

The CSIR.
People with
vision, partnerships
with **purpose**,
technology with
impact



CSIR Technology Impact 1999

OUR VISION

To be the best in technology, leadership and partnering, and - through our people - fight poverty, build global competitiveness and make an enduring difference in people's lives.

OUR MISSION

The CSIR is a uniquely South African organisation, committed to innovation. We provide technology solutions and information to support sustainable development and economic growth in the context of national priorities.



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Introduction

In a year characterised by tough business conditions, the CSIR has remained firmly on the road to brighter horizons.

The pages that follow profile the diversity, impact and relevance of our activities. They detail our commitment to remain focused on the objectives stated in the White Paper on Science and Technology: improving competitiveness and job creation, promoting better quality of life, developing human resources, ensuring environmental sustainability and extending the information society.

We have continued our investment in establishing globally competitive technologies otherwise not available in South Africa. At the same time we have provided support and extension services to grow the small business sector, which is crucial for long-term economic success.

We were a major contributor to raising public awareness of science and technology during the 1998 Year of Science and Technology and developing capacity in scientific, engineering and technological fields.

We took a proactive leadership role in demonstrating the advantages of information and communications technology to many thousands of South Africans living in cities as well as the most remote areas.

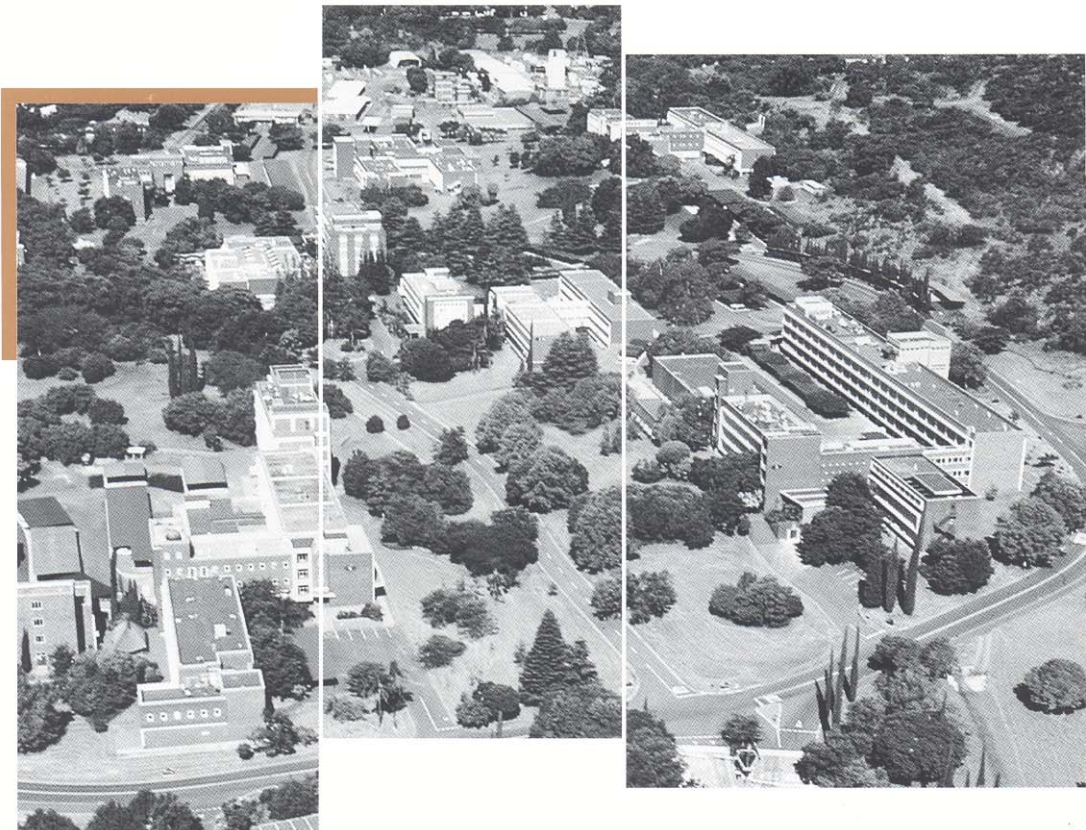
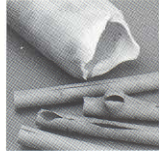
We are a key player in two major collaborative technology ventures aimed at ensuring that the gold and coal mining industries remain cost effective and productive well into the 21st century.

We have been able to grow as an organisation by being responsive and relevant to the needs of clients and stakeholders. We have touched the lives of our fellow South Africans by striving to embed quality in everything we do.

It is our hope that *Technology Impact* will be of value to you in sharing in the spirit of innovation in South Africa today.



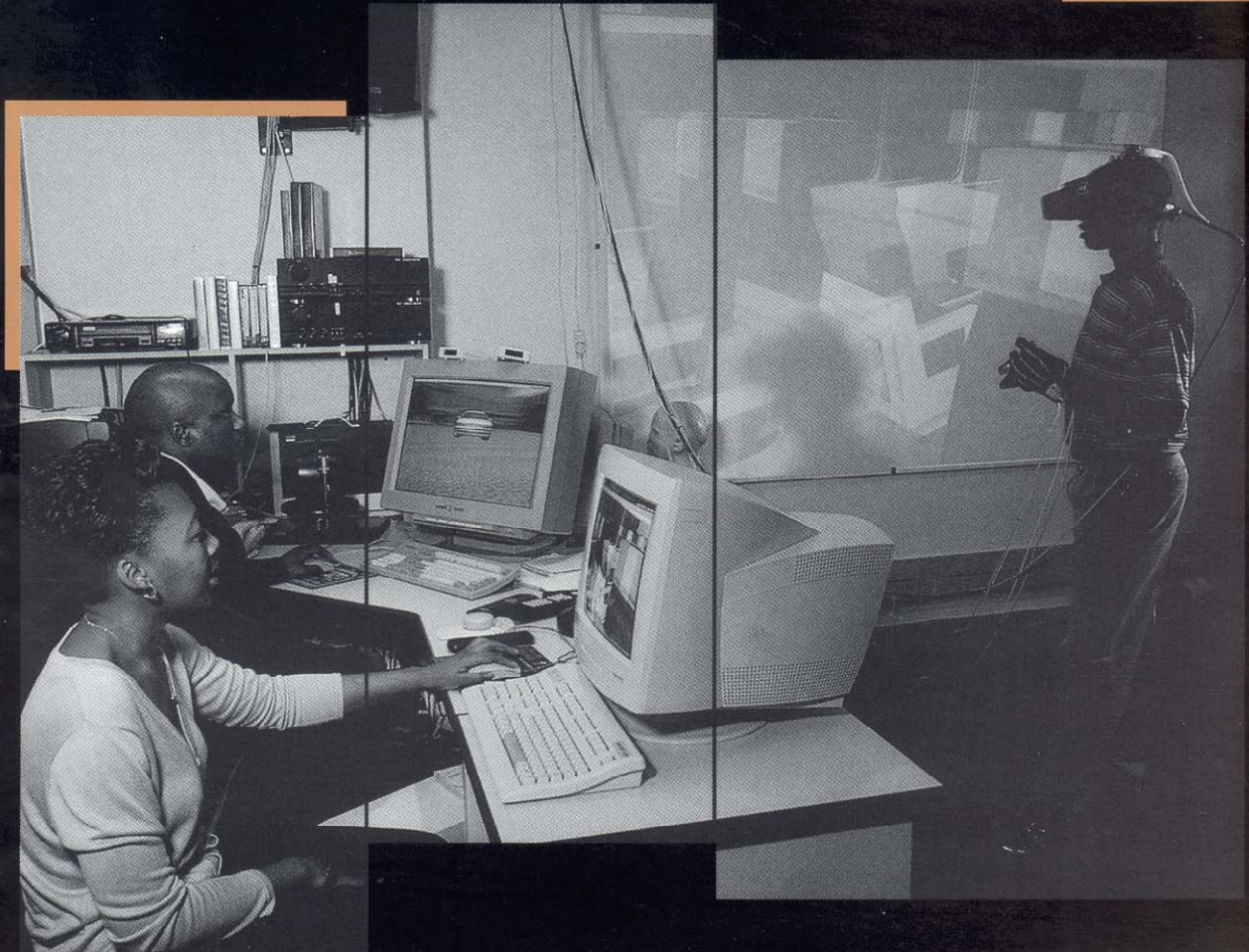
Dr Geoff G Garrett
CSIR President



The CSIR site in Pretoria

Competitiveness and job creation

The challenges of globalisation and the realisation that intellectual capital underpins competitiveness drives the CSIR's efforts to be responsive and relevant to diverse market needs. It is vital for an emerging economy such as ours that competitiveness is achieved by creating significant numbers of new jobs and applying technology to promote entrepreneurship.



The CSIR Virtual Reality Solutions Centre introduces the power of VR and interactive 3-D modelling and simulation as visualisation and decision-support tools in business, industry, and scientific applications. The CSIR is applying these new technologies to local situations where visualisation can help evaluate and provide solutions to local problems.



Mining at 5 000 m

To sustain the gold industry in South Africa gold reserves at deeper levels need to be accessed. DEEPMINE, a collaborative research programme by the CSIR, the National Research Foundation, the University of the Witwatersrand, the Chamber of Mines, and the AngloGold, Gold Fields and Durban Roodepoort Deep mining companies, is aimed at paving the way to mining gold 5 km below the surface. This programme is as concerned with human factors and underground logistics as it is with the technology required for success.

The main purpose of DEEPMINE is to acquire knowledge and develop appropriate technology to enable safe, efficient and profitable ultra-deep level mining, as well as to increase the general level of competence in this field. It conducts research, stimulates education and training, and seeks to establish a culture of innovation to ensure rapid technology transfer and implementation.

While DEEPMINE's focus is on the development of the technology and skills required to mine at ultra-depth, there will be many spin-offs for mining at current depths.

The consortium has entered its second year, having developed a sound knowledge base for its research.

"Exploring" our botanical resources

South Africa's botanical diversity of some 23 000 plants is a unique resource. The ability to release economic value from such hidden treasure is what distinguishes leading nations. To this end, a nationwide consortium-based bioprospecting initiative has been launched to harness the potential of South Africa's plants through scientific investigation of their medicinal, biopesticidal, nutraceutical and genetic properties.

Members of the consortium include the CSIR, the Agricultural Research Council, the Medical Research Council, the National Botanical Institute and the Universities of Cape Town, the North and the Western Cape.

The CSIR many years ago recognised the strategic importance of applying its expertise to South Africa's wealth of indigenous knowledge and genetic diversity by developing innovative pharmaceutical leads. The first project led to the patenting of a novel anti-obesity agent, P57, from an indigenous plant, and resulted in a license agreement between CSIR and the UK-based phytomedicine company, Phytopharm.

The benefits include transfer of new phytomedicine production technology from abroad, building research capacity in the pharmaceutical development arena and the earning of milestone payments and royalties through licensing of patented technology.

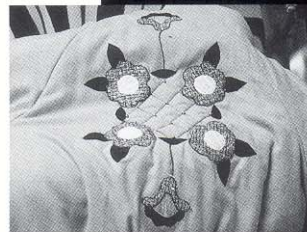
Crafts get competitive

Textile enterprises are

combining
indigenous skills,
modern business
processes and
technical training
to help improve

the quality and competitiveness
of traditional crafts, while
creating jobs.

The CSIR has undertaken
three rural projects, launched
at Decorex 98. Craft Planet
produces household accessories
made from recycled sheeting
and table linen from the Sun
City Complex. Lubisi Legends
office and household accessories
reflect the traditional Xhosa
designs, and the African
Adrenaline range of household
linens and accessories uses
rainbow-coloured patchwork.



Leading the way
to a better world,
blazing new trails through
science
and
technology

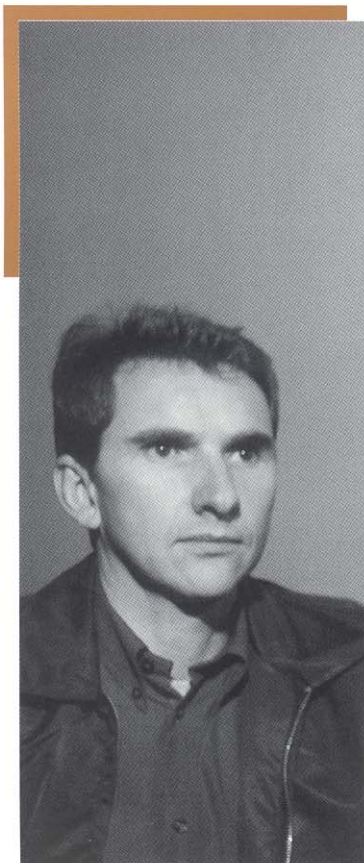
Spray-on safety support system

A new structural membrane support system, developed by the CSIR in conjunction with Evermine SA and Ictus Equipment, has the potential to significantly improve mine safety underground while being more cost-effective than conventional shotcrete.

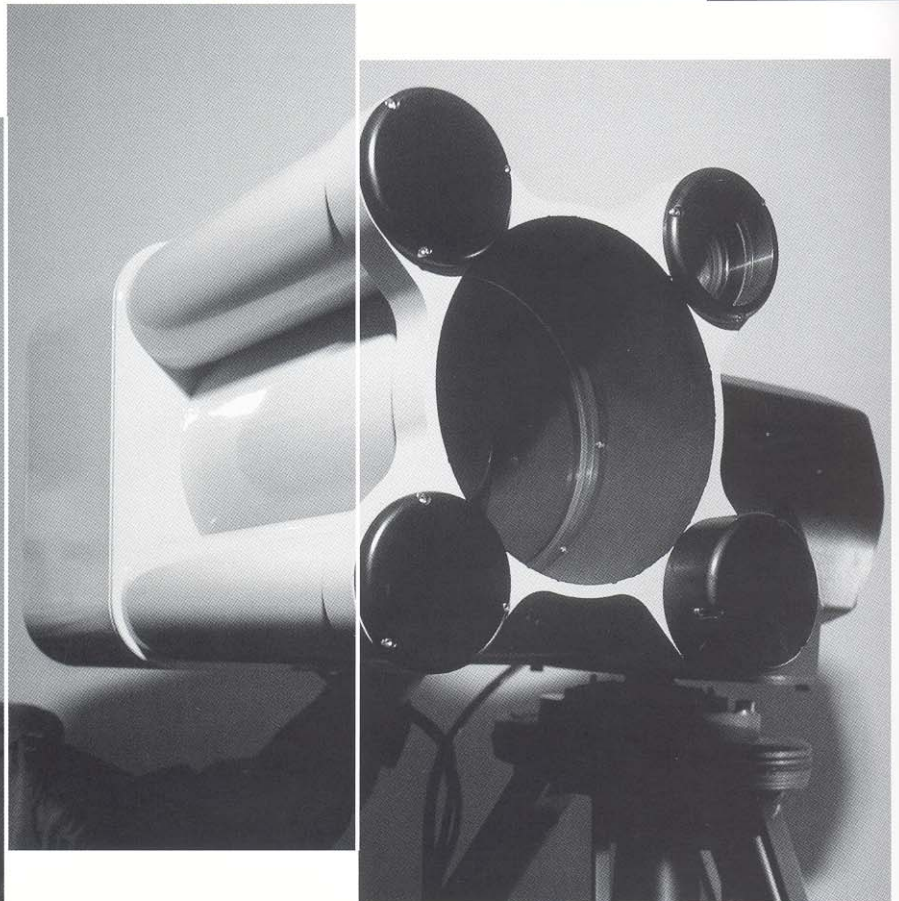
The product, Evermine, provides a tough and flexible support fabric which can cover most of the surface area of a hanging wall thus preventing, or significantly reducing, fall-out of relatively small blocks, thereby improving stability and safety under static and dynamic loading conditions.

Evermine also suppresses violent failure of brittle hard rock and improves overall stability by stabilising and preventing unravelling of discontinuous, low cohesion rock strata. This is an important development in the industry as, currently, rock-related accidents account for more than 50% of the total fatalities and about 30% of total injuries.

Evermine is environmentally safe for underground use, being non-toxic and non-flammable. A complete spray-on system is available which makes the product easy and fast to



The Tornado is a multi-purpose observation system ideal for observing long distances in low light conditions.





apply. Underground trials of the product have been completed and it will soon be available commercially.

Coal mining industry tunes in

The CSIR has developed an in-line radio-tracing solution integrated with decision support software to assist South Africa's coal mining industry.

Coal separation is a core technology used to add value to a key export commodity. Effective coal separation requires feedback on the efficiency of the separation and the quality of the product. Traditionally this has been done via off-line laboratory-based analysis that is expensive, tedious and requires high levels of skill. The new system uses tracers and transponders and produces results immediately via the software program, ensuring increased efficiency in the operation of the plant.

The system is being introduced following successful field tests at Amcoal's Goedehoop and Duiker's Tavistock plants.

Adding value to wool and mohair

The CSIR is implementing an Eastern Cape government initiative to support the growth and development of SMMEs that add value to wool and mohair. The programme supports approximately 15 companies and is having a strong positive impact. The CSIR's textile group is also involved in assisting the national government's countrywide wool and mohair cluster initiative, which supports growth and development of value-added industries.

Adding value to wool and mohair in South Africa is a key objective for economic growth and new employment opportunities. These initiatives will consolidate the interest of small enterprises throughout the country.

The programme includes product development of everyday consumer items, familiarisation tours of value-adding industries, a province-wide Xhosa jersey design competition, on-site training courses and productivity studies. Currently a website is under development to act as a collective marketing tool for Eastern Cape small and medium size enterprises. The site will enable buyers nationally and internationally to source unique wool and mohair products from the province.

Novel processing for platinum metals

Metal ores generally have to undergo preparatory treatment before the ore can be smelted to recover the required metals. With the platinum group metal (PGM) ores, sulphur has to be reduced to a sufficiently low level.

The CSIR was contracted to perform pilot scale fluidised bed test work to evaluate a novel new processing route for PGM-sulphide ores. This involved "dead-roasting" the 30 tons of PGM sulphide concentrate in a fluidised bed before smelting. The ore was heated to temperatures in excess of 1 000 °C to

IT gets the best out of wool

Expert systems, using

knowledge-based computer programs have been developed by the CSIR to assist in the

beneficiation of wool. They are used for classing wool, and in the valuation, pricing, processing and engineering of wool worsted fabrics.

These expert systems are important steps towards more cost effective production, processing, utilisation and beneficiation of South African wool. Demonstration models will be tested with the farming and manufacturing sectors.



Realising our country's goals through technology solutions and information

remove the sulphur, before being submitted to another company for smelting and leaching tests. In addition, operation and process data were obtained which will enable scaling up of the design to full industrial capacity.

In a second pilot test for a local minerals processing company, three tonnes of the client's slag material was processed to verify the proposed process. This involved an oxidative roast of the slag followed by a reductive roast using *in situ* gasification of a selected coal. During each stage, different operating conditions were tested including varying the type of coal used as an energy source.

The test work supplied sufficient information for an environmental study and allowed the client to proceed to a further stage in the design of the industrial plant with a greater degree of certainty.

Coal mining looks to the 21st century

To assist the South African coal mining industry to remain globally competitive, sustainable and safe well into the

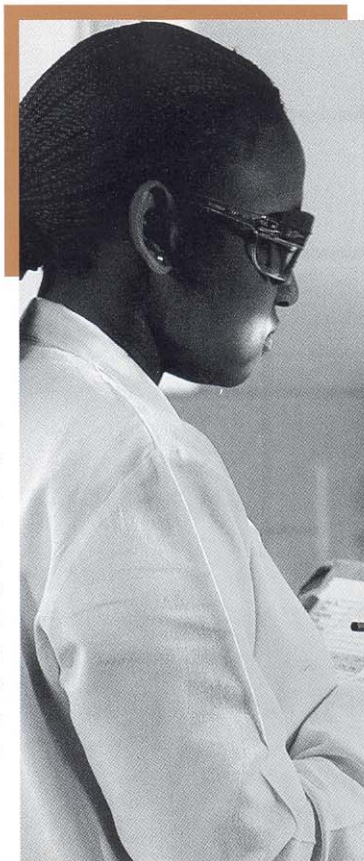
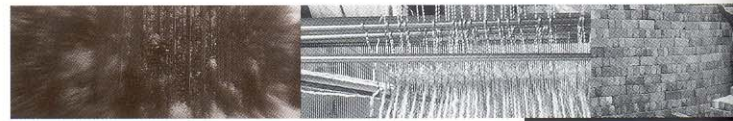
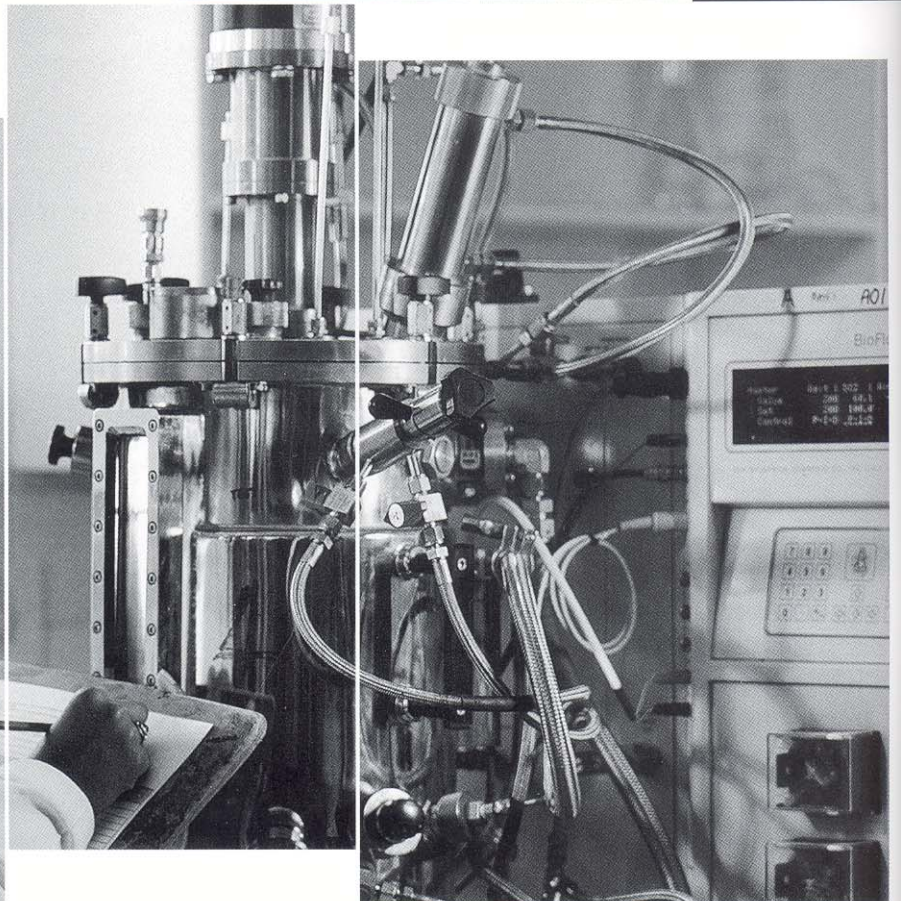


Image analysis tests performed at the CSIR have opened up the possibility of characterising micro-organism physiology. This technology has proved useful in determining the physiological state of micro-organisms in industrial-scale fermentations.



21st century, a collaborative research effort, COALTECH 2020, has been launched which will focus on developing new technologies and mining methods.

COALTECH 2020 is being driven by the CSIR as a collaborative effort between mining groups, research organisations, educational institutions, government and labour. All major stakeholders have been involved in the development of the COALTECH 2020 research programme formulated around six priority areas: geology and geophysics; underground mining; surface mining; coal processing and distribution; human and social aspects; and surface environment.

The initial focus is on extending the life of coal mining in the Witbank/Highveld coalfield to the year 2020 and beyond.

Putting crops in the SPOTlight

A decision by South African fertiliser manufacturer, Kynoch, to use satellite-derived information provided by the CSIR to add value to their service, is proving to be of great benefit to the agricultural sector.

The earth observation satellite, SPOT, produces images of biomass variation per 20-metre area, leading to an extremely accurate soil variation picture. The application rates of seed, fertiliser, herbicides and pesticides can be applied with maximum precision according to the identified soil potential at a specific position in a field.

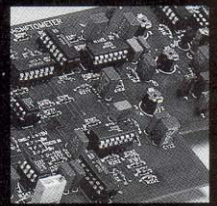
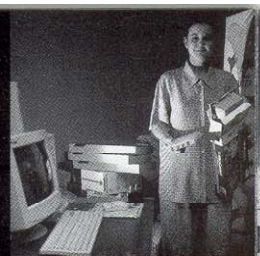
Satellite imagery provides an affordable precision-farming mechanism. By identifying management zones and managing fertiliser application – especially nitrogen – accordingly, increased income of R350 per hectare has been achieved. These results, the environment-friendly impact and the support for agricultural applications offered by the CSIR have significantly increased the demand for the provision of precision farming services based on remote sensing.

Blueprint for the automotive industry

The CSIR is working in close co-operation with the Fraunhofer IPA Group from Stuttgart, Germany, in assessing the current status and needs of the local automotive industry. This is the first phase of a project aimed at developing a business plan for an Automotive Industry Development Centre.

The needs analysis is in the form of a detailed structured questionnaire delivered in individual interviews with about 70 local companies. The Fraunhofer team is also interacting with various German companies linked with local automotive component suppliers to obtain input and long-term strategic vision for their local subsidiaries. A database containing this information is being constructed to enable efficient analysis.

The project is funded by the Department of Trade and Industry, the Gauteng Provincial Government, the Bavarian Government, the Pretoria Metropolitan Council and the CSIR.



A cut above the rest

A laser system which performs

fast and accurate profile cutting and engraving on a variety of non-metals has been designed and



built by the CSIR. Instead of painstakingly cutting out architectural models by hand, engraving on granite or etching on leather goods, this system uses a laser beam to perform tasks, including intricate detail, with effortless speed.

The system is extremely flexible and quick to change being CAD-linked and computer controlled, and can be custom built to suit client requirements.

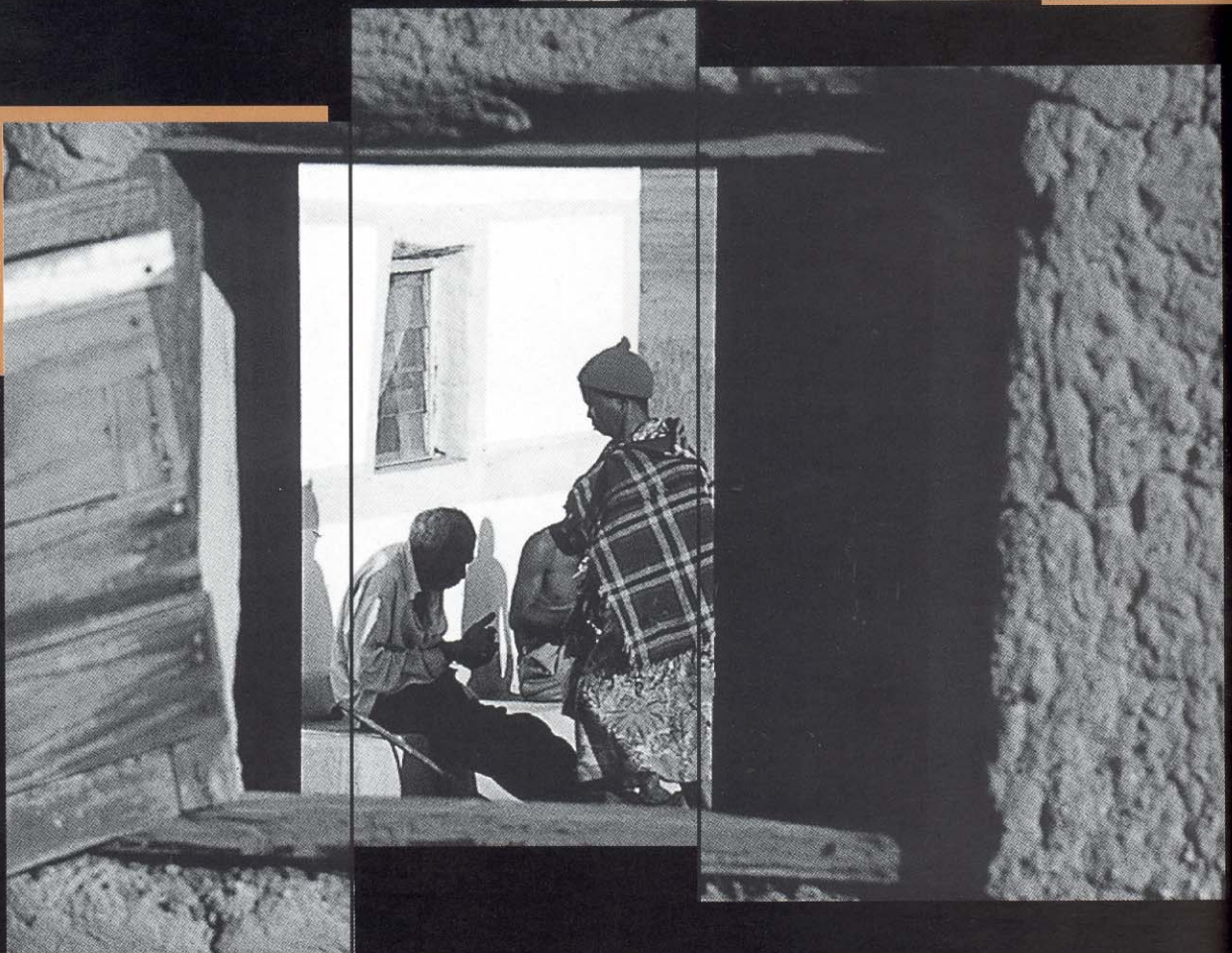
Quality of life

Urban and rural communities need social and technological innovations to assist them in achieving a better quality of life. The CSIR plays a crucial role in providing policy, tactical and technological support to assist in meeting the need for housing, water and sanitation, a safe environment and health care.



The use of earth in construction can be found in traditional technologies that are still practised in many rural and some urban areas of South Africa. A forum has been established to promote earth as a building material which respects these traditional technologies. The forum is addressing factors such as appeal to communities, government, financing institutions and industry.

The CSIR wants to demonstrate the feasibility of upgrading technologies to all stakeholders.



Now they will need wings

A low-cost, workable solution to curb escapes from police detention has been developed by the CSIR in a joint project with the SAPS. The system is easily managed and incorporates appropriate security technologies to prevent escapes.

It provides an infrared sensing "curtain" just below and above the exercise yard grille. When it detects any suspicious movement it raises the alarm. Artificial intelligence reduces the occurrence of false and nuisance alarms. In addition, practical suggestions have been made regarding the strengthening of external walls and exercise yard grilles and facilities for visitors.

A national roll-out of this system as a minimum level of workable security for police cells is being planned jointly by the CSIR and SAPS.

Synthetic bones offer new hope

Entirely synthetic, highly porous bioceramics for bone substitute applications have been developed by the CSIR in collaboration with the Bone Research Laboratory of the Medical Research Council and the University of the Witwatersrand Medical School.

The development is globally significant. It relates to the high incidence of bone loss following severe trauma or disease. If a bone defect exceeds a critical size, natural bone regrowth will not occur and it becomes necessary to introduce a bone substitute or implant. At present, bone grafting is accomplished using materials derived from natural sources. However, due to risk of, for example, immune response, there is strong international interest in fully synthetic substitutes.

The newly developed materials have been extensively tested and are now approaching clinical trials. If successful, they will answer the need for substitute products which can be produced, sterilised, and stored at minimal cost and risk.

'Sandcastle' gets new meaning

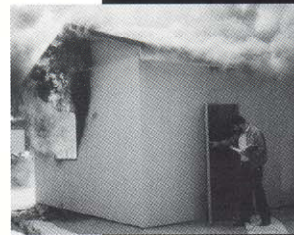
The most important reason for using earth as a building material is its availability as an accessible, environmentally friendly and less costly alternative to more conventional materials. A Forum for Earth Building Technologies has been established to bring together people interested in promoting earth as a construction material. The members are the CSIR, the Cement and Concrete Institute, the University of the Witwatersrand and the Australian Aid Agency.

Earth-based construction can be found in traditional technologies that are still practised in many rural and some urban areas of South Africa. Capturing and building on this knowledge is critical for low-cost, sustainable housing that is often more energy efficient and inherently more healthy than conventional housing.



New fire safety design code

The CSIR has developed a performance-based fire safety design code in draft. It is a technically complete regulation



incorporating all aspects of fire safety design. It includes the functional objective for each aspect of fire safety, a strategy to obtain objectives, and performance criteria to measure the long-term performance of a building exposed to fire risk.

The code is uniquely applicable to South African conditions.

Supporting the provision of basic needs for housing, water and sanitation, a safe environment and health care provision

A pilot project has been initiated in Lckgopung in the North West Province to test the upgraded raw earth block technology, traditionally used in the area. A best practice guide will be compiled at the completion of the project, as well as an assessment of the community's response to the re-evaluation of its traditional knowledge.

Early warning system to beat crime

As part of the CSIR-wide initiative to mobilise technological solutions to combat crime, an early warning system designed to meet the needs of farmers has been developed.

The Home Information Security System (HISS) is based on world-class expertise in various surveillance and electronic technologies. It provides information to farmers while in the home or via remote control when returning to the farm on the security status of their dwellings and immediate surroundings.

The system operates on the principle of movement detection and uses neural and artificial intelligence. It can



The CSIR is facilitating the technology transfer of the installation of wind turbines at the Lubisi Dam Development Centre.

The turbines provide environmentally friendly renewable energy to the Centre. The CSIR enabled the installation and provided training on the use and maintenance of the turbines to the community.



be installed in trees, bird trays, poles and rocks so that it is indistinguishable from objects found in the typical garden.

The system has already been installed on a number of farms in the pilot and test phases and much interest has been generated in the farming community.

Disease-resistant pearl millet

Food security is a pressing problem in Africa which is aggravated when food with good nutritional potential is lost through disease or bacterial attack after harvesting. Based on the CSIR's successful genetic engineering track record, the organisation obtained European Commission (DG XII) funding for a project to genetically enhance pearl millet for downy mildew resistance.

The long-term goal is to help farmers produce pearl millet varieties with improved disease and adaptability control. This will result in increased crop yields. Pearl millet is a valuable staple food in the semi-arid areas of Africa and Asia, constituting a major source of energy and protein for millions of people.

The research aims at fine-mapping, isolating and characterising genes underlying downy mildew resistance in pearl millet, which affects crop adaptability and yield. The isolated genes will provide a resource for future crop improvement, and allow elucidation of the resistance mechanisms. The genomic information of pearl millet traits will also be available for researchers to exploit in other crops.

Key role in Umtata's teaching hospital

As specialist advisers to the appointed professionals and the Eastern Cape Health and Works Departments, a team from the CSIR has assisted in making the design of a new R350 million medical teaching hospital in Umtata a reality.

The entire planning and briefing process was workshopped with all role players, resulting in a full and detailed brief. This process was completed in only seven months instead of the usual two to three years.

The CSIR team contributed to the effective flow of information between team members and the development of the brief and concept design. Features of the design are the incorporation of appropriate technology and a focus on low life-cycle costs.

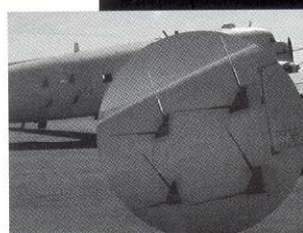
The new hospital will have 540 beds, a special out-patients department, 10 operating theatres, a 14-bed intensive care unit, an accident and emergency department, a trauma unit and specialist X-ray facilities.



At the cutting edge of radar

With its specialised radar

expertise, the CSIR has provided decision support to the SANDF in the procurement

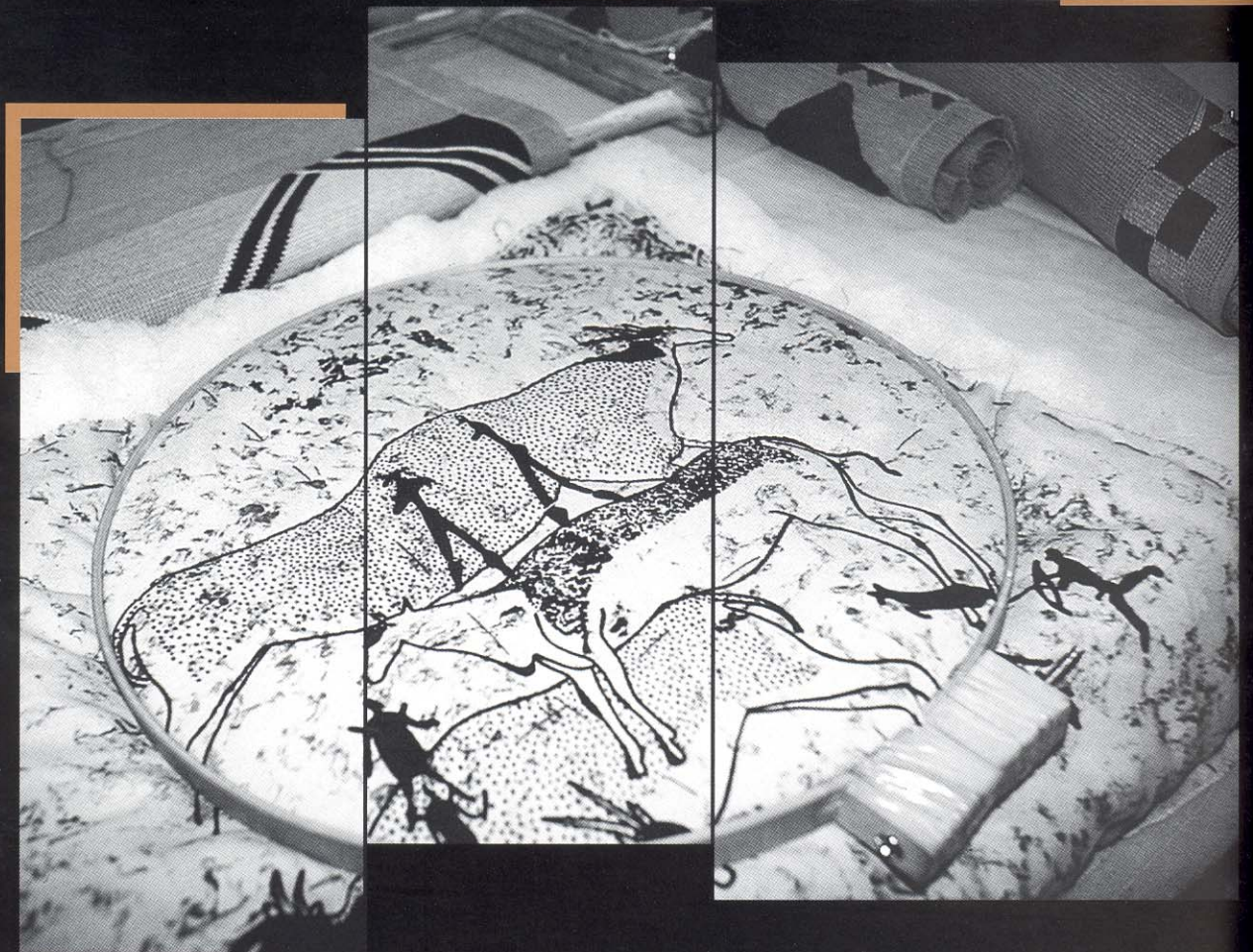


of synthetic aperture radar and the development of operational doctrines and applications.

The CSIR has obtained its first images with the SASAR VHF synthetic aperture radar developed in conjunction with the University of Cape Town and local industry. This radar uses the aircraft's motion to obtain a high resolution image of the ground akin to an aerial photograph. Key advantages include the ability to image at night, through clouds, and at long ranges.

Human resource development

An empowered human resource pool is fundamental to achieving national goals. Industry and the corporate sector contribute to this through the choice and implementation of organisational and management systems, as well as providing ongoing training to improve the skills of their workforce. The CSIR is playing its part by contributing to human resource development in science and technology so as to create a technologically effective nation.



The CSIR assists business and community groups to develop textile projects with the aim of combining indigenous textile skills, business investment and technical training to help improve the quality and competitiveness of traditional crafts, while at the same time creating jobs.



Breezing through staff assessments

Staff evaluations need not be a dreaded item on the annual working calendar. With the help of the web-based tool Aviator, evaluators can easily point and click their way through complicated forms.

Developed jointly by the CSIR and human resource specialists Creative Management Technologies (CMT), Aviator is an effective, easy way of completing staff evaluations with all processing and calculations done "behind the scenes".

Being web-based, world-wide performance evaluations in real time are possible for global companies, and employees or supervisors can complete and submit assessments regardless of location. Automatic archiving enables instant tracking of performance and development over long periods – all within the confines of a desktop.

Tackling the ABC of road safety

Of the multiplicity of solutions road safety requires, the most essential is the participation of informed citizens. The CSIR is meeting this challenge by targeting school groups and has pioneered the development of road safety education and products to support this.

School children from three high schools participated in the initial project, which focused on an approach known as Participatory Education Technologies. This includes the use of theatre, group techniques, modelling and mapping. Teachers were trained in the use of the techniques and under CSIR guidance learners undertook the research, design and development of products.

In the process teachers were provided with additional skills and methods in the traffic safety teaching environment, and the pupils gained practical understanding of the research and development process of a product.

Innovation in the building industry

Planning and managing innovation will make a successful business more successful. To promote innovation in the building and construction industry two booklets aimed at small and medium enterprises have been developed. The CSIR did the research for the guides for Agrément South Africa, an organisation which assesses non-conventional building products, materials and systems.

"An introduction to innovation in the building and construction industry" is a user-friendly booklet prepared for the small entrepreneur. It covers opportunities for innovation, encouraging innovation and a comprehensive list of contacts and resources available to small entrepreneurs. "Innovation in the building and construction industry: guidelines for SMMEs" contains more detail especially on the innovation process.

Wealth in the palm of a hand

Palm wine produced in

northern KwaZulu-

Natal has a very

short shelf life, or it

did until recently.

Researchers at the

CSIR, working with

the Manguzi

Development

Information Centre, have

developed a technology to give

palm wine, known as Ubusulu,

a much longer shelf life.

In Maputoland some 300 cutters make a living from producing and selling Ubusulu. But sales are severely restricted by the product's short shelf life, making it available only in limited areas of KwaZulu-Natal.



Empowering people through developing expertise and transferring skills

Enhancing employment opportunities

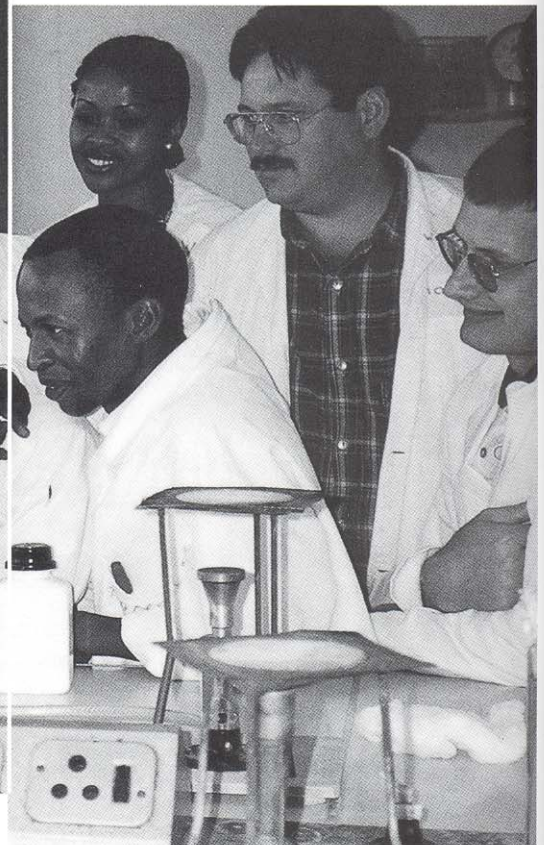
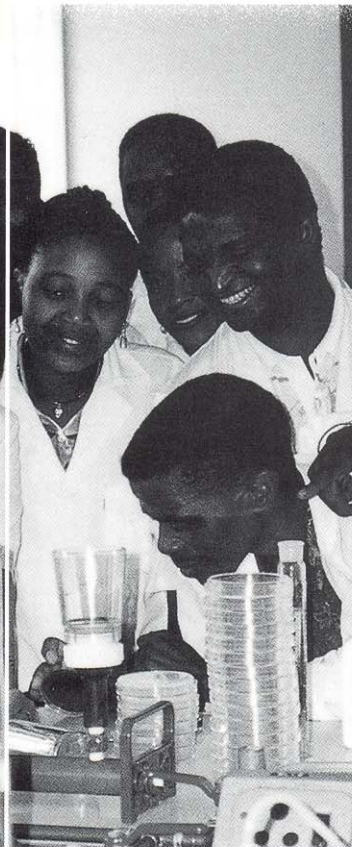
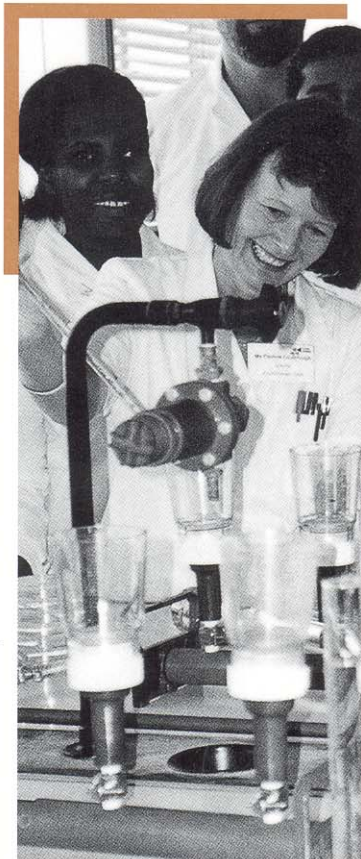
Valuable information gained from 12 pilot projects by the Department of Public Works has been captured by the CSIR. The projects were all part of the National Public Works Programme aimed at reducing unemployment, providing education and training to unemployed people and empowering communities through building capacity.

The CSIR reported results from case studies of the 12 projects to the department and quarterly seminars were arranged to convey the findings to public works practitioners in the field. The information gathered during the process has been used to develop guidelines on enhancing employment opportunities in the delivery of infrastructure projects.

Providing support for entrepreneurs

Providing extension services to small and medium enterprises is a critical factor in their growth and sustainability. Overseas countries make major investments in delivering such services.

The CSIR, in partnership with Ntsika and the National Productivity Institute, supported the establishment of the two



The CSIR offers training to people working in the water industry who need to know about the basic techniques for the microbiological analysis of water. The course covers basic concepts of health-related water microbiology as well as theoretical and practical aspects.

pilot Manufacturing Advisory Centres in Durban and Port Elizabeth. Now in their second year of operation PERMAC and DUMAC have assessed 224 small and medium enterprises, facilitated the acceptance of six Sectoral Partnership applications and assisted six SMMEs with the implementation of quality systems.

The CSIR is committed to supporting the Department of Trade and Industry in developing the pilots into a sustainable national programme. The current pilots are funded by CSIR, Ntsika and DANIDA.

Spearheading national drug programme

Drug abuse correlates with crime, and there is evidence nationally and internationally that a reduction in the use of drugs would contribute to a reduction in crime. To this end a programme has been launched to train non-medical people to evaluate a suspected drug impaired person.

After training they will be able to determine whether a person is under the influence of alcohol and/or drugs or not, as well as the category or categories of drugs causing the impairment.

The CSIR is part of the programme's multi-sectoral Steering Committee which includes representatives from the Attorney-General's office, SANCA, Human Sciences Research Council, Institute of Traffic Officers, SAPS, SA Medical and Dental Council and the departments of Correctional Services, Education, Health, Justice, Transport and Welfare.

A management plan has been drawn up and the next phase includes the training of a core group of law enforcement officers and securing funding and partnerships to ensure that the plan is implemented.

Architecture by teamwork

Community consultation was taken a step further in the design of a telecentre at Manguzi in KwaZulu-Natal with members of the rural population participating in every step of the development.

Three business units of the CSIR pooled their expertise in designing the centre using an "architecture by team" approach. The concept is gaining ground in South Africa because of the recognised need for consultation. The CSIR team walked the site with Manguzi Community Project members, revisited and refined the brief, established a rough cost framework, determined interrelationships, designed the various buildings on the site and then built 1:100 scale models of the main building and a smaller scale site model.



Sun dried food for lean times

In many rural households there

is an overproduction of food at certain times of the year and a lack of technology to

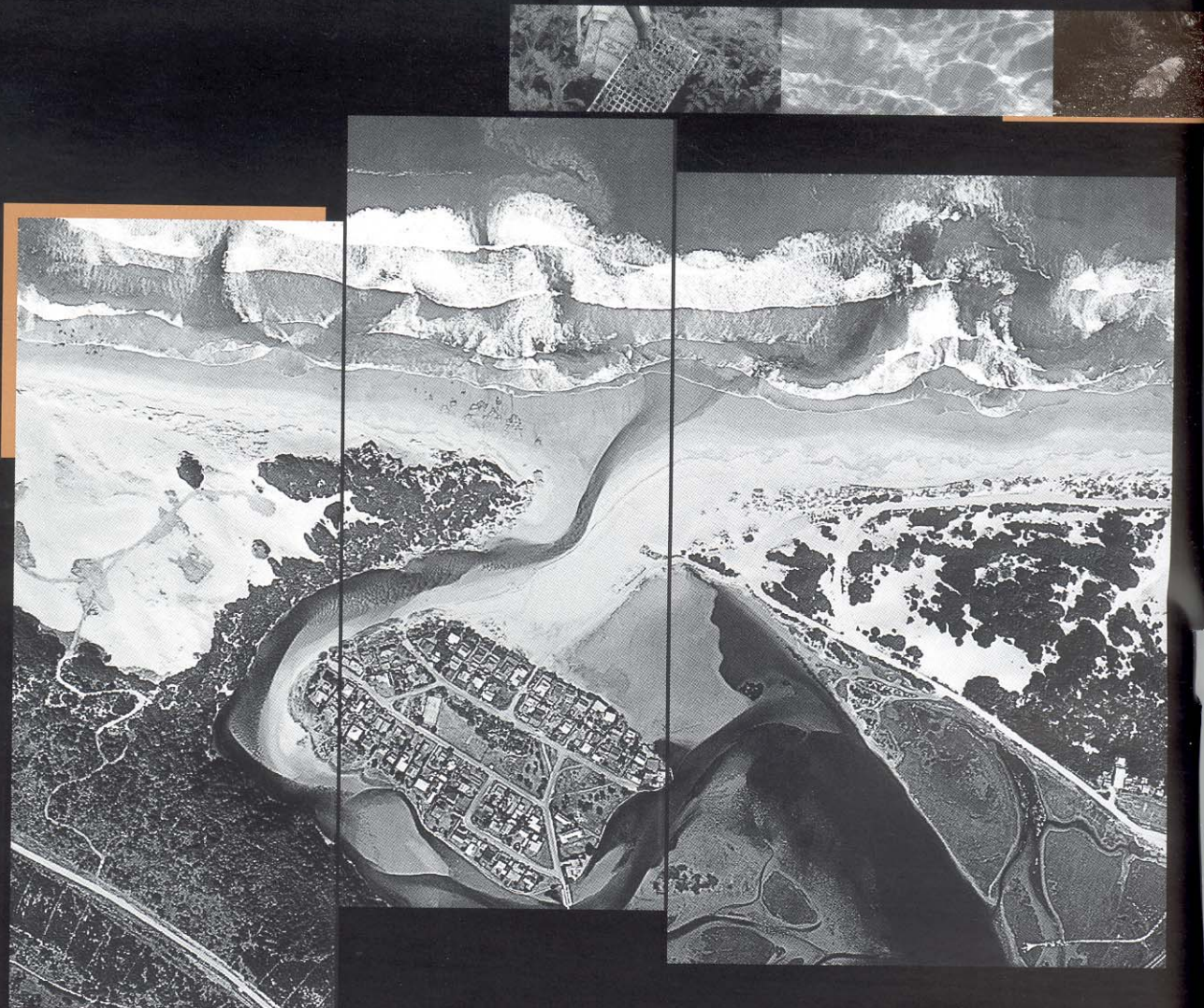
preserve the food. A comprehensive sun drying course applied to about 30 household products has been developed by the CSIR with funding from the United Nations Development Programme and Ntsika.

Fifteen trainers have been trained and 120 households have been provided with the ability to store fruit and vegetables to ensure an improved food source throughout the year.



Environmental sustainability

Potential international partners, not to mention future generations, will judge South Africa harshly if it pursues economic growth at the expense of environmental sustainability. All technological endeavour must be scrutinised and innovative practices must ensure that both economic and environmental goals are achieved. The CSIR has the most extensive knowledge base on the continent relating to the management of the biophysical environment, as well as experience in integrating all aspects of environmental planning at the policy, strategic and operational levels.



Aerial view of the Groot Brak river and estuary, where the CSIR is involved in the implementation and refinement of a management plan of the estuary.



Web-based EIA workbench

In a world first, the CSIR has developed an internationally accepted web-based Environmental Impact Assessment (EIA) workbench. Experts attending an international conference raised the need for such a workbench to provide up-to-date information, data and advice on the execution of EIA projects. CSIR software engineers and environmental assessment experts provided the solution by using innovative database web design and web integration.

The international and local EIA community now has access to a system which provides a work flow environment that ensures meticulous processing during an assessment.

Audit of indigenous conservation

The CSIR has been appointed as the lead research agency in a major project to audit soil and water conservation initiatives throughout South Africa. The focus is on capturing examples of good conservation practices resulting from the application of indigenous technical knowledge, which is regarded as a key for ensuring environmental sustainability.

The objectives of the audit include gathering data; understanding successful community-based land management; enhancing networks; proposing mechanisms and financial instruments for enhancing sustainable land management; and developing a national policy framework for community-based environmental management.

The audit falls under the Land Care Initiative of the Department of Agriculture, with funding from the Department of Water Affairs and Forestry.

New national map tracks aquifers

A map identifying South Africa's groundwater resources in terms of susceptibility to contamination has been completed by the CSIR and consultants Parsons and Associates. The map gives national planners and managers a perspective of the entire country.

The principal purpose of the map is to facilitate national planning, especially in areas where rainfall is low and surface water resources are scarce thus making groundwater a particularly important commodity.

The map has a range of applications and uses, including identifying areas where the chances of contamination are high. It will enable industry and interested parties to assess the risk their activities pose to the groundwater system and allow them to implement effective countermeasures.

First State of the Environment Report

A project by the Department of Environmental Affairs and Tourism (DEAT) to produce South Africa's first National State of the Environment Report is being co-ordinated by the CSIR and is on track to meet its October 1999 deadline. It is

Constructing roads of waste

The CSIR has been involved in a number of projects looking at the re-use of waste materials and by-products for road



construction. One of the most successful has been the SASOL ash project, which investigated the use of waste ash, produced in large quantities by SASOL's coal gasification process. The ash is used to produce a product called Premamix.

Re-using waste has environmental benefits and reduces the cost of stockpiling. It also reduces the cost of road construction. The SASOL project has all of these characteristics.

Integrating environmental planning and helping to strike the optimum balance between development and the conservation of natural resources

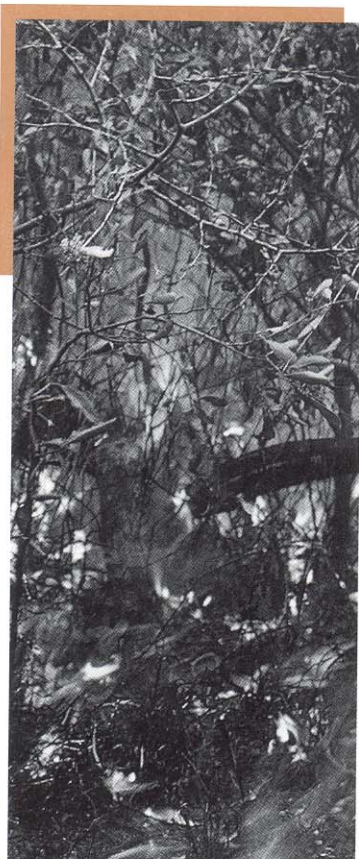
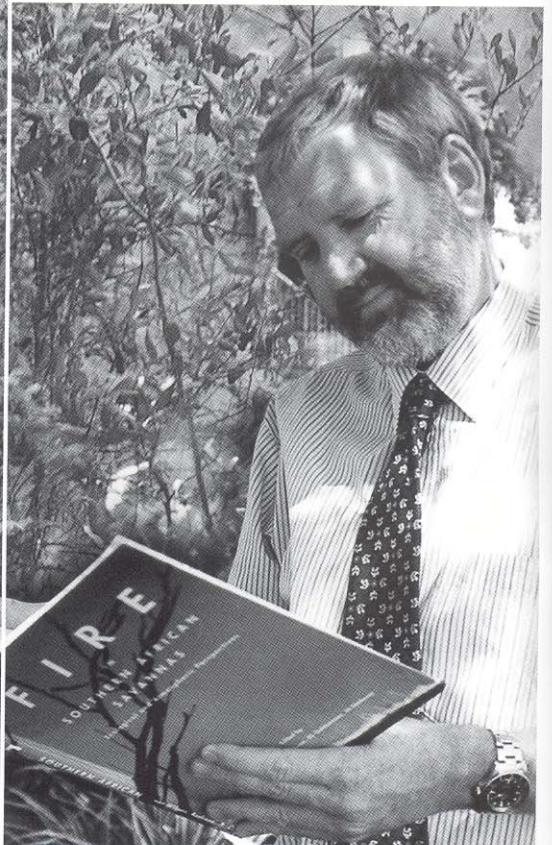
running in parallel with a process to produce various City State of the Environment Reports. Four cities – Johannesburg, Pretoria, Durban and Cape Town – are involved in the pilot phase.

The purpose of state of the environment reporting is to support development decision-making by providing objective, comprehensive, scientifically based environmental information. It will increase understanding of environmental trends and conditions, and their causes and consequences, provide a foundation for improved decision making and facilitate measuring progress towards sustainability.

Recycling plastic soft drink bottles

Soft drink bottles are manufactured from polyethylene terephthalate (PET), which is fully recyclable. At present, PET bottles end up in land-fill sites and there is no technology available in South Africa to recycle and process PET.

The CSIR is running a project funded by the Department of Arts, Culture, Science and Technology to develop and adapt existing technologies to recycle and process PET for local



Some five years of hard work on one of the most exciting environmental science projects yet undertaken in southern Africa has culminated in the publication of a book "Fire in Southern African Savannas: Ecological and atmospheric perspectives" with key contributions by the CSIR. The book documents the contribution of veld fires to greenhouse gases and to climatic changes.

needs. The benefits could be employment opportunities, South African-owned technology and intellectual property, and enhanced competitiveness in the local textile and plastics industries.

A community development project has been started in Mamelodi and several schools are participating.

Safe alternative to pesticides

The traditional approach to preventing insects attacking crops has been through the use of insecticides. However, accumulation of some insecticide residues poses a risk.

The CSIR has developed an entirely safe and environmentally friendly solution, which exploits pheromones – the chemical compounds secreted by insects as an essential part of the mating process. The CSIR is able to produce novel polymeric matrices which deliver the right amount of pheromones for the required duration to disrupt the insects' mating.

Role in seismic surveys and oil exploration

The search for oil around South Africa has returned to the sea off KwaZulu-Natal and the CSIR is contributing its skills to ensure the environment is not adversely affected. Phillips Petroleum South Africa Pty Ltd with its coventurers conducted marine seismic explorations in December 1997 and January 1998. A comprehensive pre-seismic Environmental Impact Assessment and Environmental Management Programme Report were prepared by the CSIR and approved by the Department of Mineral and Energy Affairs.

The finding of the CSIR's EIA indicated that marine seismic surveying is a short-duration, low-impact activity which will have negligible effect on the environment. The seismic survey results were promising and the CSIR is now involved in a second EIA on the effect of drilling prospect holes in the survey area.

User-friendly database for estuaries

The management of South Africa's estuaries will be more effective with the use of the PC-based data management system developed by the CSIR.

The new estuarine database facility overcomes many of the problems that have made the retrieval of data tedious and often ineffective. It is flexible and easy to operate and takes into account variability in data formats, the large diversity in data types and the often quite small data sets.

The design was based on investigations which the CSIR, in collaboration with WAM Technology cc, did in developing a similar system for coastal marine data and information for the Department of Water Affairs and Forestry.

Because the system operates from a PC, has a modular structure and requires no special software, it can be easily applied by institutions for managing their estuarine data sets.



Revolution in water treatment

The CSIR has developed a low-cost, environmentally friendly water-stabilisation system which revolutionises

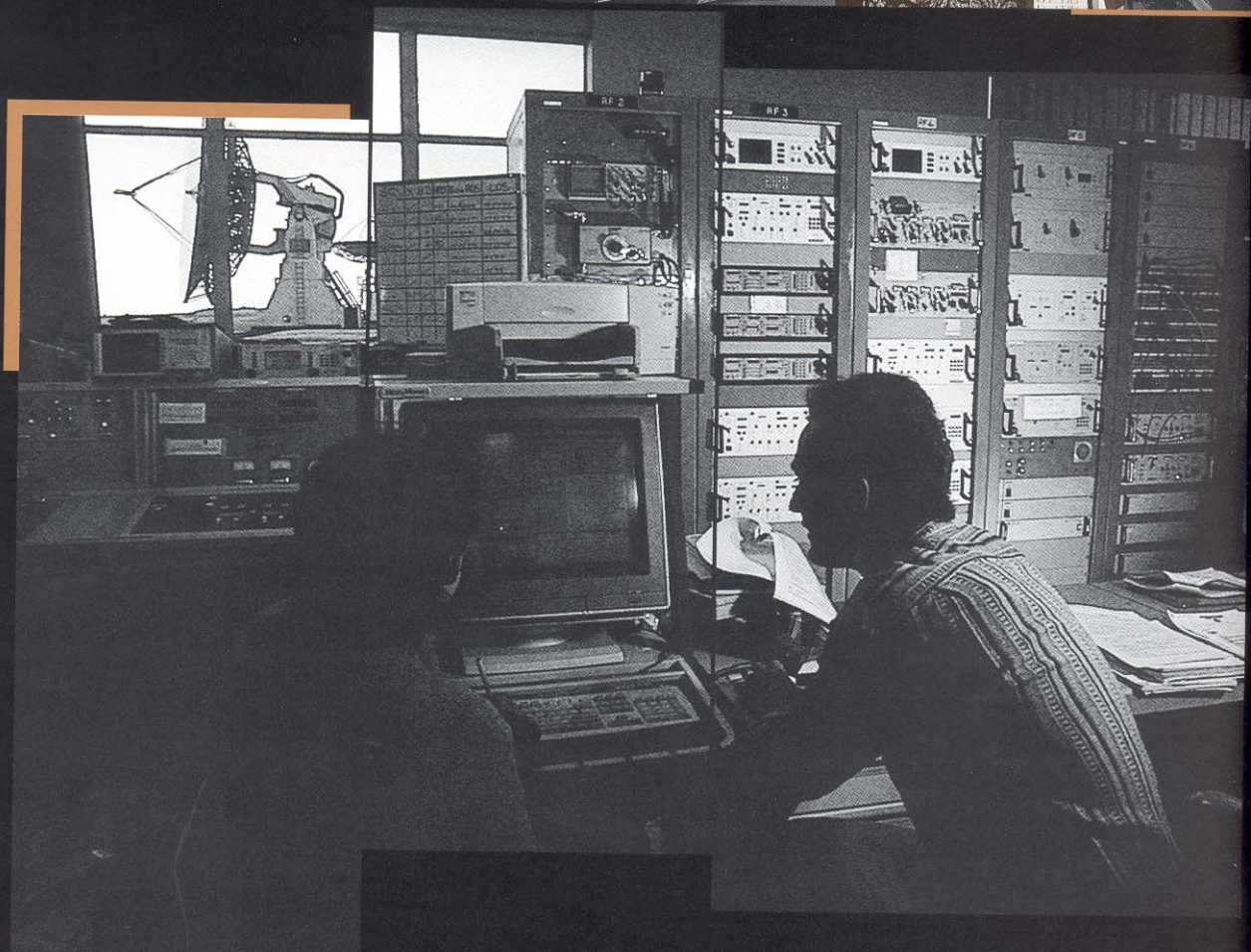


the way water is treated. Currently, pipe maintenance and repair due to corrosion is a major hidden cost. Soft acidic water attacks concrete and metal, corroding and destroying underground and household pipes, geysers and water supply reservoirs.

The CSIR's water-stabilisation system uses naturally occurring calcium carbonate (limestone) to make water less corrosive. It has been designed for low maintenance.

Promoting the information society

To ensure that the world of "haves" and "have-nots" is not replaced by a world of "knows" and "know-nots", the CSIR is applying the vast potential of information and communications technology (ICT) to support education, promote social development and prevent marginalisation. The CSIR's vision of South Africa's information society is to serve our country's needs by taking the benefits of ICT to every level of society.



The CSIR Satellite Applications Centre provides products, services and information related to the space industry and its applications.



Electronic buying extended to remote areas

With the latest module of the CSIR's inTouch Africa™ software system, South Africans without credit cards can conveniently do their business electronically using a debit card.

This innovation could typically assist a computer novice visiting a community centre to buy pre-paid electricity, settle accounts, search for local services, print business cards and send mail and faxes on a self-help ATM-type interface.

inTouch Africa™ is part of the CSIR's effort to improve the delivery of information to neglected groups. Fourteen service centres have been licensed in the North West Province and a multi-purpose Community Centre has recently been established at Manguzi, in KwaZulu-Natal.

New facility for evaluating radar systems

The CSIR has completed the first phase of the development of a Hardware-in-the-Loop simulator facility for the SANDF to evaluate the ability of operational radar systems to withstand electronic attacks. Other important roles will be in the acceptance testing of new radar during acquisition; the optimisation of the operational use of existing radar and associated platforms; and the definition of possible upgrades.

The export potential of the technology is illustrated by the fact that the CSIR and two international partners, EW Simulation Technology (UK) and Air Affairs (Australia), were chosen as the preferred suppliers for a similar facility for the Defence Science and Technology Organisation in Australia.

Textile laboratory information system

A comprehensive textile laboratory information system, TexSys, is the latest in Y2K compliant programmes to be developed by the CSIR.

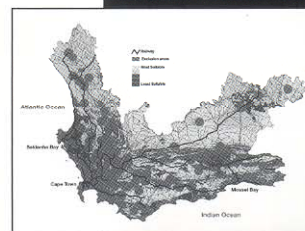
It fulfils the needs of textile laboratories for easy access to performance standards, company information, supplier information for fabric and garment manufacturers, fabric classifications, quality specifications, laboratory references, test results, historical data for trend analyses and supplier/quality management.

The system will provide better control of test house standards by ensuring a uniform application of the latest standards available. It also allows for Electronic Data Interchange between customers and suppliers resulting in better integration of the production pipeline.

Huge expansion in satellite support

The CSIR has significantly expanded its satellite support business in the last year. Facilities have been upgraded to provide support in Ku/Ka band for spacecraft operators in Region One, which consists of Europe, Africa and the Middle East. Since the system has been operational, support has been provided for Swedish telecommunications satellites, Russian communications spacecraft and a Japanese satellite. The facility positions the CSIR to grow its business in this field both locally and abroad.

GIS identifies waste disposal sites



Spoornet decided it wanted to establish a waste-by-rail scheme in the

Western Cape but needed to know which areas would be most suitable. So it approached the CSIR to conduct a "prefeasibility" study to assess options and strategies, and to identify potential sites.

The CSIR used a Geographical Information System (GIS) to pin-point areas that could be used. The GIS overlay technique proved flexible enough to incorporate further data sets and to rapidly evaluate the suitability of a given area or to compare a number of likely areas.

Improving management decision-making skills and promoting the information society through the use of information technology

Customise diets with software tool

South Africans can now become their own nutrition consultants with the help of a software program. Teaming up with strong commercial player The Kellogg Co. of South Africa and a well-known sports dietician, CSIR software engineers created a new tool, The Kellogg's Get It All Vitality Software, which determines a unique nutrition blueprint based on individual input.

The software calculates personal energy expenditure and the resultant carbohydrate and protein needs. It formulates recommended weight and body fat ranges; advises on how to follow a low-fat diet; recommends vitamins and minerals depending on age, gender and whether the individual participates in sport. In this way the software allows users to create customised, healthy diets.

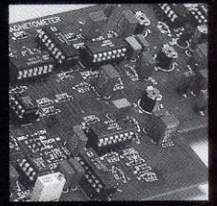
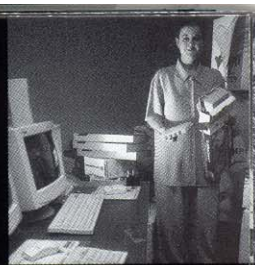
New tools boost performance in sport

The CSIR understands that South African sportsmen and sportswomen must remain internationally competitive. This requires objective and accurate descriptors of performance. Video technologies coupled with computer hardware and software are revolutionising the analysis of sports performance.

Computer-based analysis and mapping of crime information is a major tool in crime prevention.

The CSIR has run two pilot projects at the Johannesburg Area Office and Brooklyn Police Station, where Geographical Information System (GIS) and appropriate statistical techniques were introduced. Mapping crime has helped crime prevention officers gain a better understanding of crime in their areas of jurisdiction and it has helped in addressing crime more effectively.





The CSIR's Sports Technology Centre is a recognised innovator and pioneer in the development of advanced computer-based information technology solutions for enhancing sports performance, using real-time and asynchronous approaches. Information and data generated by the Centre's first product, known as Crickstat, were used successfully by the United Cricket Board of South Africa and national coach Bob Woolmer to develop winning strategies in both the 1998/99 West Indies tour to South Africa and the 1999 SA tour to New Zealand.

Evaluating the electronic "enemy"

A new type of military warfare is emerging as a result of the rapid growth of information technology where the threat is shifting from the physical to the knowledge domain. The CSIR is playing a leading role in ensuring that South Africa will be ready to face the threats as they occur.

By providing strategic assistance to the SANDF, and through the establishment of a specialist laboratory focused on identifying and analysing potential threats, the CSIR can help ensure that there is no disruption to the country's infrastructure. An Information Warfare Battlelab has been established focused on identifying and analysing potential threats, developing countermeasures and transferring the technology and knowledge to the SANDF.

Soon they'll be just a phone call away

Telkom is charged with installing 2,8 million telephone links before 2002. Subscriber access will be through digitally enhanced cordless telephone (DECT) technology in high-density subscriber areas. In rural areas time division multiple access (TDMA) point-to-multi-point microwave link technology will be used.

The Radio Frequency (RF) group of the CSIR was initially contracted to conduct the radio planning of four DECT systems in the Eastern Cape. This culminated in the planning of complex point-to-multi-point links in Graaff-Reinet, Aberdeen, Steytlerville, Baviaanskloof, Cango Valley, Steynsburg and Hofmeyr. More than two hundred microwave links were designed. The next contribution involved optimising the design of a high capacity DECT network in the Port Elizabeth area.

Local radar tracking system is globally competitive

The South African Navy needed an effective, modern tracking system for its Corvettes, and local industry needed a technology edge to compete against some of the best tracking systems on the international market.

The CSIR's state-of-the-art design and development capability in the areas of radar system engineering, antenna design and high speed digital signal processing, provided an attractive technology base that could be used by local industry. In collaboration with Reutech Systems an Optronic Radar Tracker (ORT) has been offered to the navy.

Magnetometer makes its name in space



CSIR technology in the specialised field of magnetometers is being utilised at the cutting edge of space applications.

A custom-built CSIR magnetometer is

currently controlling the orientation of the international message-forwarding satellite, SAFIR-2.

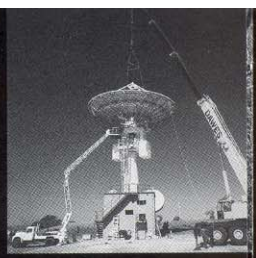
The magnetometer sailed through environmental tests conducted locally and by OHB Systems in Italy and feedback about its performance has been extremely positive.

International dimensions

The CSIR continues to play a significant role in South Africa's international relations in the fields of science and technology. Internationalisation is important in strengthening the CSIR's position domestically and in the broader region. Strategic alliances with international institutions and companies have provided access to international high-quality offerings and knowledge.

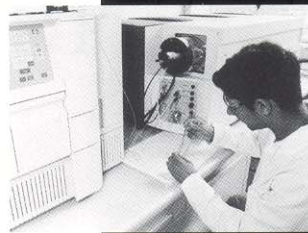


The CSIR launched CSIR-North America Inc in the USA, a company with expertise in corrosion-related pipeline problems. Recent projects include the integrity assessment of three product lines in Alabama and stray current mitigation studies in the Chicago area.



The following are some of the highlights of our work in the SADC region and internationally:

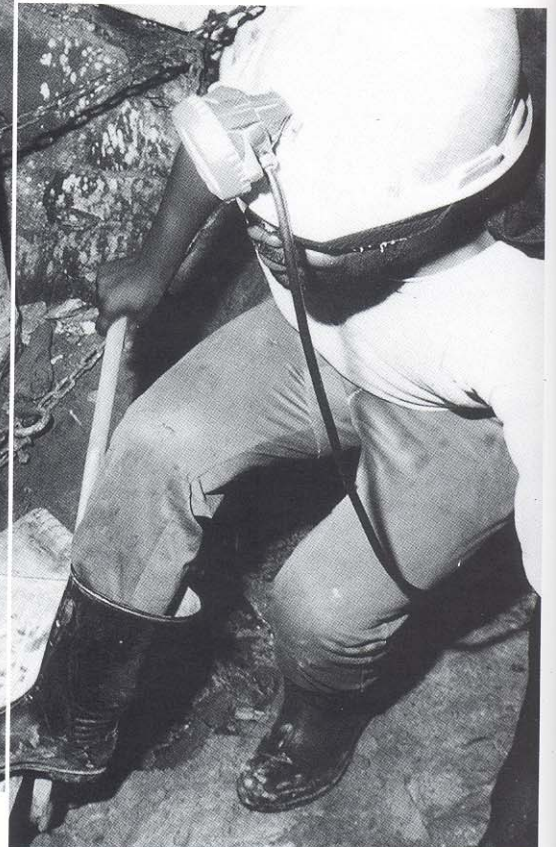
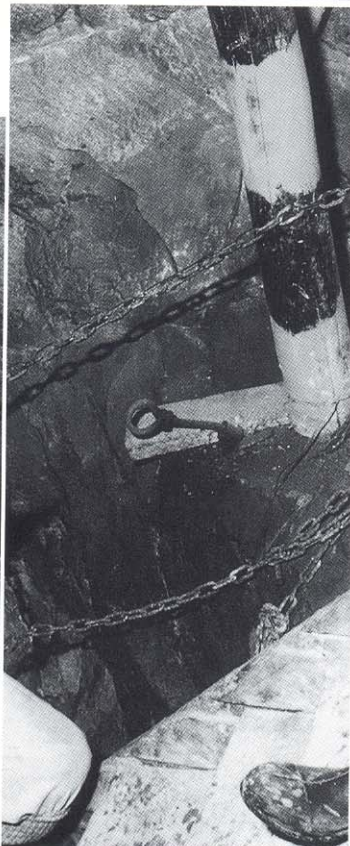
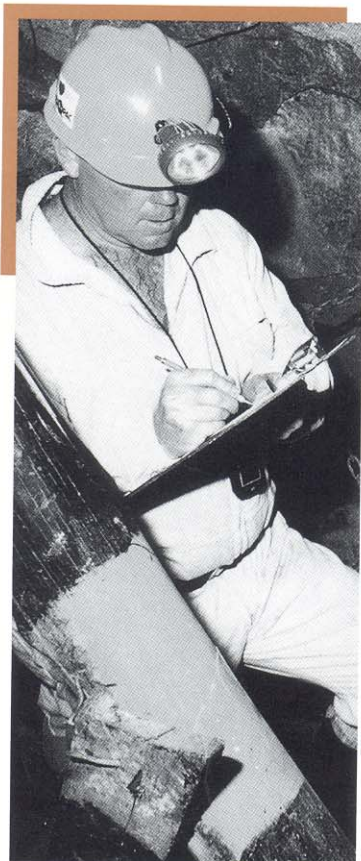
- The CSIR was the local host and chief sponsor of the Fifth International Conference on Coastal and Port Engineering in Developing Countries.
- A second batch of specialised PZT ceramic cylinders was delivered to a Danish company.
- A consignment of 22 Aeroflo filters, the air intake filters for aircraft, to SABCA in Belgium are destined for the Belgian Air Force.
- A Protocol of Scientific and Technological Co-operation has been signed between CSIR South Africa and CSIR India to promote and extend co-operation in scientific and technological development. This includes the exchange of staff and the identification and operation of joint research programmes and implementation pilots. Good progress is already being made in the areas of mining, biodiversity and SMME development.
- The CSIR tested the machine-mounted active explosion suppression system for INERIS in France.
- A detailed techno-economic study into the recycling of waste in Mauritius was completed.
- A Memorandum of Agreement signed between the CSIR and Mozambique's Eduardo Mondlane University, underwritten by the Southern African Transport and Telecommunications Commission, will initiate a programme of research, development and implementation within the SADC region.
- The CSIR undertook backfill consultancy work for Ashanti Gold in Ghana.
- The CSIR provided 336 full-scene satellite images for Earth Satellite Corporation, USA.
- The CSIR was contracted to develop an active coal dust explosion suppression system for coal mines in Australia.
- Pavement evaluation on roads in California with the aid of two Heavy Vehicle Simulators, the road testing machines developed by the CSIR, is in the fifth year of successful operation.
- The CSIR and the Netherlands Organisation for Applied Scientific Research (TNO) have signed a Memorandum of Understanding. The organisations are committed to new modes of co-operation and identifying opportunities for joint research, development and consultancy projects.
- The CSIR project manages an annexure to the Binational USA-SA agreement covering international networks for business-to-business and institutional linkages, training and education in support of the provision of extension services to small and medium manufacturing enterprises.
- The CSIR provides information and communications technology components of the "Vision for Water, Life and Environment in Southern Africa in the 21st Century" initiative.



The CSIR. Building global alliances and partnerships, expanding the frontiers of knowledge and with our partners shaping our world through the power of science and technology.

Developing and sourcing knowledge and technology, adapting them to local needs and transferring them to clients

- A Memorandum of Understanding with Egypt's National Research Centre and the Central Metallurgical Research and Development Institute will enhance co-operation. Immediate mutual interest areas are mineral beneficiation, advanced metal technologies and establishing a network for metal manufacturing in Africa.
- A contract with Diehl and Schwierz, Germany, for joint work on water treatment has been signed.
- The CSIR through ACARP of Australia is conducting a research project to investigate the use of a seismic system to predict the collapse of a mined-out seam behind a longwall face.
- The Pipeline Integrity activities within the CSIR expanded to the extent that international expansion became feasible. As a result CSIR North America, Inc. was established with an office in Houston, Texas. CSIR North America offers a multi-disciplinary consulting and testing service to numerous pipeline operators and owners across the USA. Contracts vary from integrity studies and refurbishment specifications for cross country pipelines and corrosion consulting and design of cathodic protection devices for gas distribution companies in some of the largest cities in the USA.



The CSIR is involved in DEEPMINE, a collaborative research project to acquire knowledge and develop appropriate technology to enable safe, efficient and profitable ultra-deep level mining, as well as to increase the general level of competence in this field.



The CSIR's 'engine-room' consists of 10 major, market-oriented business units. In striving towards being an organisation with no boundaries, there are also many cross-cutting and integrating initiatives which draw on skills from all the units.

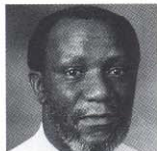
Business units



• **BIO/CHEMICAL TECHNOLOGIES**
DIRECTOR:
DAVID BATH



• **MANUFACTURING AND MATERIALS TECHNOLOGY**
DIRECTOR:
DR HOFFMAN MAREE



• **BUILDING AND CONSTRUCTION TECHNOLOGY**
DIRECTOR:
NEO MOIKANGO



• **MINING TECHNOLOGY**
DIRECTOR:
DR GÜNER GÜRTUNCA



• **DEFENCE TECHNOLOGY**
DIRECTOR:
JOHANN AHLERS



• **ROADS AND TRANSPORT TECHNOLOGY**
DIRECTOR:
PHIL HENDRICKS



• **FOOD SCIENCE AND TECHNOLOGY**
DIRECTOR:
DR PETRO TERBLANCHE



• **TEXTILE TECHNOLOGY**
DIRECTOR:
TINA EBOKA



• **INFORMATION AND COMMUNICATIONS TECHNOLOGY**
DIRECTOR:
DR BRIAN ARMSTRONG



• **WATER, ENVIRONMENT AND FORESTRY TECHNOLOGY**
DIRECTOR:
DR ANTHOS YANNAKOU

Integrative activities (examples)

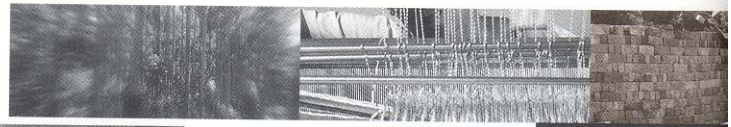
- CRIME PREVENTION
- SMALL, MEDIUM AND MICRO ENTERPRISES
- TECHNOLOGY FOR DEVELOPMENT
- INTERNATIONAL AND REGIONAL INITIATIVES
- SPORT
- VIRTUAL REALITY SOLUTIONS
- TOURISM
- ENVIRONMENT

In conclusion

As the final year of the decade, the century and the millennium comes to an end, we ask ourselves: "What can we as an organisation achieve in the future? What products, processes, innovation and solutions can we bring to fruition? What can we do today – as an organisation, as a nation – to make the world of the future a better place?"

In striving to answer these questions, we are sowing the seeds of a better tomorrow. We are creating value through people, knowledge and capital in the quest to make our vision come alive for the benefit of all South Africans.

The CSIR will continue to make a difference.



The CSIR is testing an activated saw cutter, a device used by the mining industry, which superimposes vibrations onto a conventional cutting action resulting in lower cutting forces and power requirements. It is suitable for cutting hard rock with conventional tungsten carbide saw tips.