividend income from investments is recognised when the shareholders' rights to receive payment have been established.

#### Borrowing costs

Borrowing costs are charged against income as and when incurred.

#### Financial instruments

Financial instruments are initially measured at cost 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.

#### Financial assets

##### Trade and other receivables

Trade receivables are stated at cost as reduced by appropriate allowances for estimated irrecoverable amounts, which approximate their fair value due to the short-term nature thereof.

After initial recognition other receivables are measured at their fair values. The following categories of other receivables 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:

- Receivables originated by the group and not held for trading;
- Financial assets that do not have a quoted market price in an active market and where the fair value cannot be measured reliably.

##### Contracts in progress

Contracts in progress are stated at net realisable value.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 1. PRINCIPAL ACCOUNTING POLICIES (continued)

#### Financial instruments (continued)

##### Financial assets (continued)

##### *Investments and loans*

Investments, other than in associates or joint ventures, are stated at cost less any provisions for diminution in 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.

After initial recognition investments and loans are measured at their fair values, adjusted for any deduction for transaction costs that may be incurred on sale or other disposal. The following categories of investments and 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:

- Loans receivable originated by the group and not held for trading;
- Held to maturity investments;
- Investment in financial assets that do not have a quoted market price in an active market and where the fair value cannot be measured reliably.

##### *Bank balances and cash*

Cash on hand is stated at face value, which is its fair value. Deposits held on call are stated at amortised cost, which approximates its fair value due to the short-term nature thereof.

##### *Forward exchange contracts*

Gains and losses from forward exchange contracts are dealt with in the income statement. Unrealised gains and losses arising on fair valuing currency forward for identified expenses are charged to income and the resultant foreign exchange asset or liability recognised in the balance sheet. Fair values of financial instruments are disclosed in the financial statements.

##### Financial liabilities and equity instruments

##### *Trade and other payables and advances received*

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

##### *Equity instruments*

Equity instruments are recorded at the proceeds received, net of direct issue costs.

##### Fair value adjustments

Gains and losses arising from changes in fair value are recognised in the income statement in the appropriate period.

##### 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 and any prior adjustment to reflect fair value that had been reported in equity are 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, including related unamortised costs, and amount paid for it 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, adjusted for any transaction costs necessary to realise the asset or settle the liabilities.

The fair value of financial instruments not traded in an organised financial market, is determined using a variety of methods and assumptions that are based on market conditions and risk existing at balance sheet date, including independent appraisals and discounted cash flow methods. The fair value determined is adjusted for any transaction costs necessary to realise the assets or settle the liabilities.

# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP				CSIR			
	2005 R'000	%	2004 R'000	%	2005 R'000	%	2004 R'000	%
<b>2. REVENUE</b>								
<b>Parliamentary Grant</b>	<b>356 992</b>	35	321 996	33	<b>356 992</b>	36	321 996	34
Parliamentary Grant received	<b>366 326</b>	36	323 014	33	<b>366 326</b>	37	323 014	34
Less:								
Grant received for projects started before year end but not completed	<b>(27 928)</b>	(3)	(18 594)	(2)	<b>(27 928)</b>	(3)	(18 594)	(2)
Add:								
Grant received in prior year for projects completed in this year	<b>18 594</b>	2	17 576	2	<b>18 594</b>	2	17 576	2
<b>Contract income</b>	<b>659 241</b>	64	638 931	66	<b>639 819</b>	63	623 546	65
Private sector	<b>199 602</b>	19	235 459	24	<b>191 499</b>	19	231 751	24
Public sector	<b>252 499</b>	25	215 472	22	<b>252 499</b>	25	215 472	22
National safety & security sector	<b>99 566</b>	10	95 793	10	<b>99 566</b>	10	95 793	10
International sector (including Africa)	<b>107 574</b>	10	92 207	10	<b>96 255</b>	9	80 530	9
<b>Royalties</b>	<b>7 158</b>	1	8 766	1	<b>7 158</b>	1	4 166	1
	<b>1 023 391</b>	100	969 693	100	<b>1 003 969</b>	100	949 708	100

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

### 3. NET OPERATING SURPLUS/(DEFICIT)

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

Auditors' remuneration	1 444	1 488	1 240	1 245
Audit fees	1 372	1 414	1 178	1 183
Expenses	72	74	62	62
Fees for services	133 224	107 869	133 195	104 958
Patent costs	1 863	2 241	1 863	2 241
Legal costs	241	1 128	241	962
Consultants*	131 120	104 500	131 091	101 755
Operating leases	21 229	27 051	20 607	25 983
Buildings	4 955	4 850	4 449	3 939
Equipment	13 621	17 931	13 533	17 774
Vehicles	2 653	4 270	2 625	4 270
Net realised foreign exchange loss	1 357	5 850	1 387	5 869
Net unrealised foreign exchange (gain)/loss	(1 593)	242	(1 596)	242
Board members' and executive management's emoluments (note 21)	11 486	10 893	8 816	6 474
Provision for and amounts written-off/(written back)	3 953	353	12 789	(6 316)
Lost and/or stolen equipment	555	385	555	385
Damaged equipment	2 068	690	2 068	690
Theft and/or damage to hired vehicles	445	466	445	466

\* Comparative figures have been reclassified to ensure comparability

### 4. NET INCOME FROM INVESTMENTS

Net interest income	14 673	14 641	14 477	14 194
Interest on bank balances and investments	15 824	14 858	15 386	14 195
Interest paid on loans and other liabilities	(1 151)	(217)	(909)	(1)
Fair value adjustment	(7 250)	1 018	(7 250)	1 018
Dividend income	-	-	11 275	814
	7 423	15 659	18 502	16 026



# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>5. INCOME TAX EXPENSE</b>				
The CSIR and its subsidiary, the South African Inventions Development Corporation (SAIDCOR), are exempt from South African income tax.				
South African normal taxation	-	27		
Current taxation: current year	-	25		
Current taxation: prior year	-	2		
Foreign taxation	3	128		
Current taxation	13	96		
Deferred taxation	(10)	32		
	<b>3</b>	<b>155</b>		
South African normal rate of taxation	<b>30.00%</b>	30.00%		
Surplus attributable to tax exempt entities	<b>(26.78%)</b>	(28.83%)		
Expenses not allowed	<b>0.00%</b>	0.01%		
Previous year assessment revised	<b>0.00%</b>	0.01%		
Assessed loss	<b>(1.44%)</b>	0.93%		
Effect of foreign taxation	<b>(1.78%)</b>	(1.71%)		
Current and deferred taxation – effective rate	<b>0.00%</b>	0.41%		

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 6. PROPERTY, PLANT AND EQUIPMENT

	Depreciation for the year R'000	Cost R'000	2005 Accumulated depreciation R'000	Net book value R'000	Cost R'000	2004 Accumulated depreciation R'000	Net book value R'000
<b>Group</b>							
Land	-	8 197	-	8 197	8 197	-	8 197
Buildings	3 842	195 964	83 181	112 783	185 905	79 336	106 569
Equipment	37 272	445 987	341 656	104 331	413 458	313 205	100 253
Vehicles	330	4 278	3 625	653	4 227	3 502	725
	<b>41 444</b>	<b>654 426</b>	<b>428 462</b>	<b>225 964</b>	<b>611 787</b>	<b>396 043</b>	<b>215 744</b>
<b>CSIR</b>							
Land	-	8 197	-	8 197	8 197	-	8 197
Buildings	3 840	195 953	83 176	112 777	185 895	79 333	106 562
Equipment	37 028	444 081	340 089	103 992	411 313	311 552	99 761
Vehicles	295	4 223	3 585	638	3 667	3 008	659
	<b>41 163</b>	<b>652 454</b>	<b>426 850</b>	<b>225 604</b>	<b>609 072</b>	<b>393 893</b>	<b>215 179</b>

	Land R'000	Buildings R'000	Equipment R'000	Vehicles R'000	Total R'000
<b>Group</b>					
Net book value 31 March 2003	8 795	103 870	94 348	1 028	208 041
Additions	-	6 653	42 422	144	49 219
Disposals	(598)	(158)	(4 239)	(43)	(5 038)
Depreciation	-	(3 796)	(32 267)	(404)	(36 467)
Exchange differences	-	-	(11)	-	(11)
Net book 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
Net book value 31 March 2005	<b>8 197</b>	<b>112 783</b>	<b>104 331</b>	<b>653</b>	<b>225 964</b>
<b>CSIR</b>					
Net book value 31 March 2003	8 795	103 860	91 778	808	205 241
Additions	-	6 653	41 943	144	48 740
Disposals	(598)	(158)	(2 355)	(15)	(3 126)
Depreciation	-	(3 793)	(31 605)	(278)	(35 676)
Net book 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)
Net book value 31 March 2005	<b>8 197</b>	<b>112 777</b>	<b>103 992</b>	<b>638</b>	<b>225 604</b>

Land and buildings are unencumbered and full details of the titles are available at the registered office of the CSIR. Equipment and vehicles with a net book value of R Nil (2004: R36 211) are encumbered (note 14).

# Notes to the Annual Financial Statements for the year ended 31 March 2005

## 7. INTANGIBLE ASSETS

	Amotisation for the year R'000	Cost R'000	2005 Accumulated amotisation R'000	Net book value R'000	Cost R'000	2004 Accumulated amotisation R'000	Net book value R'000
<b>Group</b>							
Investments in technology	828	7 468	4 482	2 986	8 193	5 053	3 140
<b>CSIR</b>							
Investments in technology	-	-	-	-	1 398	1 398	-
						<b>Group R'000</b>	<b>CSIR R'000</b>
Net book value 31 March 2003						4044	392
Additions						520	-
Disposals						(103)	-
Amortisation						(1 321)	(392)
Net book value 31 March 2004						3 140	-
Additions						674	-
Disposals						-	-
Amortisation						(828)	-
Net book value 31 March 2005						<b>2 986</b>	-

GROUP		CSIR	
2005 R'000	2004 R'000	2005 R'000	2004 R'000

## 8. INTEREST IN JOINT VENTURES AND ASSOCIATES

Cost of investments	1	6 292	-	-
Loans to joint ventures and associates	35 900	16 691	15 000	1
Share of post-acquisition losses	(15 076)	(3 838)	-	-
	<b>20 825</b>	19 145	<b>15 000</b>	1

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 so long as the liabilities of the relevant joint ventures or associates exceed their assets, fairly valued.

Where financial statements were not available, unaudited management accounts as at 31 March 2005 were used to account for joint ventures and associates.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 8. INTEREST IN JOINT VENTURES AND ASSOCIATES (continued)

Details of the joint ventures and associates at 31 March 2005 are as follows:

Name of joint venture/associate	Place of incorporation	Portion of ownership interest	Portion of voting power held	Principal activity	Carrying value		Financial year end
					2005 R'000	2004 R'000	
<b>Joint ventures</b>							
Mbuyu Biotech (Pty) Ltd	South Africa	50%	50%	Development and trading in biotechnology & expertise	1 180	1 693	31 March
Miningtek Consultants & Services Ltd (Disposed of during the year)	British Virgin Islands	-	-	Mining industry consultancy	-	12 436	31 March
SERA (Pty) Ltd	South Africa	50%	50%	Commercialisation and licensing of patents	19 559	4 013	31 March
Ellipsoid Technology (Pty) Ltd	South Africa	50%	50%	Development encapsulation technology	26	53	31 March
<b>Associates</b>							
AIDC Development Centre (Pty) Ltd (Converted to a Section 21 company during the year)	South Africa	-	-	Automotive industry development and support services	-	943	31 March
AIDC Development Centre Eastern Cape (Pty) Ltd	South Africa	25%	25%	Automotive industry development and support services	60	7	31 March
					<b>20 825</b>	<b>19 145</b>	

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

	Joint ventures Group		Associates Group	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000
Current assets	43 723	44 372	2 541	27 257
Long-term assets	1 638	4 700	192	1 914
Current liabilities	3 363	24 058	2 485	18 753
Long-term liabilities	72 269	38 478	-	8 031
Income	2 801	135 555	12 468	45 426
Expenses	11 398	138 375	12 248	43 777



# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

## 9. INTEREST IN SUBSIDIARIES

Shares at cost			31 773	36 773
Indebtedness			(7 220)	(1 213)
- by subsidiaries			19 728	25 877
- provision against loans			(18 137)	(18 130)
- to subsidiaries			(8 811)	(8 960)
			<b>24 553</b>	<b>35 560</b>

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 so long as the liabilities of the relevant subsidiaries exceed their assets, fairly valued.

## 10. INVESTMENTS

Listed Shares	% held	Number of shares held		Class of shares	GROUP		CSIR	
		2005	2004		2005	2004	2005	2004
Samsys Technologies Ltd	2.30	1 100 000	-	Ordinary	9 065	-	9 065	-
<b>Unlisted Shares</b>					<b>5</b>	<b>5</b>	<b>-</b>	<b>-</b>
Breathetex (Pty) Ltd	15.63	14 800	14 800	Ordinary	9 195	6 850	9 195	6 850
Provision for impairment					(9 195)	(6 850)	(9 195)	(6 850)
Aluminum Squeeze	5	10 000	10 000	Ordinary	5	5	-	-
Castors (Pty) Ltd								
Pan-A-Cam (Pty) Ltd	15	18	18	Ordinary	-	-	-	-
<i>Executive's valuation of shares R'000</i>		5	5					
<b>Deposits (funds on call)</b>					<b>-</b>	<b>20 000</b>	<b>-</b>	<b>20 000</b>
					<b>9 070</b>	<b>20 005</b>	<b>9 065</b>	<b>20 000</b>

Current accounts are included in current assets and/or current liabilities.

## 11. TRADE AND OTHER RECEIVABLES

Trade receivables	124 342	127 040	121 813	125 717
Prepaid expenditure	3 006	4 058	3 006	4 058
Other receivables	15 809	18 414	15 699	18 281
	<b>143 157</b>	<b>149 512</b>	<b>140 518</b>	<b>148 056</b>

## 12. INVENTORY AND CONTRACTS IN PROGRESS

Inventory	3 304	1 751	3 148	1 499
Contracts in progress less provision for losses	62 200	48 281	62 200	48 352
	<b>65 504</b>	<b>50 032</b>	<b>65 348</b>	<b>49 851</b>

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>13. MINORITY INTEREST</b>				
Shareholders' loans	3	38		
Profit attributable to outside shareholders	-	805		
Prior years	805	805		
Current year	(805)	-		
	3	843		
The loans are interest free, unsecured and there are no fixed terms of repayment.				
<b>14. LONG-TERM LIABILITIES</b>				
<b>Secured and interest bearing</b>				
Capitalised finance leases	-	-	-	-
Amounts payable under finance leases	-	98	-	-
Less: Portion repayable within one year included in trade and other payables (note 17)	-	(98)	-	-
Amounts due for settlement after one year	-	-	-	-
The leases are repayable in monthly instalments at interest rates that vary between 17.091% to 17.324%. The current finance leases are secured over vehicles with a net book value of R Nil (2004:R36 211) (note 6). The final payment was made in September 2004.				
<b>15. DEFERRED TAX LIABILITIES</b>				
Balance at the beginning of the year	33	1		
Accelerated capital allowances	(9)	32		
	24	33		
<b>16. ADVANCES RECEIVED</b>				
Advances on contracts received from clients	114 160	90 522	114 160	90 522
<b>17. TRADE AND OTHER PAYABLES</b>				
Accounts payable and accruals	214 984	177 138	211 347	173 482
Forward exchange contracts	-	455	-	455
Short-term portion of long-term liabilities (note 14)	-	98	-	-
	214 984	177 691	211 347	173 937

# Notes to the Annual Financial Statements for the year ended 31 March 2005

## 18. PROVISIONS

	Opening balance R'000	Additional provisions R'000	Utilised and reversed R'000	Closing balance R'000
<b>Group</b>				
<b>Provision for salary and related expenses</b> The provision for salary and related expenses includes provisions for leave pay and bonuses. The provision represents management's best estimate of the liability at year end.	70 676	41 072	(39 146)	<b>72 602</b>
<b>Provision for own insurance fund</b> The provision for own insurance fund represents management's best estimate of the insurance liability for past events not covered under the insurance policy at year end.	486	618	(854)	<b>250</b>
<b>Provision for future warranty expenses</b> The provision for future warranty expenses represents possible future warranty expenses regarding specialised equipment sold. The provision represents management's best estimate of the liability at year end.	79	-	(79)	<b>-</b>
	<b>71 241</b>	<b>41 690</b>	<b>(40 079)</b>	<b>72 852</b>
<b>CSIR</b>				
<b>Provision for salary and related expenses</b> The provision for salary and related expenses include provisions for leave pay and bonuses. The provision represents management's best estimate of the liability at year end.	70 453	41 136	(39 082)	<b>72 507</b>
<b>Provision for own insurance fund</b> The provision for own insurance fund represents management's best estimate of the insurance liability for past events not covered under the insurance policy at year end.	486	618	(854)	<b>250</b>
<b>Provision for future warranty expenses</b> The provision for future warranty expenses represents possible future warranty expenses regarding specialised equipment sold. The provision represents management's best estimate of the liability at year end.	79	-	(79)	<b>-</b>
	<b>71 018</b>	<b>41 754</b>	<b>(40 015)</b>	<b>72 757</b>

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

### 19. OPERATING LEASE COMMITMENTS

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

Within one year	21 260	18 441	21 048	17 804
Land and buildings	5 943	3 265	5 732	2 628
Equipment	12 627	13 503	12 626	13 503
Vehicles	2 690	1 673	2 690	1 673
Within two to five years	28 102	12 905	28 102	12 709
Land and buildings	10 853	1 427	10 853	1 231
Equipment	14 486	9 341	14 486	9 341
Vehicles	2 763	2 137	2 763	2 137

Operating lease payments for land and buildings are negotiated on an annual basis and are fixed for the term of the agreement. Operating lease payments for equipment and vehicles vary between 12 and 60 months and are fixed for the term of the agreement.

### 20. RETIREMENT BENEFITS OF EMPLOYEES

#### 20.1 CSIR Pension Fund

The Fund is registered in terms of the Pension Funds Act, 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 R42,0 million (2004: R38,5 million) and employee contributions of R21,5 million (2004: R19,7 million) were paid over during the year. Employer contributions are charged against income when incurred.

#### 20.2 Mine Officials Pension Fund and Sentinal

At the time of the merger with the Chamber of Mines Research Organisation 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 R159 912 (2004: R195 619) and employee contribution of R87 786 (2004: R107 283) were paid over during the year. Employer contributions are charged against income when incurred.

#### 20.3 Associated Institutions Pension Fund (AIPF) and Temporary Employees Pension Fund (TEPF)

These Funds are defined benefit plans. 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 four employees (2004: five employees) who are members of the AIPF and no employees (2004: one employee) who are members of the TEPF. Both funds are controlled by the State, which has assumed responsibility for the unfunded portions of these funds.

Employer contributions of R39 587 (2004: R55 505) and employee contributions of R24 507 (2004: R32 094) were paid over during the year to the AIPF and TEPF.



# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000
<b>20. RETIREMENT BENEFITS OF EMPLOYEES (continued)</b>				
<b>20.4 Post-retirement medical benefits</b>				
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 2005.				
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	<b>380 992</b>	371 222	<b>380 992</b>	371 222
Fair value of plan assets	<b>(273 685)</b>	(222 998)	<b>(273 685)</b>	(222 998)
Net liability on balance sheet	<b>107 307</b>	148 224	<b>107 307</b>	148 224
Amounts recognised in income in respect of the scheme are as follows:				
Current service cost	<b>5 901</b>	3 904	<b>5 901</b>	3 904
Interest in obligation	<b>34 522</b>	43 847	<b>34 522</b>	43 847
Expected return on plan assets	<b>(20 918)</b>	(22 163)	<b>(20 918)</b>	(22 163)
Actuarial gains recognised during the year	<b>(44 470)</b>	(36 410)	<b>(44 470)</b>	(36 410)
Total	<b>(24 965)</b>	(10 822)	<b>(24 965)</b>	(10 822)
Movement in the net liability recognised in the balance sheets is as follows:				
Net liability at the beginning of the year	<b>148 224</b>	170 647	<b>148 224</b>	170 647
Net income recognised in the income statement	<b>(24 965)</b>	(10 822)	<b>(24 965)</b>	(10 822)
Contributions	<b>(15 952)</b>	(11 601)	<b>(15 952)</b>	(11 601)
Net liability at the end of the year	<b>107 307</b>	148 224	<b>107 307</b>	148 224
Actual return on plan assets	<b>25.60%</b>	33.60%	<b>25.60%</b>	33.60%
Principal actuarial assumptions at the balance sheet date:				
Discount rate at 31 March	<b>9.50%</b>	13.00%	<b>9.50%</b>	13.00%
Expected return on plan assets at 31 March	<b>9.50%</b>	13.00%	<b>9.50%</b>	13.00%
Medical inflation costs	<b>7.35%</b>	11.00%	<b>7.35%</b>	11.00%

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

### 21. BOARD MEMBERS, DIRECTORS AND EXECUTIVE MANAGEMENT'S REMUNERATION

Entity		Managerial services				Total R'000
		Fees for services as director	Basic salary	Bonuses and performance- related payments	Retirement fund & medical aid contributions	
		R'000	R'000	R'000	R'000	
<b>Board members and Executive Directors</b>						
Dr S Sibisi	CSIR	-	1 218	413	269	1 900
N Badenhorst (up to May 2004)	Agrimage (Pty) Ltd	-	66	-	5	71
Dr O Safriel	Technology Finance Corporation (Pty) Ltd	-	801	110	23	934
<b>Foreign subsidiaries</b>						
A Loots (up to April 2004)	Quotec Limited (UK)	-	72	-	-	72
Dr NA Waterman	Quotec Limited (UK)	-	305	-	-	305
Dr A Hickman	Quotec Limited (UK)	-	891	173	6	1 070
J Galsworth (since Jan 2005) Remunerated in Pound sterling	Quotec Limited (UK)	-	159	58	1	218
<b>Non-executive Board members</b>						
Prof C de la Rey	CSIR	13	-	-	-	13
K Ginwala	CSIR	12	-	-	-	12
Prof M Wingfield	CSIR	13	-	-	-	13
Dr N Msomi	CSIR	10	-	-	-	10
Dr Z Rustomjee	CSIR	12	-	-	-	12
I Mkhize	CSIR	13	-	-	-	13
<b>Executive Management</b>						
Dr A Yannakou* (up to February 2005)	CSIR	-	3 057	219	174	3 450
AJ Jordaan	CSIR	-	1 023	519	265	1 807
T Eboka (up to January 2005)	CSIR	-	1 034	220	136	1 390
Dr P Mjwara (since March 2005)	CSIR	-	67	117	12	196
<b>2005</b>		<b>73</b>	<b>8 693</b>	<b>1 829</b>	<b>891</b>	<b>11 486</b>
2004		89	8 571	1 201	1 032	10 893

\* Including leave payout and severance benefit

# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

## 22. 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 (2004: 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.

## 23. CONTINGENT LIABILITIES AND FACILITIES

Bank guarantees issued in respect of third party liabilities	<b>33 062</b>	28 430	<b>33 062</b>	28 430
South African Revenue Service (SARS)	<b>1 000</b>	1 000	<b>1 000</b>	1 000
	<b>34 062</b>	29 430	<b>34 062</b>	29 430

South African Revenue Service (SARS):

Prior to the National Laser Centre 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. Should the exemption not be granted, the CSIR will be liable for the income tax payable as a result thereof. SARS did however indicate that the income from the Trust could be capital in nature and therefore, not taxable.

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 that could result in any material losses to the CSIR.

Management's best estimate of all liabilities for legal costs is provided for and included in accounts payable and accruals (note 17).

Banking facilities:

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

## 24. CAPITAL COMMITMENTS

Authorised but not contracted	<b>96 380</b>	9 411	<b>96 380</b>	9 411
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Included in these amounts is an amount of R93 million for the erection of a building. This capital expenditure is to be financed from internal sources.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

### 25. FINANCIAL INSTRUMENTS

#### 25.1 Forward exchange contracts

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 and accounts payable at 31 March 2005 include foreign trade receivables of R11,7 million (2004: R27,8 million) and foreign trade payables of R Nil (2004: R Nil).

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

US dollars 3 – 6 months at rates averaging USD 5.9429 (2004: USD 6.5162)	144	165	144	165
Euro 3 – 6 months at rates averaging EUR 7.8308 (2004: EUR 8.1511)	207	5 984	207	5 984
	<b>351</b>	<b>6 149</b>	<b>351</b>	<b>6 149</b>

#### 25.2 Credit risk

Financial assets that could subject the group to credit risk consist primarily of bank balances and cash, 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 the allowance for doubtful receivables or loan write-offs. 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.

#### 25.3 Fair values

At 31 March 2005, the carrying amount of bank balances and cash, deposits, trade and other receivables, trade and other payables, contracts in progress, advances received and short-term borrowings approximated their fair values due to the short-term maturities of these assets and liabilities.

Other receivables are carried at fair values except receivables originated by the group not held for trading and financial assets that do not have a quoted market price in an active market and where the fair value cannot be measured reliably in which cases the other receivables are measured at amortised cost using the effective rate method if they have a fixed maturity or at cost if there is no fixed maturity.

Long-term loans to joint ventures and subsidiaries are interest free with no fixed repayment terms and therefore the fair value of these loans cannot be calculated.

The fair value of the loans to outside shareholders cannot be determined as the loans are interest free with no fixed terms of repayment.



# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

## 25. FINANCIAL INSTRUMENTS (continued)

### 25.4 Interest rate risk

The evaluation of interest rate exposure and investment strategies is done by management on a regular basis. Interest bearing investments are held with reputable banks in order to minimise exposure.

## 26. RECONCILIATION OF NET OPERATING SURPLUS/(DEFICIT) TO CASH GENERATED BY OPERATIONS

Net operating surplus/(deficit)	28 029	(183)	16 832	1 229
Adjusted for:				
Profit on disposal of property, plant and equipment	(22)	(48)	-	-
Profit on disposal of interest in subsidiary	-	(5)	-	-
Depreciation and amortisation	42 272	37 788	41 163	36 068
Net unrealised foreign exchange (gain)/loss	(2 051)	242	(2 051)	242
Unrealised gain on investment	(15 063)	-	(15 063)	-
Provision for and amounts written-off/(written back)	1 608	353	10 827	(6 316)
Loss on disposal of property, plant and equipment	523	2 242	431	2 234
Loss on disposal of joint venture	1 704	-	-	-
Loss on disposal and deregistration of interest in subsidiaries	-	1 772	-	-
<b>Operating surplus before changes in working capital</b>	<b>57 000</b>	<b>42 161</b>	<b>52 139</b>	<b>33 457</b>
Decrease in trade and other receivables	5 092	17 940	6 273	15 453
(Increase)/decrease in inventory and contracts in progress	(15 472)	4 797	(15 497)	2 271
Increase in advances received	23 638	34 072	23 638	34 072
Increase in trade and other payables and provisions	39 457	3 533	39 604	6 133
<b>Net working capital changes</b>	<b>52 715</b>	<b>60 342</b>	<b>54 018</b>	<b>57 929</b>
<b>Cash generated by operations</b>	<b>109 715</b>	<b>102 503</b>	<b>106 157</b>	<b>91 386</b>

## 27. BANK BALANCES AND CASH

Cash on deposit	217 121	152 653	209 000	148 000
Bank balances	86 645	60 996	85 974	60 278
Cash on hand	443	459	443	459
	<b>304 209</b>	<b>214 108</b>	<b>295 417</b>	<b>208 737</b>

The CSIR acts as an agent in the management of certain projects. Funds received for these projects are not managed through a separate legal entity and therefore the balance of R28, 367 million (2004: R26,032 million) has been included in bank balances and cash and trade and other payables.

# Notes to the Annual Financial Statements

## for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

### 28. DISTRIBUTION FROM NLC TRUST

The dissolution of the NLC Trust took place on 31 October 2003. The assets and the business of the Trust were transferred to the CSIR on 1 November 2003.

The net assets of the NLC Trust on 1 November 2003 were as follows:

Property, plant and equipment	6 660	6 660
Trade and other receivables	853	853
Inventory and contracts in progress	2 316	2 316
Bank balance and cash	5 618	5 618
Trade and other payables	(14 448)	(14 448)
Net asset value	999	999
Distribution from the NLC Trust	(999)	(999)
<b>Total consideration</b>	-	-
<b>Net cash inflow arising on distribution from NLC Trust</b>		
Bank balance and cash distributed	5 618	5 618

### 29. DISPOSAL OF INTEREST IN SUBSIDIARIES

#### 29.1 Mbuyu Biotech (Pty) Ltd

The group held 100% of the issued share capital in Mbuyu Biotech (Pty) Ltd. On 1 April 2003 the CSIR's interest was diluted to 50%.

The net assets of Mbuyu Biotech (Pty) Ltd on 1 April 2003 were as follows:

Bank balance and cash	26
Trade and other payables	(36)
Net asset value	(10)
Group's remaining share in net assets	5
Profit on disposal	5
<b>Total consideration</b>	-
<b>Net cash outflow arising on disposal of interest in subsidiary</b>	
Bank balance and cash disposed	26

# Notes to the Annual Financial Statements for the year ended 31 March 2005

	GROUP		CSIR	
	2005 R'000	2004 R'000	2005 R'000	2004 R'000

## 29. DISPOSAL OF INTEREST IN SUBSIDIARIES (continued)

### 29.2 Pipeline Performance Technologies (Pty) Ltd

The group held 75% of the share capital in Pipeline Performance Technologies (Pty) Ltd. The shares held were sold effective 1 April 2003.

The net assets of Pipeline Performance Technologies (Pty) Ltd on 1 April 2003 were as follows:

Bank balance and cash	229
Trade and other receivables	2 648
Property, plant and equipment	492
Long-term liabilities	(50)
Trade and other payables	(1 555)
	<hr/>
Net asset value disposed*	1 764
Loss on disposal	(1 764)
	<hr/>
<b>Total consideration</b>	-
	<hr/>
<b>Net cash outflow arising on disposal of interest in subsidiary</b>	
Bank balance and cash disposed	229
	<hr/>

\* Due to losses made, Pipeline Performance Technologies (Pty) Ltd was 100% consolidated in prior years.

## 30 DEREGISTRATION OF SUBSIDIARY

### 30.1 Thermaspray (Pty) Ltd

The business of Thermaspray (Pty) Ltd was sold to management effective 1 November 2003. The company was deregistered during November 2003.

The net assets of Thermaspray (Pty) Ltd on deregistration were as follows:

Bank balance and cash	5
Trade and other receivables	5
Trade and other payables	(2)
	<hr/>
Net asset value disposed	8
Loss on deregistration	(8)
	<hr/>
<b>Total consideration</b>	-
	<hr/>
<b>Net cash outflow arising on disposal of interest in subsidiary</b>	
Bank balance and cash disposed	5
	<hr/>

# ADVENUM A:

## Interest in subsidiaries

### 31 March 2005

Interests of the CSIR							
Consolidated subsidiaries	Country of incorporation	Issued capital R'000	Effective holding		Financial year end	Shares at cost	
			2005 %	2004 %		2005 R'000	2004 R'000
<b>Direct investments</b>							
South African Inventions Development Corporation (SAIDCOR)	South Africa	27 220	100	100	31 March	27 220	27 220
Technovent (Pty) Ltd	South Africa	5 000	100	100	31 March	-	5 000
CSIR International Limited*	British Virgin Island	326	100	100	31 March	326	326
Quotec Limited	United Kingdom	100	100	100	31 March	4 227	4 227
Silverbreeze (Pty) Ltd	South Africa	100	100	100	31 March	-	-
* No statutory audit was performed							
						<b>31 773</b>	<b>36 773</b>
<b>Indirect investments</b>							
<b>Included in SAIDCOR:</b> Technology Finance Corporation (Pty) Ltd (Technifin)	South Africa	5 200	100	100	31 March	4 400	4 400
<b>Included in Technifin carrying value:</b> Implico BV (incorporated in the Netherlands)	Netherlands/ South Africa	500	100	100	31 March	118	118
<b>Included in Technovent (Pty) Ltd</b> 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	80	31 March	-	-
* Issued capital R100 and shares at cost R88 ** Issued capital R100 and shares at cost R100 *** Issued capital R100 and shares at cost R80							

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

Interests of the CSIR

to subsidiaries		Net indebtedness by subsidiaries		Net investment		General nature of business
2005 R'000	2004 R'000	2005 R'000	2004 R'000	2005 R'000	2004 R'000	
8 811	8 960	-	-	18 409	18 260	Investment in research development and implementation of technology.
-	-	-	-	-	5 000	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. The investment was written-off during the year.
-	-	-	6 293	326	6 619	The company serves as a holding company for certain CSIR international activities.
-	-	1 591	1 454	5 819	5 681	The principal activity of the company is that of consulting on technology auditing, technology evaluation and technology transfer on behalf of clients in the public and the private sectors.
-	-	-	-	-	-	Provides mobile e-solutions enabling software. Company was dormant during the 2005 financial year and will be deregistered during the 2006 financial year.
<b>8 811</b>	<b>8 960</b>	<b>1 591</b>	<b>7 747</b>	<b>24 554</b>	<b>35 560</b>	

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

Assists 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.

Commercialises and exploits a range of intrusion alarm systems. The company will be deregistered during the 2006 financial year.

Provides plasma nitrating surface hardening services to industry.

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

8 811	8 960	1 591	7 747	24 554	35 560
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## List of Abbreviations

AFIS	Advanced Fire Information System
AIDC	Automotive Industry Development Centre
AIR	Airborne Infection Research
AMD	Acid Mine Drainage
AMTL	Advanced Manufacturing Technology Laboratory
AMTS	Advanced Manufacturing Technology Strategy
ART	Anti-Retroviral Therapy
BioPAD	Biotechnology Partnership and Development
BRIC	Biotechnology Regional Innovation Centre
CEO	Chief Executive Officer
CSiLLA	CSIR Innovation, Leadership and Learning Academy
COIN	Community Owned Information Network
CSDLC	CSIR Sustainable Development Liaison Committee
CSIRIS	CSIR Information Services
DAC	Department of Arts and Culture
DEAT	Department of Environmental Affairs and Tourism
DFID	United Kingdom Department for International Development
DPLG	Department of Provincial and Local Government
DRFM	Digital Radio Frequency Memory
DoT	Department of Tourism
DSC	Dye-sensitised Solar Cells
DWAF	Department of Water Affairs and Forestry
EPWP	Expanded Public Works Programme
EHS	Environment, Health and Safety
ERP	Enterprise Resource Planning
EU	European Union
EVA	Economic Value-Added
FLOSS	Free/Libre Open Source Software
GEO	Group on Earth Observation
GEOSS	Group Earth Observation System of Systems
GRA	Global Research Alliance
HLT	Human Language Technologies
HM	High Methoxyl
HR	Human Resources
HRD	Human Resources Development
HVS	Heavy Vehicle Simulator
ICC	International Cricket Council
ICT	Information and Communication Technology
IKS	Indigenous Knowledge Systems
IT	Information Technology
KRA	Key Result Area
LDPW	Limpopo Department of Public Works
LMDC	Light Metals Development Centre
MDR-TB	Multi-drug Resistant Tuberculosis
MHSC	Mine Health and Safety Council
MNC	Multinational Corporations
MODIS	Moderate Resolution Imaging Spectroradiometer

NCPC	National Cleaner Production Centre
NEPAD	New Partnership for Africa Development
NLC	National Laser Centre
NML	National Metrology Laboratory
NRF	National Research Foundation
OHSAS	Occupation Health and Safety Assessment Series
OMPT	Oryx Mission Planning Tool
OSC	Open Source Centre
PLC	Process Logic Control
PC	Personal Computer
R&D	Research and Development
SAAF	South African Airforce
SABS	South African Bureau of Standards
SAC	Satellite Applications Centre
SADC	Southern Africa Developing Community
SAFMA	Southern African Millennium Assessment
SANRAL	South African National Roads Agency Limited
SAPI	South African Planning Institute
SET	Science, Engineering and Technology
SETA	Skills Education and Training Authority
SHE	Safety, Health and Environment
SIMS	Strategic Innovation Management System
SKA	Square Kilometre Array
SMME	Small, Medium and Micro Enterprises
SoST	State of Science and Technology
SPC	Stepping Pump Concentrator
S&T	Science and Technology
TEI	Tertiary Education Institutions
TfD	Technology for Development
the dti	The Department of Trade and Industry
THRIP	Technology and Human Resources for Industry Programme
UCT	University of Cape Town
UKZN	University of Kwazulu Natal
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
UP	University of Pretoria
WAITRO	World Association of Industrial and Technological Research Organisations
WSSD	World Summit in Sustainable Development
YSDP	Youth Skills Development Programme

**Khungeka Njobe**  
 Director: Water,  
 Environment and Forestry  
 Technology



**Dr Sibusiso Sibisi**  
 CSIR President and CEO



# Leadership Team

## 2004/5

**Phil Hendricks**  
 Director: Roads and  
 Transport Technology



**Mr Albert Jordaan**  
 Executive Vice-President:  
 Finance and  
 Commercialisation



**Dr Hoffie Maree**  
 Director: Manufacturing  
 and Materials Technology



**Terry Watson**  
 Director: Food, Biological  
 and Chemical Technologies



**Dr Anthos Yannakou**  
 Executive Vice-President:  
 Operations



**André Nepgen**  
 Director: Defence  
 Technology



**Vishnu Pillay**  
 Director: Mining  
 Technology



**Dr Phil Mjwara**  
 Group Executive R&D  
 and Human Capital  
 Development



**Dr Rodney Milford**  
 Director: Building and  
 Construction Technology



**Ms Tina Eboka**  
 Executive Vice-President:  
 Organisational  
 Development and  
 Communications



# CSIR Structure

**CSIR BOARD**

**PRESIDENT**

**EXECUTIVE**

Operations  
Finance and Commercialisation  
Organisational Development and  
Communications

**BUSINESS UNITS**

Building and Construction Technology

Defence Technology

Food, Biological and Chemical Technologies

Manufacturing and Materials Technology

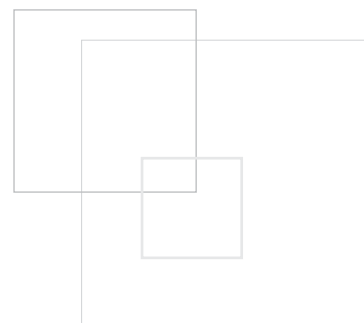
Mining Technology

Roads and Transport Technology

Water, Environment and Forestry Technology

**CENTRES &  
INITIATIVES**

Crime Prevention Centre  
Information Society Technologies  
National Laser Centre  
National Metrology Laboratory  
Open Source Centre  
Satellite Applications Centre  
Sports Technology Centre  
Technology for Development



# CSIR SUBSIDIARIES

## 2004/5

**SOUTH AFRICAN INVENTIONS  
DEVELOPMENT CORPORATION (SAIDCOR)**  
+27 12 841 3017

Technology Finance Corporation  
(Pty) Ltd +27 11 884 5200

**TECHNOVENT (PTY) LTD**  
+27 12 841 4709

Brilliant Security Solutions  
(Pty) Ltd

Plasmatherm (Pty) Ltd

Agrimage (Pty) Ltd

**CSIR INTERNATIONAL LIMITED**  
+27 12 841 4131/3017

**QUOTEC LIMITED**  
+9 44 1494 432277

**SILVERBREEZE (PTY) LTD**  
+27 12 841 2014