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## CSIR TECHNOLOGY IMPACT 1998

your technology partner

## 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

*"The CSIR is an effective organisation that is enthusiastically and vigorously attempting to meet the demands of the new policy climate in South Africa...with appropriate support from government and continued good management the CSIR can progress from a very good organisation to a great one, with technical competencies of world class and contributing significantly to the nation's well-being."*

International Review Panel Report  
to the Department of Arts, Culture,  
Science and Technology, December 1997

This assessment acknowledges the CSIR's commitment to helping South Africa achieve the goals enshrined in the Government's macroeconomic policy: to eradicate poverty and stimulate social upliftment through improving competitiveness, job creation, enhancing quality of life, developing skills, protecting the environment and increasing access to information.

In pursuing this task we have a very clear role: to develop and source knowledge and technology, adapt it to national needs and transfer it to our clients and stakeholders to help them find the best solutions to their problems.

We believe that the pages that follow are striking testimony to our achievements. The stories they tell show how our work has supported the five pillars of that macroeconomic policy, and describe how far we have progressed in getting technology and innovation to where it will make a difference.

Our challenge, as embodied in our mission statement and 5-year strategy, is always to apply scientific and technological competencies that, while ensuring sustainable development, also stimulate economic growth.

As a result, the spread and diversity of our scientific and technological activities have become, by any measure, impressive: business methods, planning systems, aeronautics, advanced materials, mining, information management, manufacturing, housing, transport, food security, textiles, the environment.

In the end, it is innovation – from mind to market – which represents the focus of all our effort, and the products and services we describe are the fruit of our pursuit of scientific and technical excellence.

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# Competitiveness & job creation

MEETING THE NEEDS AND EXPECTATIONS OF ALL SOUTH AFRICANS WILL TAKE NOTHING SHORT OF AN ECONOMIC RENAISSANCE. FOR THAT TO HAPPEN OUR FIRMS AND INDUSTRIES HAVE TO BECOME MUCH MORE COMPETITIVE IN GLOBAL MARKETS WHICH MEANS, FOR MANY, RECEIVING CRUCIAL INJECTIONS OF TECHNOLOGICAL INNOVATION AND SOLUTIONS. HERE WE OUTLINE OUR CONTRIBUTION DURING THE PAST YEAR TOWARDS HELPING TO PROVIDE THOSE INFUSIONS.

## Opening the way into international markets

New products and services using piezoelectric and fibre optic based technologies developed by the CSIR's Sensor Group have stimulated considerable interest internationally.

As a result new export opportunities have been generated for South African industry and these products will form a key component of the local content requirements of the South African National Defence Force's forthcoming defence acquisitions. One example is the Airhead ultrasonic air-ranging product which measures range and level in industrial applications. At the moment it is being exported to Europe. A world-wide launch is planned this year.

Also the piezoelectric ceramic processing facility, which develops niche and customised ceramic products, has secured the first overseas orders for its products.

## RockRisk leads the field world-wide

A new system developed by the CSIR to assess the potential risk of rockbursts underground represents the most advanced technology of its kind in the world.

Known as RockRisk, this is the only program of its kind in South Africa that takes a holistic approach to the assessment of the risk of rockbursts. Using artificial intelligence techniques, the system helps gold mines to assess the risk over an area of a few thousand square metres and over a time-scale of a few months. This allows proactive measures to be taken to minimise the risk.

## Seeing what's going to happen before it happens

Casting simulation software ProCAST allows the CSIR to offer the foundry industry competitive solutions leading to shorter product lead times, reduced costs and improved efficiencies.

ProCAST is 3-Dimensional Finite Element (FE) based software that is capable of performing a combined thermal and fluid analysis of a casting to simulate the filling and subsequent cooling down of the metal during solidification.

Alumadie Castings in Kempton Park, with CSIR assistance, used the service successfully to optimise riser and runner design, improve casting yield, reduce scrap to below 2%, shorten development cycle time and cut machining cost.

Several local foundries from the die casting, sand casting and

investment casting industries are reaping benefits from computerised simulation. Process modelling was also used to develop aerospace parts prior to manufacture for local and international companies.

Computer-aided process modelling technology forms part of the Time Compression Technologies/SiliconWorks Centre which is geared to reducing time-to-market and saving cost of new product development. The centre is an alliance between CSIR, Rapid Design Technologies and Silicon Graphics.

## Making the construction industry globally competitive

The CSIR, in collaboration with major construction-related companies has embarked on a joint initiative to bring South Africa's construction industry up to world standard. Following the industrial development strategies adopted in the manufacturing and service sectors internationally, the Construction Industry Performance Improvement Initiative (CIPII) uses business process analysis to identify critical bottlenecks in the construction value chain.

Specific organisational, technological and informational product or process innovations are then used to address the bottlenecks. In developing these performance improvements, the initiative seeks to define industry best practices benchmarked against international practices. Current projects include:

- Benchmarking the use of information technology in construction.
- Developing a construction industry process protocol.
- Developing best practice guidelines for partnering in construction.
- Developing web-enabled project management tools.
- Applying virtual reality modelling to improve construction processes.

## Thermal spray repair technology

High quality surface engineering solutions are provided for South African industry at the CSIR's Thermal Spray and Repair facility. This ISO 9001 certified installation uses stringent control procedures to ensure the highest possible quality and reproducibility and has a well-equipped metallography laboratory which provides information on coating properties such as microstructure, thickness, porosity, and adhesion.

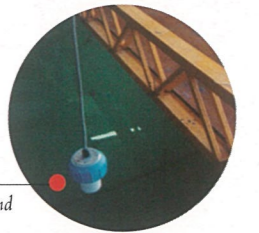
Two recent applications of the coating facility are ceramic coatings for the high-speed spinning machines of a major international producer of synthetic fibre and the development, in conjunction with Stellenbosch University, of thermal barrier coatings for diesel engine piston crowns and cylinder heads.

## Sending enemy radar dilly

The CSIR is helping the Air Force with special technologies to protect its aircraft in the air. The Fynmeet mobile laboratory was developed and built for the SAAF by the CSIR. It is used to determine the detectability of an aircraft by radar sensors and the effectiveness of active and passive countermeasures to find ways to increase its ability to survive attacks by radar controlled weapon systems.

## International market...

A number of piezoelectric and fibre optic based technologies developed by the CSIR's Sensor Group have led to export opportunities.



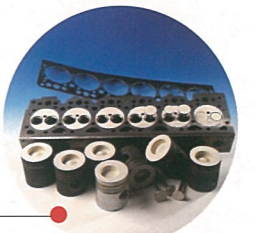
## Industrial development...

The Construction Industry Performance Improvement Initiative focuses on developing product and process innovations aimed at global competitiveness.



## Coating properties...

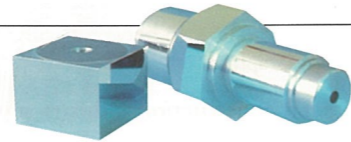
The Thermal Spray and Repair facility is ISO 9001 certified and provides industry with high quality surface engineering solutions.



The Fynmeet mobile laboratory plays a significant role in the evaluation of Radio Frequency protection suites for the SAAF.



METROLOGY, THE SCIENCE OF ACCURATE MEASUREMENT, IS ESSENTIAL IN ALL FIELDS OF SCIENCE, ENGINEERING AND INDUSTRY. THE CSIR'S NATIONAL METROLOGY LABORATORY (NML) ESTABLISHES THE COUNTRY'S NATIONAL MEASURING STANDARDS IN SUPPORT OF INDUSTRY'S GLOBAL COMPETITIVENESS.



Fynmeet measures the Radar Cross-Section (RCS), or radio frequency "signature", of an aircraft during typical flying manoeuvres. Once its RCS is known, cost effective techniques and countermeasures can be implemented to reduce its vulnerability. These may include the addition of and correct use of active and passive protection equipment, such as on-board jammers or the launching of chaff to obscure or confuse enemy radar in combination with carefully designed flight profiles.

Fynmeet is a well calibrated instrumentation radar, emitting radar pulses and measuring the reflection from the aircraft being studied. The system consists of a retractable antenna, positioner, wideband radio frequency transmitter and receiver, and sophisticated data capture and storage equipment, all packed in a container which is air-transportable.

#### A real cool miracle blanket

A fire and trauma blanket, developed and introduced locally a few years ago, is now being marketed in over 60 countries around the globe. The Burnshield Survival Hydrogel Fire and Trauma Blanket is jointly developed by the CSIR and the then SA Wool Board. Levtrade, which manufactures, markets and distributes the blanket, has created a multi-million rand, world-class facility in Gauteng.

The product is a 3D woven, 100% pure virgin wool blanket impregnated with an antiseptic water-based gel. It smothers flames instantly, can withstand high temperatures, and gives relief to burn victims by dissipating heat, moisturising burn wounds, reducing pain, and minimising infection. The antiseptic water-based gel contains an oil extracted from the leaves of an Australian tea tree, *Melaleuca alternifolia*, used by Aborigines for its soothing effect.

#### Creating work in the North West Province

A pilot project which is part of a network of Entrepreneurial Support Centres (ESC) in southern Africa was launched at Bodirelo Industrial Park in North West Province. It is a joint initiative of the CSIR, North West Provincial Government and North West Development Corporation.

ESCs are technically and infrastructurally supported manufacturing environments that use initial marketing opportunities such as outsourcing, import substitutions and export oriented manufacturing to incubate SMMEs (small, medium and micro enterprises).

At a later stage the SMMEs will provide the tenant base for commercial industrial parks, thus forming one of the government/private partnerships required for economic growth. The model for the ESC was developed by the CSIR which acts as facilitator in conjunction with provincial government and the local implementing agency.

Wool heartland gets major boost  
A major initiative to build and strengthen the growth of the wool and mohair industry has been launched in the Eastern Cape. The programme has the overarching objective of job and wealth creation through small, medium and micro enterprise development.

The Wool and Mohair Beneficiation Programme launched in Graaff-Reinet in March 1998 is a local economic development pilot project of the Eastern Cape Socio-Economic Consultative Council (ECSECC). The CSIR has been tasked with executing the programme. It will co-ordinate the implementation and will also provide expert Research and Development services for SMMEs through technical task teams whose activities will cover the entire industry.



#### Applause for our supersonic facilities

In recognition of their contribution to high speed experimental aerodynamics and in the development and operation of wind tunnel facilities; the High and Medium Speed Wind Tunnels at the CSIR have been granted membership of the newly formed Supersonic Tunnel Association International (STAI). This came about as a result of the CSIR being a member in good standing (since March 1971) and conforming to all the requirements of the Association. Through the CSIR, South Africa is one of 14 member countries of STAI.

The wind tunnels are strategic, test and evaluation facilities for the SANDEF. They also form an integral part of the SA aerospace industry. Capabilities at the wind tunnels typically include characterisation and aerodynamic evaluation of airframes, store release (CTS) testing, development of dedicated test techniques according to the needs of the aerospace industry, and tests to generate results in aeroelastic and CFD code validation.

#### Supertag™ just keeps on getting better

Business logistics – the entire gamut of movement, tracing, tracking, counting and stock taking of goods – are set to change following developments in Supertag™ technology.

Supertag™ is an application of Radio Frequency Identification (RFID) which allows for goods to be scanned, identified and counted while still packed in boxes and crates. What makes Supertag™ special, however, is that it allows items with identical tags to be counted simultaneously – the first time this has been achieved in the world.

The CSIR first announced the existence of Supertag™ in 1994. Since then the technology has been refined. A commercially viable chip at the heart of Supertag™ is now available from a Swiss supplier for \$0.23 – which could be reduced to \$0.07 through further economies of scale.

Components in the low frequency tag have been reduced to the chip module, a coil to act as an antenna and the plastic packaging. In this process the CSIR has designed a chip which measures less than 2.6mm<sup>2</sup>. For high frequency applications, the all-important reader has been greatly reduced in size and, if required, can be made as a hand-held, battery-operated unit.

#### Getting derailed mine vehicles back on track

A unit designed to deal with major derailments of vehicles in mines has been developed by a combined team from the CSIR and JCI's Randfontein Estates Gold Mine.

The new Super Hoist re-railer is not limited to any specific kind of rail track or vehicle, but has particular applications in confined spaces such as tunnels, haulages and cross-cuts in underground mines.

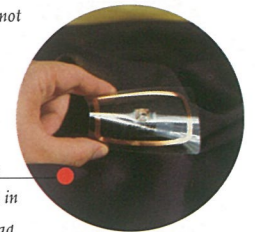
Super Hoist is transported in a dismantled state and assembled at the site of the derailment by a four-man team. The advantages of Super Hoist are that it can be transported to relatively inaccessible positions in mines, assembled without tools and operated manually without the need for a power source.

#### New seat improves aircrew safety

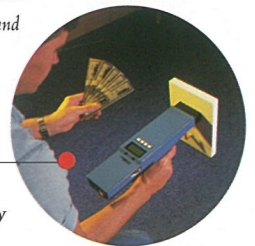
A new generation of aircraft seat which incorporates innovative technologies is being developed which will help increase the chances of crew surviving a crash. The seats, developed under the CSIR/Ammscor



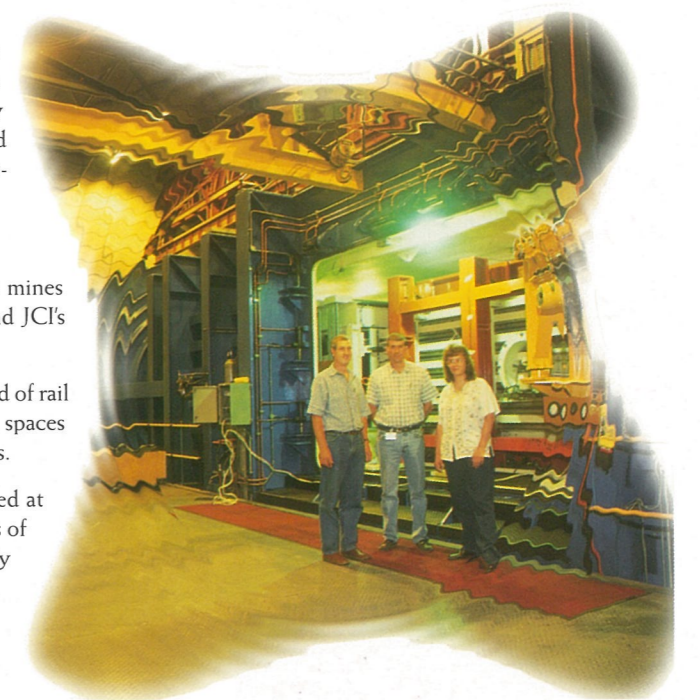
Unique to Supertag™...  
What distinguishes Supertag™ from all other Radio Frequency Identification systems is that identical items can be counted simultaneously which has not been possible before.



Refining the technology...  
The number of components in Supertag™ low frequency tag have been reduced to three – the chip module, a commercial coil to act as an antenna and the plastic packaging.

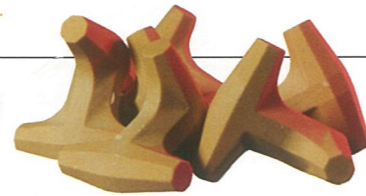


New development...  
The all important Supertag™ high frequency reader has been reduced in size and, if required, is available as a hand-held, battery-operated unit.



The Medium Speed Wind Tunnel is one of the four primary facilities performing aerodynamic tests in three flow regimes – subsonic (up to Mach 0,8), transonic (Mach 0,8 to Mach 1,2) and supersonic (above Mach 1,2).

THE CSIR'S FOUNDATION MANUFACTURING COMPETENCE RANKS WITH THE WORLD'S BEST AND IT HAS PROVED TO BE AN EFFECTIVE PARTNER IN THE APPLICATION OF MANUFACTURING METHODS AND TECHNOLOGIES TO MEET A WIDE VARIETY OF SA INDUSTRY NEEDS.



#### Foolproof spacing of roofbolts

The correct spacing of support roofbolts in mine tunnels according to the strata engineer's specifications can be easily and accurately determined with the Anchor Bolt Position Unit (ABP) developed jointly by the CSIR and SASOL Coal. The unit enhances productivity and safety – and should have a major impact on the costs of servicing roof anchor bolts.



The ABP was designed for simplicity, ruggedness and multiple uses. It interfaces with the anchor bolt drilling machine and operates on the principle of two converging laser beams, which give the machine operator an indication of spacing and direction for the drill bit. When the drilling machine operator moves into position to start a new row of roofbolts, the laser beams projected by the unit fall onto the drill tip. If the bit is too far from the previously installed bolt, two lines are visible on the bit with a flashing beam above. If it is too close, two lines are also visible with the flashing beam below. The lines converge when the drill bit is in position.

Composite Crashworthy Seat Project, uses composite materials which have better energy absorption than metal seats currently in use. Being lighter, they should be cheaper to produce.

This year more than 100 crew seats were delivered to the Oryx transport helicopter programme by the CSIR. The Oryx airframe did not allow for the advanced features of energy absorption to be incorporated. Instead the Oryx seats combine superb armour protection with superior ergonomics affording crew peace of mind and reduced fatigue levels. The seats are designed in compliance with static load cases for FAR 29 and MIL-S-58095.

#### Gravel roads test kit

The performance of a gravel road is primarily a function of the material selected, which involves testing and control of constructed layer work.

The CSIR, in conjunction with the International Labour Organisation (ILO), has developed a field test kit to evaluate borrow materials for use as a wearing course on unsealed roads.

The Field Gravel Road Test Kit ensures that the quality of the construction is appropriate. Also it is ideal for use by small contractors and in labour-intensive road constructions. In addition it determines borrow material qualities such as material grading, cohesion (liquid limit and linear shrinkage), compacted and aggregate strength. The kit is designed to make use of local water and solar energy.

#### Easier access to boreholes

A cheap and simple method for accessing upwardly inclined boreholes, that would otherwise be difficult to enter, was successfully tested over the past year.

The new borehole access system comprises a manually operated crawling device which enables the placing of a pulley and a rope in a vertical or inclined borehole for hoisting geophysical or survey equipment. This development should considerably enhance survey and geophysical applications.

#### Showing how efficiency saves money

Two manufacturing companies have been helped by the CSIR to achieve enormous savings through its Competitiveness Improvement Programme (CIP). This service is designed to help South African manufacturing companies enhance their productivity and ultimately their global competitiveness.

In the first, a fabric supplier, an analysis of its operations showed that it was utilising only 30% of its plant. When this was improved to 70%, an annualised saving of R2,5 million was achieved. A further R1 million was saved through the implementation of quality training. The second, a food company, achieved annualised savings of R3,2 million after CIP developed a strategy for optimising its capacity utilisation and improving its product throughput.

#### Extending the service life of aircraft

The CSIR's Ground Vibration Test Centre is developing techniques to monitor changes in an aircraft's vibration characteristics which can be related to changes in the condition of the aircraft's structure as it ages.

The vibration structural inspection approach promises to provide the capability to assess the structural condition of an aircraft rapidly and cost-effectively, and to provide information on areas of concern for maintenance. Because of its simplicity, this approach will be suitable for frequent inspections, making it attractive to civil and military aircraft operators.

#### Aiming for flavour of the month

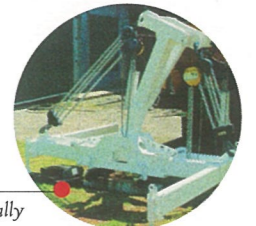
Bad odours and tastes are the prime cause of customer complaints and purchase returns in the food industry. The Food Quality Programme at the CSIR is creating a sensory and analytical capability to identify and solve taint and off-odour problems in foods, beverages and packaging, and to develop flavour quality control protocols so that problems can be prevented.

The CSIR has a fully equipped gas chromatography and mass spectrometry laboratory with the option of special detection and sampling techniques. Oxidative rancidity in snacks and pet foods, off-odours in beverages, comparisons of flavour concentrates, and volatile quality indicators in fruit juice are just a few examples of the wide range of problems that the CSIR can address.

#### New partnership focuses on barley and wheat

Barley and wheat come under the microscope as a result of a contract signed by the CSIR and Cape Grain (Pty) Ltd. In terms of the agreement, the CSIR will carry out quality analyses on barley and wheat. This includes grading and grain quality, nutritional and microbiological analyses.

This is part of the CSIR's thrust to provide a one-stop service to the grain industry. In the year under review the CSIR's Grain Technology Centre (GTC) was established to advance this process. It hosts expertise in diverse fields including grain biotechnology, processing and quality, geared to



*Saving money and time... Super Hoist has been specially designed to cope with major derailments of vehicles underground in mines.*



*Enormous savings... The CSIR's Competitiveness Improvement Initiative was established to assist manufacturing companies to enhance productivity.*



*One stop service... The CSIR has established a Grain Technology Centre to assist the grain industry.*



*Rapid and cost-effective inspections of aircraft to assess their structural condition is possible with techniques developed at the CSIR's Ground Vibration Test centre.*



RESEARCH AND DEVELOPMENT WORK ON THE PROCESSING, PROPERTIES AND PERFORMANCE OF MATERIALS IS ONE OF THE LARGEST AND MOST HIGHLY REGARDED ACTIVITIES AT THE CSIR. MUCH OF THIS WORK IS UNDERTAKEN BY THE DIVISION OF MATERIALS SCIENCE AND TECHNOLOGY (MATTEK).



meet industry needs with regard to physical, chemical and microbiological quality analyses. The development of new products such as batter mixes, pizza bases and doughs can also be undertaken.

#### New system builds on award-winning product

The next generation of the CSIR's seam inspection system has been released. LabCAM (Laboratory Computer Aided Measurement) is a PC-based quality control system used to maintain statistical process control on critical processes within canning laboratories.

The system, based on the CSIR's award-winning SeamCAM seam inspection product, has been extended to monitor most laboratory process control inspections. LabCAM's elegant seam analysis pedestal houses all the components needed to perform a complete seam analysis. This system uses powerful CSIR-developed measurement and statistical process control software. The software not only interfaces with the LabCAM pedestal, but has been extended to include interfacing with most laboratory measuring equipment through serial communication.

#### Starch gelatinisation measurement

One of the CSIR services is the measurement of starch gelatinisation to establish the correct processing conditions for instant cereal foods. The degree of starch gelatinisation that occurs during the manufacture of these foods is an important quality control measure. For example, too much starch gelatinisation in the dry masa flour used for tortillas will make the dough too sticky, whereas too little will make it brittle.

#### High integrity castings for automotive industry

The South African automotive industry and its component suppliers are facing the challenge of responding to the increasing globalisation of supply chains. As South Africa is an established international supplier of aluminium, an opportunity exists for expanding the role of local manufacturers in the global supply of high quality aluminium automotive components.

The CSIR is establishing an advanced die casting facility with the aim of improving the capability to design and manufacture complex quality parts and associated tooling. The facility is being developed in collaboration with the University of Natal and is based on a new generation 400-ton high-pressure die casting machine featuring real-time computer control of the entire cycle. The advanced process technology embodied in this unit will enable major improvements in quality and reject rates compared to the conventional liquid die casting process.

Moreover, the facility will be used to develop a local capability in semi-solid metalworking (SSM), which represents the latest and most innovative advance in aluminium processing in recent years. The local introduction of this technology will enable South African manufacturers not only to improve their competitiveness in existing markets, but also to enter new markets where aluminium has not been able to compete before.

#### Finding diamonds in the sea

The CSIR is involved in predicting the areas where billions of carats of marine diamonds will be deposited off the west coast of southern Africa.

The unique investigation by the CSIR's Coastal Dynamics Group under contract to De Beers Marine has developed novel analysis techniques. It includes hydroforcing methods to predict offshore diamond distributions through reconstruction of the transport and deposition dynamics under ancient paleocoastlines. The base technique is embedded in a Geographic Information System (GIS) framework and is being used as an expert system for operational decision support in the exploration division of De Beers Marine.

#### Reaping the spin-offs from silk

A development by the CSIR for converting "waste" silk into spun yarn and other spun-silk products has created a number of job opportunities for local residents and unskilled people in southern Africa.

A form of wild silk, is derived from the cocoon of the indigenous *Gonometa* worm found only in certain areas of southern Africa. The CSIR is the first organisation to convert wild silk into spun yarn and other high-value-added spun products much sought after in fashion circles. The production of silk is a labour-intensive, but low capital-intensive, activity. This makes it ideal for southern Africa with its potentially abundant supply of wild silk in certain areas.

#### Wild silk project launched in Ganyesa

The Department of Finance and Economic Affairs, in conjunction with the CSIR and the North West Development Corporation, officially launched a wild silk pilot project at the NWDC Small Industries in December 1997.

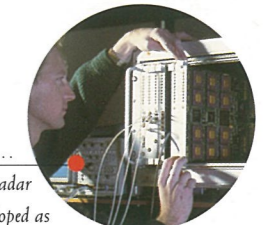
The project focuses on facilitating the sustainable harvesting of wild silk and subsequent value-adding industries in the textile sector. The NWDC project has been running for a year and six people are employed at the project plant in Ganyesa to clean cocoons. Three more people will be employed on the plant and eight more to do the harvesting of cocoons. This trial project has been launched to determine the viability and sustainability of a wild silk industry.



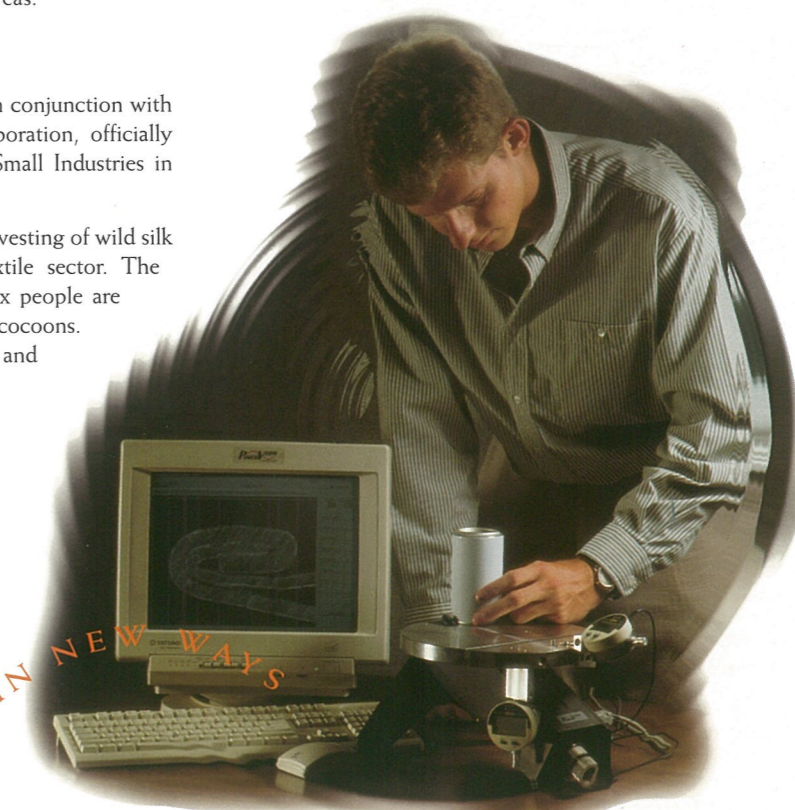
*Ideal for field work... CoroCAMIII, the CSIR's image intensified day/night video camera to monitor corona, is fully portable and operates off batteries carried in a belt.*



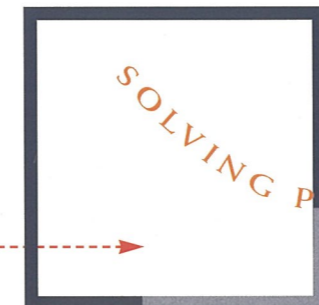
*Injection moulding... One-stop product development and mould-making expertise is offered to foster manufacturing to international standards.*



*Core defence technology... Pulse Doppler tracking radar technology is being developed as part of a long-term strategic core technology base for the SANDF.*



*With the CSIR's LabCAM seam inspection system all the components necessary for a complete seam analysis are mounted on a single compact pedestal.*



**Crack rockburst team**  
The CSIR's rockburst investigation team provides the South African mining industry with a highly specialised investigative aid to understanding the causes of seismic events and the related distribution of damage. The team has conducted 24 investigations since it was initiated in 1994 as part of the Safety in Mines Research Advisory Committee (SIMRAC) project.



These investigations exposed the team to a broad range of underground conditions and enhanced a combined level of expertise unique in the industry. Investigations have produced the most detailed rockburst reports available and have often identified the actual causes.

# Quality of life

A PERVAIDING SENSE OF LOSS OF COMMUNITY AROUND THE WORLD IS FINDING EXPRESSION WITH A VENGEANCE IN CRIME, DRUGS AND VANDALISM. IN SOUTH AFRICA THE CSIR IS CONTRIBUTING TO THE REBUILDING OF OUR OWN SENSE OF COMMUNITY BY DELIVERING TECHNOLOGIES TO MAKE LIVING AND WORKING SAFER, HEALTHIER, MORE COMFORTABLE AND MORE ECONOMICAL IN TERMS OF OUR PRECIOUS RESOURCES.

## This seems to be a real life-saver

During 1996, the cost of road accidents to the economy was approximately R11,9bn. Some 10 000 people died and 40 000 were seriously injured. To address the problem, a Short Term Implementation Plan (STIP), later renamed Arrive Alive, was launched in October 1997 by the Minister of Transport Mac Maharaj. The CSIR was appointed to independently monitor the project.

Arrive Alive's primary goal was to reduce road traffic accidents by 5% between October 1997 and January 1998 over the comparable period in 1996. To achieve this three offences were targeted: speeding, drunk driving and not wearing seat belts. Traffic forces were mobilised and supported by intensified road safety communication campaigns.

The data is still incomplete, but initial results show that there was a reduction of 9% in total accidents recorded over the period. The implications are that between October 1997 and December 1997 potentially 536 lives were saved.

## Life getting tougher for cash-in-transit robbers

Following the dramatic increase in attacks on cash-in-transit vehicles, SBV Services (Pty) Ltd approached the CSIR to find ways of neutralising the cash in the event of a robbery. The challenge was to come up with a solution that would be quick to implement, pose no threat to the SBV personnel involved or to innocent bystanders and require no major modification to SBV operations.

Three possible solutions were developed and SBV has subsequently asked the CSIR to implement one of the systems which will make it extremely difficult for robbers to get the cash in the event of a robbery. In addition, the CSIR is investigating a suitable communication system, which will not only improve SBV's communications with its vehicles, but will allow the solutions to be triggered remotely from a central control room without the driver or security staff in the vehicle having to be involved.

## It's all in the flow

A critical component in improving the environment inside buildings is getting the air flow right. The CSIR has a special CFD (computational fluid dynamics) unit which has succeeded in evaluating the effectiveness of various ventilation system designs for a new building scheduled for construction at an aluminium remelt facility.

CFD is a method of numerically predicting fluid flows and heat

transfer. It allows temperature, velocity, pressure, density and other physical variables to be predicted at every location in a flow field. Chemical reactions, free surface flows and combustion can be modelled. But it has many uses other than in ventilation. Its speed, versatility and cost-effectiveness makes it a popular tool in predicting molten metal flow, improving engine design, analysing mine cage design and assessing the impact of pollution.

## Device keeps drivers awake

A device to increase safety and reduce heavy-duty truck accidents at open-pit operations due to drivers falling asleep has been developed by the CSIR. Equipped with an audio warning system, it alerts both the driver and central despatch if a driver closes his eyes for more than two seconds.

Currently mounted on a hard hat, the device uses a CSIR-developed infrared sensor to monitor the condition of the driver's eyes. Although it was developed under contract for open-pit operations, the device has many applications throughout the mining industry, and the commercial and private sectors.

## Crime information for planning

Crime mapping is a major tool in crime prevention. A project undertaken by the CSIR with the South African Police Service (SAPS) analysed the use of operational information and designed state-of-the-art systems to optimise the use of crime information.

The CSIR's work has helped policemen gain a better understanding of crime in their areas and, in the process, helped them reduce crime. In some cases, it has led to arrests. The systems and procedures set up at two pilot police stations are as good as can be found anywhere in the world. Plans are in place for these to be rolled out to other police stations in the country.

The CSIR's involvement was funded by the Innovation Fund of the Department of Arts, Culture, Science and Technology (DACST) which is aimed at providing technological solutions in support of the National Crime Prevention Strategy (NCPS).

## Designing safer cities and towns

The CSIR, in collaboration with the Institute for Security Studies (ISS), has completed the initial phase of the first research project in South Africa on crime and its relationship to the environment.

The project was a response to Pillar Two of the NCPS: Reducing Crime Through Environmental Design, and was funded through DACST's Innovation Fund.

It is evident that the design of South African cities plays a role in the level of crime as well as in the effectiveness of policing. The intention of the project was to put the issue of crime prevention through environmental design on the agenda of local authorities, planners, designers, and the safety and security fraternity, and to advocate the benefits of including environmental design in local crime prevention strategies.

A document was prepared outlining the role of environmental design in preventing crime, with recommendations for the design of safer cities and towns and suggestions for implementing safer design measures.

## Safety device...

Infrared sensors mounted on a hard hat alerts the driver and central despatch if his eyes close for longer than two seconds, which may indicate he is falling asleep.



## Local government team...

A planning methodology to assist local government in the formation of Integrated Development Plans has been developed by the CSIR.



## Arrive Alive...

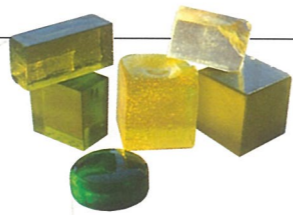
The CSIR was contracted to independently monitor the Arrive Alive Campaign conducted from October 1997 to January 1998.



The CSIR used Computational Fluid Dynamics, a method of numerically predicting fluid flows and heat transfer, to evaluate building ventilation systems.



DEVELOPING SMALL BUSINESSES BASED ON THE EXTRACTION OF HIGH-VALUE CHEMICAL PRODUCTS FROM PLANTS IS ONE OF THE PROGRAMMES AT THE CSIR'S DIVISION OF FOOD SCIENCE AND TECHNOLOGY.



#### One of a kind

The only facility in South Africa providing simulated underground environmental conditions for the testing of heat transfer equipment is at the Heat Exchanger Test Centre at the CSIR.

The testing services of the centre have been significantly enhanced with the addition of two new facilities.

The first offers testing and accreditation of refrigerant cooling coils for a wide range of air cooling applications. Funded by Carrier SA, in response to a need to establish a facility of this kind in South Africa, the facility enables the testing of refrigerant-to-air heat exchangers up to 45 kW in size at temperatures of as low as -30°C.

In the second, the CSIR's climatic chamber has been modified to include testing and accreditation of cold chain equipment, in addition to its traditional function of enabling heat physiology experimentation.



#### Ferretting out the criminals

The CSIR-wide "Forensic Science and Information" project, also funded under DACST's Innovation Fund, is aimed at transferring cutting-edge technology to the SAPS.

- The Forensic Science Laboratory (FSL) is being helped to establish a materials database, as well as to synthesise particular chemicals and their intermediates for use in criminal investigations.
- The SAPS Criminal Record Centre (CRC) is being helped with regard to chemistry related needs, especially in the area of fingerprint technologies.

#### Residents must have a real say in housing

Under the Government's current housing policy many core housing projects are being constructed. A CSIR study has investigated whether residents of housing projects are managing to successfully add space to their houses and thus make them more habitable. About 450 households were interviewed in two core housing areas in Durban and Cape Town to see how they had improved and extended their houses.

The relevance of the study to present housing policy and practice is that, in a worst-case scenario, large numbers of small core houses could be mass built with no participation by residents or ongoing support for consolidation. This is likely to lead to dissatisfaction and overcrowding for those not able to add living space.

The Government's "Housing for All" policy envisages "habitable, stable and sustainable public and private residential environments for viable households and communities". But for this to happen, the study found that residents need to be given real decision-making power, secure tenure, access to training in how to organise and build for themselves if they elect to do so, and very importantly, to have access to appropriate end-user finance.

#### Making local government planning more efficient

The Local Government Transition Act compels local governments to develop negotiated Integrated Development Plans (IDPs) for their areas which will provide the legal and strategic framework for Government expenditure. The CSIR, in partnership with the Department of Constitutional Development and GTZ (German Technical Agency), has developed a planning methodology to assist

local governments in the formulation of their IDPs. It is a single, simple and practical process that meets local government planning requirements in terms of a range of separate pieces of legislation.

An Integrated Development Information System is being developed to address the issue of managing and integrating planning information in support of the development process. This system will save time and money by assisting local authorities to obtain information quickly and easily, and avoid duplication.

#### New simulator for Self-Contained Self Rescuer monitoring

The CSIR has commissioned a new breathing simulator, the most modern and high-tech equipment of its kind. This makes the CSIR the only institution in the southern hemisphere capable of providing a performance monitoring service of this nature that is up to international standards.

The new simulator measures all the relevant variables in the functioning of Self-Contained Self Rescuers (SCSRs), such as breathing resistance, oxygen concentration, carbon dioxide and the temperature of inhaled and exhaled air. It will be used in conjunction with the CSIR's existing simulation unit.

#### Housing the nation

The well-known Red Book, which provides planning and engineering guidelines for human settlements, has undergone a major revision. The CSIR, as the custodian of the Red Book, was appointed by the Department of Housing to carry out the revision. Eight Government departments contributed financially to the process. The revised Red Book has as its central concerns the needs of people in residential areas, maximising opportunities for self-actualisation, and awareness of impacts on the natural environment.

It consists of an integrated set of planning and engineering guidelines which present a unified approach to the creation of viable and attractive living environments.

#### Progress in detecting landmines

The development of technologies to detect landmines is a priority project for the CSIR. The project, now in its second year, focuses on techniques using multiple sensors and data fusion. This work is being done in collaboration with the Radar Remote Sensing Group at the University of Cape Town.

Three sensors are currently being used: infrared, ground penetrating radar (GPR) and metal detectors. By integrating these with data fusion and image recognition capability many landmine detection problems can be overcome. The project is still in its first stages, but promising results in improved detection with low false alarm rate are being obtained even on landmines with limited metal content.

Exciting possibilities for international co-operation and partnerships have been established and are being investigated.

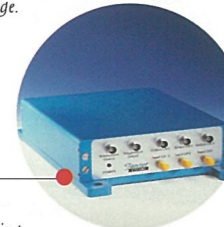
#### Housing...

A CSIR study has shown that where residents are given a say in housing they are more likely to add improvements at a later stage.



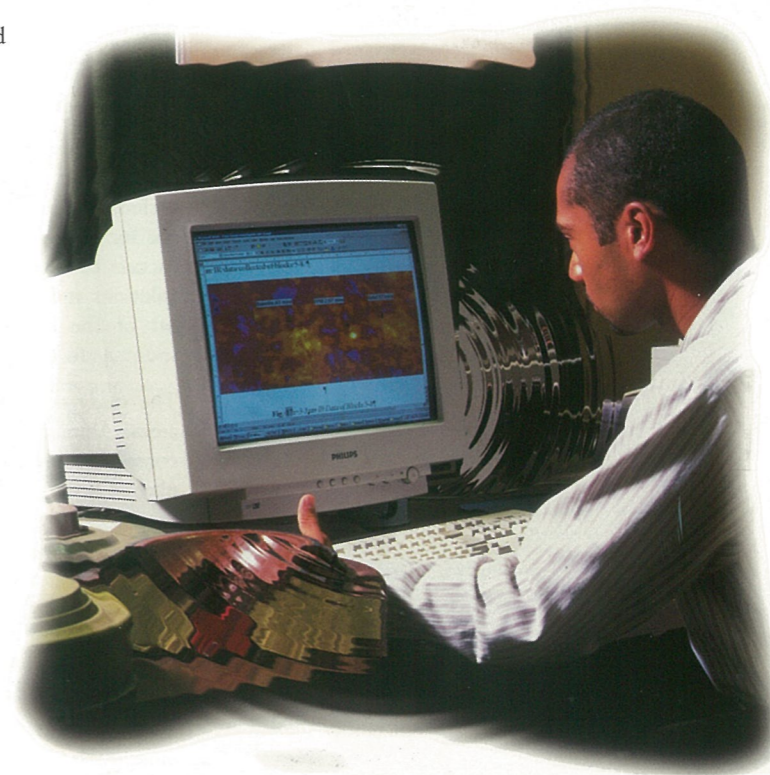
#### Innovative technology...

The CSIR's six channel multiplexed fibre optic sensing system is now on the market.



#### Crime prevention...

A CSIR study analysed the success of various methods in preventing crime at high traffic areas.



The CSIR's landmine detection system, which uses multiple sensors and data fusion technologies, is achieving remarkable results in landmine detection tests.



THE CSIR HAS A FORMAL SYSTEM OF INNOVATION WITH ACCESS TO THE TOOLS AND METHODOLOGIES OF CUTTING-EDGE SCIENCE. IT ACTIVELY SEEKS TO SHARE THESE THROUGH ITS CROSS-CUTTING CORPORATE TECHNOLOGY FOR DEVELOPMENT PROGRAMME.



#### Water for all

The quality of drinking water in rural areas in the Western Cape has been assessed by the CSIR. Its Cape Water Programme investigated water quality and water quality management practices at 20 rural communities representing larger towns, smaller rural towns and coastal resorts. Sampling locations included raw-water sources, schools, municipal offices, hospitals and homes.



In only one community did all the samples satisfy the SABS Recommended and Maximum Allowable Limits and in only two communities did all samples satisfy the SABS Maximum Allowable Limits. A Drinking-Water Quality Management Programme, to manage both chemical and microbiological water quality from raw source to point of consumption, was introduced at six of the 20 communities. A success rate of 95% compliance with SABS Recommended Limits was achieved within three months.

#### Fibre-optics make measurement easier and safer

The use of optical fibre as a medium for ultra high speed data transmission has been applied by the CSIR to make the taking of measurements much easier and safer. Conventional sensing systems often use a great deal of electrical wiring to connect sensors, but replacing the copper wiring with fibre optic cables allows many sensors (literally hundreds) to be connected to a single fibre.

Multiplexing, as it is called, eliminates the need for electrical supply wires and signal wires running to and from sensors. A big advantage is that the sensors and fibre are electrically passive, providing an intrinsically safe sensing system which is particularly important in environments such as coal mines and petrochemical process plants.

The optical fibre and the sensors are also immune to electrical interference caused by power lines, lightning, etc. The sensors can be remotely interrogated which means that the demodulation unit can be installed hundreds of metres away from the closest sensor.

#### Focus on high crime areas

The transport sector is not exempt from the crime wave in South Africa. The CSIR has been involved in several special projects including crime prevention at modal interchanges. The study looked at the incidence of crime at various modal interchanges, analysed the success of various methods in preventing crime, described potential solutions and evaluated various crime prevention methods. One spin-off of the study was that community crime prevention groups spontaneously formed at each facility that was studied.

The study concentrated on mass transport facilities in metropolitan areas. Among several recommendations was the development of a comprehensive and holistic system to enable community groups to play an active part without themselves resorting to violence.

#### A safe cap lamp battery

A protective device to ensure the safety of cap lamp batteries has been developed which has the additional advantage of extending the battery life by protecting the battery against full discharges. The device has been patented in South Africa.

Ensuring the safety of mining equipment is critical to the safety of mine workers underground, particularly in the flammable atmospheres of coal mines.

#### Moving South Africa

The CSIR is providing substantial support for "Moving South Africa", the major transport strategy project initiated by the Department of Transport (DoT). The CSIR is represented on the Steering Committee and the Project Action Team.

The project identifies the key requirements of transport customers, markets and Government over the next 20 years and the challenges of building an appropriate system to meet their needs. The eventual objective is the development and implementation of a national strategy in line with the "Key Thrusts" of the Transport White Paper.

The CSIR has played a significant role in the Transport Policy Review process. Its participation has continued beyond the analysis and formulation process to the implementation phases. This includes assistance to the DoT's Chief Directorate: Roads in its transformation to an independent National Roads Agency in April 1998.

#### Science goes shopping in nature's drugstore

A nation-wide bioprospecting project has been launched by the CSIR's Chemical and Microbial Products Programme. The aim is to discover, develop and commercialise novel biological products, such as pharmaceuticals and natural pesticides, from South Africa's 23 000 species of indigenous plants and thousands of micro-organisms.

In the next 10 years over 250 000 extracts from these sources will be screened for commercially important biological substances. The project has already yielded a novel appetite suppressant, a high intensity sweetener and a mosquito repellent.

#### There's cash in cashmere

Cashmere, the fine, soft, downy winter undercoat of various breeds of goat, is a much sought-after commodity world-wide, especially by manufacturers of fine clothing. Many of the approximately four million goats in South Africa can produce cashmere, making cashmere harvesting an important potential income-generator for indigenous goat owners. Some estimates are that it could grow into a multi-million rand industry, and the CSIR is researching technologies suitable for the small-scale processing of this fibre.

#### Learning from each other

The CSIR has enhanced its competitiveness in food technology by forming strategic partnerships with tertiary institutions and other research councils. It now has formal alliances with the University of the North (UNIN), University of Pretoria (UP), the Medical Research Council (MRC) and Agricultural Research Council (ARC).

The partnerships are often built around gifted individuals who work in collaboration with the CSIR to better serve southern Africa's food technology needs. Associates appointed in the year under review are Professor John Taylor of UP who is an expert in Cereal Science and Technology; Professor Piet Steyn of Potchefstroom University, who is renowned for research into mycotoxins, toxic and medicinal substances in plants; and Professor Mbudzeni Sibara of UNIN who is a specialist in plant pathology.

#### Redesigning transport...

One CSIR project for the Department of Transport focuses on redesigning transport networks and systems.



#### Updated...

The CSIR has carried out a revision of the Red Book which provides planning and engineering guidelines for human settlements.



#### Newly commissioned...

The CSIR's new breathing simulator is the most modern available to measure the functioning of self-contained self rescuers used in mines.



A multiplexed fibre optic strain sensing system has been developed at the CSIR to measure strain on aircraft, and the technology can be customised for many other applications.

# Human resource development

IT IS NOT REALLY POSSIBLE TO THINK ABOUT SUSTAINABLE DEVELOPMENT WITHOUT THINKING ABOUT BUILDING HUMAN CAPACITY. THE CSIR HELPS TO EMPOWER OUR HUMAN RESOURCE POOL SPECIFICALLY IN THE AREAS OF SCIENCE AND TECHNOLOGY. BY DEVELOPING EXPERTISE AND TRANSFERRING SKILLS, WE AIM TO PROVIDE PEOPLE WITH THE MEANS TO SUSTAIN THEIR OWN DEVELOPMENT AND TO SUSTAIN DEVELOPMENT IN THEIR COMMUNITIES.

## Letting the community decide on traffic safety

Many factors impact on the quality of life of communities, none more so than safety on the roads. Hence community involvement in traffic safety has become an important priority of the Road Traffic Management Strategy (RTMS) adopted by the Minister of Transport.

The CSIR's Traffic Management Programme is actively involved in developing community skills by establishing local traffic safety forums. As a result, it has gained considerable experience in helping citizens improve their quality of life. Participatory rural or urban appraisal techniques are used to enable people to express and analyse the realities of their lives in terms of traffic safety, to plan what actions need to be taken, and to monitor and evaluate the results.

Participatory educational technologies have been developed and include techniques such as participatory theatre, modelling and mapping and various participatory group methods. This transfer of ideas is undertaken in the form of community workshops. In Mamelodi the technique was applied to assist the Mamelodi Traffic Safety Forum. Members built a model of their community and then plotted road traffic accidents. Through a process of dialogue, programmes were developed to monitor and evaluate progress.

## Learning how to assess and control risk

Training courses in Workplace Risk Assessment and Control (WRAC) have been initiated by the CSIR and are held regularly at the Johannesburg premises of its Division of Mining Technology (Miningtek). The aim is to introduce a team-based method for workplace risk assessment and control. This method identifies and assesses risks, and determines controls for occupational health and safety, the protection of assets, production and the environment.

## Growing the science and technology skills pool

The CSIR's Internship Programme aims at growing the pool of skills available in science, engineering and technology. The interns are sourced from university and technikons and must have potential for development and a positive academic record. Interns are treated as temporary employees. This year of the 112 CSIR interns, 12 were employed within the CSIR and 14 by outside organisations. Fifty interns, after completing the Internship Programme, are now pursuing postgraduate studies, and 36 are looking for employment or are completing undergraduate qualifications.

## Maximising the role of women

The Small Projects Fund of New Zealand's Official Development Assistance Programme (NZODA) has joined with the CSIR in its initiative to promote small-scale agro-processing by providing grant funding for two projects in South Africa's Northern Province. NZODA focuses on income-generating projects in rural areas, particularly those which are community-driven and maximise the role of women.

One project involves the implementation of a pilot plant based on a novel, outdoor sorghum-malting process. The other promotes the cultivation of high-value-added products such as herbs, spices and other products extracted from plants. A third project, the reintroduction of traditional mageu making into a community, has also received funding.

## Looking for the creepy-crawlies

An Introductory Course in Water Microbiology is offered by the CSIR's Water Resources Management Programme. It is aimed at upgrading the skills of people working in the water industry who need to know about basic techniques for the microbiological analysis of water.

Training is given in the basic theoretical concepts and practical aspects of health-related water microbiology, including the detection and analysis of faecal indicators of pollution and other pathogens as well as the interpretation and reporting of results, quality control procedures and labour safety.

## Introducing children to the magic of cloth

The CSIR has launched a Textile Education project which combines textile arts and crafts, as a field of creativity, expression and craftsmanship, and textile sciences and technology, as fields of learning, understanding and innovation. The project links textile education with other areas of learning and aims to:

- Provide comprehensive information to teachers so that children can be exposed to textile arts, crafts and sciences.
- Conduct workshops to empower teachers.
- Give children an interest in and understanding of textiles so that at a later stage they will be able to take up careers in the industry, be further educated in textiles and clothing, or be discerning consumers.

## Labour intensive roads project

The CSIR has initiated a labour-intensive programme in the Lubisi area of the Eastern Cape for road construction. The site is at the Lubisi Conference Centre which required an access road from the road to Lubisi Dam, and surfacing of the internal roads and parking areas.

The project demonstrates appropriate road building technologies, trains members of the Lubisi community in



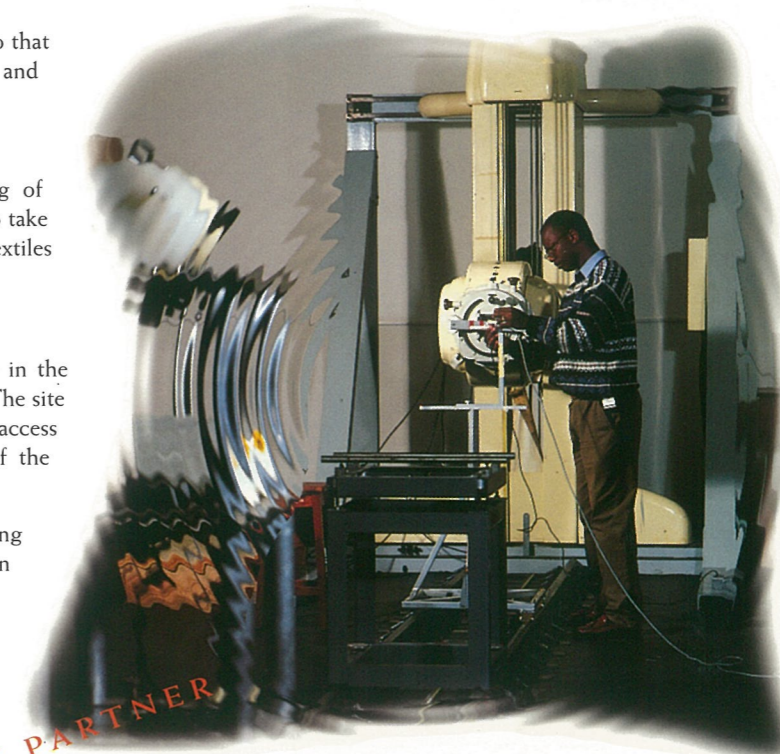
Personal attention...  
The CSIR offers an introductory course in the basic techniques of microbiological analysis of water.



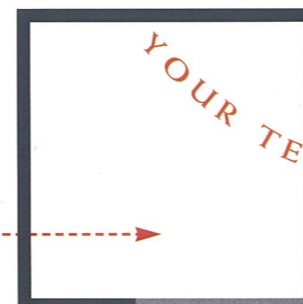
Income generating projects...  
Small-scale agro-processing projects in rural areas are community driven and maximise the role of women.



Advisory centre...  
Hands on assistance to textile SMEs is offered at the Manufacturing Advisory Centre in Port Elizabeth.



The National Metrology Laboratory at the CSIR celebrated its 50th year of service with various activities during Metrology Week, which attracted international delegates.



FROM A MACRO-ECONOMIC PERSPECTIVE, EDUCATION AND TRAINING ARE THE KEYS TO THE DEVELOPMENT OF SOUTH AFRICA AND THE WELFARE OF ITS PEOPLE. THROUGH INNOVATIVE PROGRAMMES THE CSIR IS HELPING TO PROVIDE A CORE OF TECHNICAL LEADERS OF DIVERSE BACKGROUNDS AND SKILLS TO HELP BUILD THE FUTURE.



**Polymer research and training**  
A joint polymer technology facility, which has been established at the CSIR as a result of an agreement with Technikon Pretoria, will generate a critical mass of expertise, infrastructure and equipment for polymer processing research and development, as well as training. The Centre for Polymer Technology is an extension of the polymer research programmes of the CSIR's Division of Materials Science and Technology (Mattek) and the Technikon's Department of Polymer Technology.



Ongoing projects at the centre sponsored by the private sector include processing of polymers; thermal properties of polymers; end use properties of polymers; and additives for PVC. In addition, a short course on polymers for Africa is being sponsored by Polifin.

these technologies, and establishes employment opportunities.

Fourteen trainees were selected from the community and trained in methods of setting out the work for level and horizontal alignment without using survey instruments; elementary methods of selection of natural road building materials; and the stabilisation of in situ material with lime. They have also been introduced to concrete mixes and the principles of sound compaction.

#### Fifty years of the NML celebrated

The National Metrology Laboratory's (NML) 50th anniversary was celebrated by various activities, culminating in a Metrology Week that attracted international speakers and delegates. During the week, conferences, workshops and an exhibition were held at the CSIR Conference Centre with a focus on developing capacity in line with the latest techniques and developments world-wide.

- A course was held on Three-dimensional Co-ordinate Metrology covering a basic introduction to the operation of co-ordinate measuring machines.
- A workshop was held on Force Metrology, which looked at latest calibration techniques, inter comparison results and developments world-wide in the force metrology.
- A Time and Frequency Workshop concentrated on the different time transfers used in South Africa, including the CSIR Telephone Time Service (TTS), the Automatic Time Transfer Control Unit (Auto TTCU), the Global Positioning System (GPS) and the Network Time Protocol (NTP).

#### Designs on knitting and weaving

The CSIR Technology Research, Design and Product Development Centre aims at improving the quality and competitiveness of the South African crafts products market by focusing on our country's natural treasures, cultural heritage and traditional crafts.

It assists this sector with customised design services, product development, raw material testing, product testing, business support services and labelling.

Small, medium and micro enterprises are assisted in developing niche markets for niche products, concentrating on natural fibre interior items and garments that are influenced and enhanced by indigenous arts and crafts and hand-embellished work.

#### Getting more from your GIS

The CSIR's Satellite Applications Centre (SAC) has signed a Memorandum of Understanding with GDTA (French Aerospace Remote Sensing Development Group) to develop and deliver joint training courses and workshops in earth observation and GIS applications for professionals from SADC countries.

The first initiative was the development of a course series entitled "Using satellite imagery to get more from your GIS", which addresses various thematic fields, such as natural resources management, land-use planning, environmental monitoring and coastal studies.

A second initiative was a two-day training course on the use of Synthetic Aperture Radar (SAR) imagery. The course covered radar imagery principles and methodologies for interpreting the image in different application areas.

#### Tree breeders course balances theory and practice

CSIR courses introducing tree breeders to the application of best linear unbiased prediction (BLUP) are attracting interest locally and internationally. BLUP is a statistical procedure used to predict and rank the genetic value of trees.

Courses held at the CSIR's Mpumalanga offices have attracted geneticists and tree improvement managers from the majority of the major players in the South African forestry industry, as well as from international companies as far afield as Indonesia and Japan.

#### Making things happen for SMMEs

A Manufacturing Advisory Centre Pilot Programme has been launched in Port Elizabeth. PERMAC, as it is known, offers hands-on assistance to small and medium sized manufacturing enterprises and operates as an autonomous non-profit organisation.

The services include business information, general business management advice and counselling, technological and marketing assistance, aftercare and networking to service providers. The programme for Manufacturing Advisory Centres (MACs) complements the existing Local Business Service Centres (LBSC) programme.

PERMAC supports the government priority to develop the competitiveness of SMMEs by establishing localised support centres that provide a range of services to manufacturing SMMEs and have the credibility of relevant stakeholders.

#### Fun spinning a good yarn or two

"Fibre Fun Workshops" are presented by a team from the CSIR as part of a programme to promote crafts in the Eastern and Northern Cape Provinces. Workshops are held in co-operation with the Department of Arts, Culture, Science and Technology, the Port Elizabeth Technikon, the PE Museum, the Eastern Cape Crafts Council and art galleries.

The workshops are presented to children between the ages of 6 and 12 and to adults. Activities include handspinning with an apple spindle, handweaving on meat tray looms, dyeing with food colouring and cool drink mixes, separation of dye colours using column chromatography and fun with light.

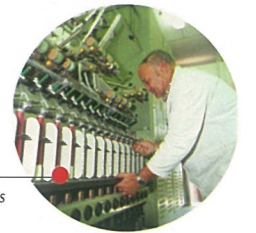
Attracting attention...

The CSIR's course introducing tree breeders to the application of best linear unbiased prediction attracts local and international participants.



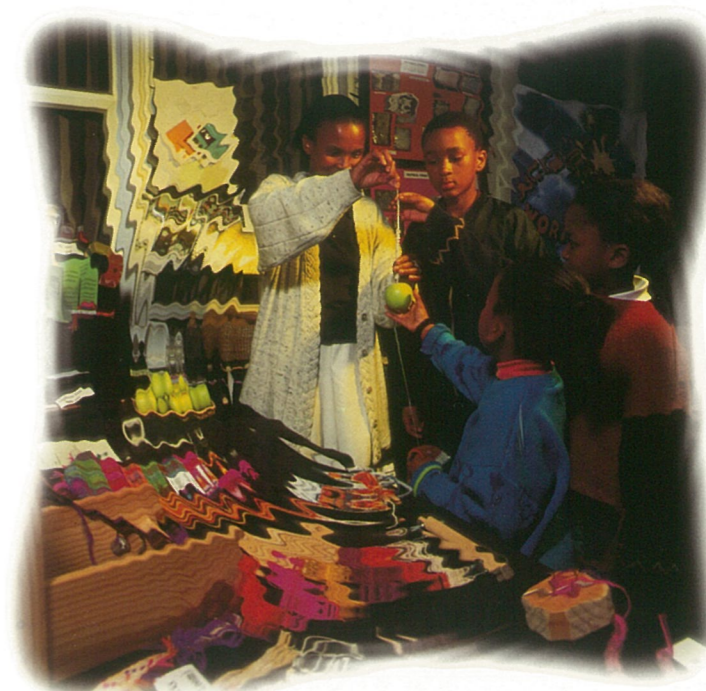
Textile training...

This year 250 entrepreneurs and 1 800 students in the formal education sector were trained in various textile courses and programmes at the CSIR.



Road construction...

Labour intensive road construction projects offer training in appropriate road building technologies to communities in rural areas.



The CSIR's Textile Education project links textile arts and crafts with textile science and technology to give children an interest in and understanding of textiles.

# Sustainable environment

BUILDING INFRASTRUCTURE, BOOSTING PRODUCTIVITY AND CREATING JOBS ARE CRITICALLY IMPORTANT TO ANY GROWING ECONOMY. BUT THE CHALLENGE IS TO SUCCESSFULLY BALANCE THIS AGAINST THE EQUALLY CRITICAL NEED TO CONSERVE NATURAL RESOURCES. THESE STORIES DESCRIBE THE CSIR'S ACHIEVEMENTS IN HELPING DEVELOPERS TO STRIKE THE OPTIMUM BALANCE.

## Caring for the environment can save money

Inefficient use of resources and energy in buildings cost South African business millions of rand a year. The CSIR's Green Buildings for Africa programme seeks to change all that by showing how caring for the environment can save property owners money.

In partnership with the Green Buildings for Africa programme, property owners are assisted to improve the environmental performance of their buildings within the bounds of good business sense. The Green Buildings for Africa programme has been recognised by the United Nations Environment Programme, the United States Environmental Protection Agency and the Mbeki-Gore Binational Commission. This programme is setting a trend in environmental action throughout business and commerce.

## Boost for natural fibres

Common synthetic fibres are not biodegradable. This has led to a world-wide trend towards natural fibres in products ranging from apparel and household textiles to the automotive, building and construction, and furniture industries.

This offers South Africa a great opportunity because of its large variety of indigenous fibres which are not being exploited commercially. So the CSIR has initiated an extensive feasibility study into the potential for establishing a competitive natural fibre industry in South Africa. It has found that the potential for adding value to indigenous fibres, and for growing new types of natural fibres in South Africa, is huge. Besides helping to sustain the environment, it offers significant opportunities to develop rural communities, create jobs and increase exports.

A market survey of some 140 South African textile companies revealed an interest in developing new natural fibre markets and products. Discussions are taking place with major international and local companies to provide the market pull for natural fibre composites in industrial components.

## Viable disposal of sewage for Durban

Discharge of wastes into the sea is acceptable provided that there is careful planning and management to minimise impacts. Durban has a dynamic oceanographic system which favours the rapid dilution and dispersion of added materials. In the late 1960's, based on technical information supplied by the CSIR, two submarine outfalls discharging three to four kilometres offshore were installed 50m underwater.

The CSIR's current role is the long-term management of the environmental impact of the outfalls to ensure compliance with permit requirements of the Department of Water Affairs and Forestry.

The Durban marine outfalls are functioning well and have been doing so for close on 30 years. It is important that the assimilative capacity of the environment is not exceeded and that close vigilance and careful planning is maintained. The CSIR is developing models which will provide a deeper understanding of dispersion processes and confer a predictive capability.

## Teamwork counted in the end

Gauteng now has a full and detailed report on the state of its environment thanks to the co-operation of its own Directorate of Environment with the CSIR.

Powerful information networks and sourcing skills at the CSIR were put to use in compiling the State of the Environment assessment for the province. The report describes the status quo, identifies and prioritises key concerns, highlights environmental trends and their socio-economic implications and proposes remedial actions. It also offers a useful overview from which to develop a sustainable environmental plan.

## Nearly 10 years old and still going strong

In 1990 a monitoring programme was devised by the CSIR for the Department of Water Affairs and Forestry (DWA&F) to measure the impact on the Groot Brak estuary of the Wolwedans Dam, built 2km away to supply Mossgas in Mossel Bay with fresh water.

Nearly 10 years later this monitoring plan is still continuing to give valuable input to the management of the Groot Brak estuary. If the need arises, monitoring can intensify to the point where daily contact is kept with residents and the DWA&F during critical periods.

Through effective monitoring a much clearer picture of the hydrodynamics of the estuary has been established. As a result a refined and finely-tuned management plan has been established to keep the estuary in the healthy state it is in today.

## Getting services to where people are

ACCESSMAP, the CSIR's GIS-based decision support system, proved its usefulness in studies conducted in the Cape Metropolitan Area to locate facilities more effectively. It identifies areas with poor accessibility, explores the benefits of various development options, and reproduces the results in the form of easily understandable maps.

Show case green building... The CSIR's Conference Centre is one of the first buildings in South Africa to become a Green Buildings for Africa building.



World-wide trend... A CSIR study into establishing a competitive natural fibre industry in South Africa showed that areas of KwaZulu-Natal are among the best in the world for growing sisal.



Monitoring... The Groot Brak estuary where the CSIR devised a monitoring programme to measure the impact of the Wolwedans Dam.



The scale model of the proposed Coega Harbour breakwater constructed at the CSIR's facility in Stellenbosch was used to measure wave action under various weather conditions and to develop appropriate designs.

(Photograph courtesy Argus)

THE DIVERSE STRENGTHS AND COMPETENCIES ACROSS THE RANGE OF CSIR DIVISIONS GIVE SOUTH AFRICA A STATE-OF-THE-ART CAPABILITY TO ADDRESS ISSUES OF ENVIRONMENTAL SUSTAINABILITY THAT IS AVAILABLE NOWHERE ELSE IN AFRICA.



Getting low-down from high up  
An ambitious project has been started to map Gauteng from space. Its purpose is to accurately determine land coverage and usage. A pilot study has been completed as the first step in the project that will provide full digital land maps from satellite images.



The purpose of the pilot study conducted by the CSIR was to test the capability of its Satellite Application Centre (SAC) Urban-Eye 1:50 000 SpaceMap products to produce the maps required.

SpaceMaps are precision geo-corrected satellite image mosaics. Under its Urban Eye programme, SAC aims to produce 1:50 000 scale SpaceMaps of the main metropolitan areas in South Africa.

In a project in support of the National Crime Prevention Initiative, ACCESSMAP was used to help improve the siting of police stations and to assist with their rightsizing. Khayelitsha was selected for the pilot study with the help of the Police Management Services in the Cape Metropolitan Area. The area is expanding rapidly, is under-serviced in policing terms and has a high rate of crime.

Based on an analysis of present supply and demand, future supply scenarios of police station provision were generated. The results showed that the greatest need was for at least one new station in the Macassar area.

Three projects to locate public facilities using ACCESSMAP have been undertaken within the Cape Metropolitan Area. A further contract study looking at service area coverage is under way and a rural application of the system is being developed.

#### Shifting the balance from private transport

The excessive use of private transport has long been recognised as a significant environmental problem in cities around the world. Now South Africa is seeking to solve the problem using Travel Demand Management (TDM). Basically this is a set of measures aimed at encouraging the use of public transport rather than private vehicles.

The CSIR is at the forefront of applying TDM in South Africa, and is assisting with a pilot implementation in Midrand. TDM has been introduced successfully in a number of cities throughout the world, but Midrand is the first city in South Africa to implement it.

At present the ratio of private vehicle occupants to public transport users in Midrand is 80:20. It is hoped to reverse this trend during the next five years to achieve a more equitable split.

#### Those clumps of trees are national assets

Woodlands are the most extensive vegetation formations in South Africa, potentially covering 30% of the country. Although they vary in composition, structure, function, status, ownership and condition, they should be regarded as national assets because of their potential value to rural communities.

However, there has been no detailed analysis of the actual value of these woodlands, so the CSIR is making a substantial investment in a project to stimulate woodland research. The potential value of woodlands can be broken down into direct use values (such as timber, non-timber products, grazing and eco-tourism) and non-use values (such as centres of biodiversity, aesthetic and cultural).

The CSIR's project fosters collaboration among researchers, has established a forum to increase interest and attract funding and support, and develops capacity in South Africa to:

- Assign a defensible value to any given woodland resource.
- Recommend management options to restore biological diversity and productivity to degraded woodland areas.
- Understand the social, economic and ecological drivers and constraints of change in woodlands and how they are managed.

#### Detecting toxic gases in the air

A system that can detect poisonous gases, such as chemical warfare agents, up to 10km away has been developed by the CSIR. The system uses a pulsed CO<sub>2</sub> laser and is so sensitive it can provide accurate assessments of the concentration of the toxic agents and even track the movement of the gas clouds.

The CSIR is working on establishing the suitability of this system for monitoring several industrial pollutants. The Long Range Gas Detection System (LRGDS) being developed can be used for gas pollution monitoring; early warning of chemical warfare threats; gas/petroleum pipeline leak detection; measurement of airborne particles/smoke and for meteorological applications.

#### Environmentally friendly process solutions

Local industry is reaping the rewards of almost two decades of expertise building and investment by the CSIR in fluidised bed technology.

The most recent application of this technology provided an environmentally friendly solution at African Products' maize processing plant, one of the largest of its kind in the southern hemisphere. As a result, the plant conforms to current world standards in reducing environmental impacts.

The air from the plant's animal feed drying circuits produces a characteristic but unpleasant odour and, in keeping with the project's environmental focus, African Products wanted a way to make this air odourless. It was decided that fluidised bed thermal treatment was the most appropriate technology for this and the CSIR's Fluidised Bed Team was awarded the contract through its licensee, IMS Projects.

The total project cost was R13 million and the plant was commissioned in September 1997.



#### National assets...

The CSIR has initiated a project to promote research on Woodlands, which cover 30% of the country.



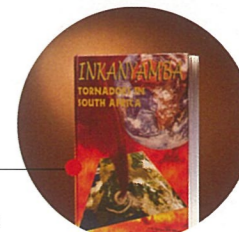
#### Toxic gases...

A new system can detect poisonous gases up to 10km away and track the movement of gas clouds.

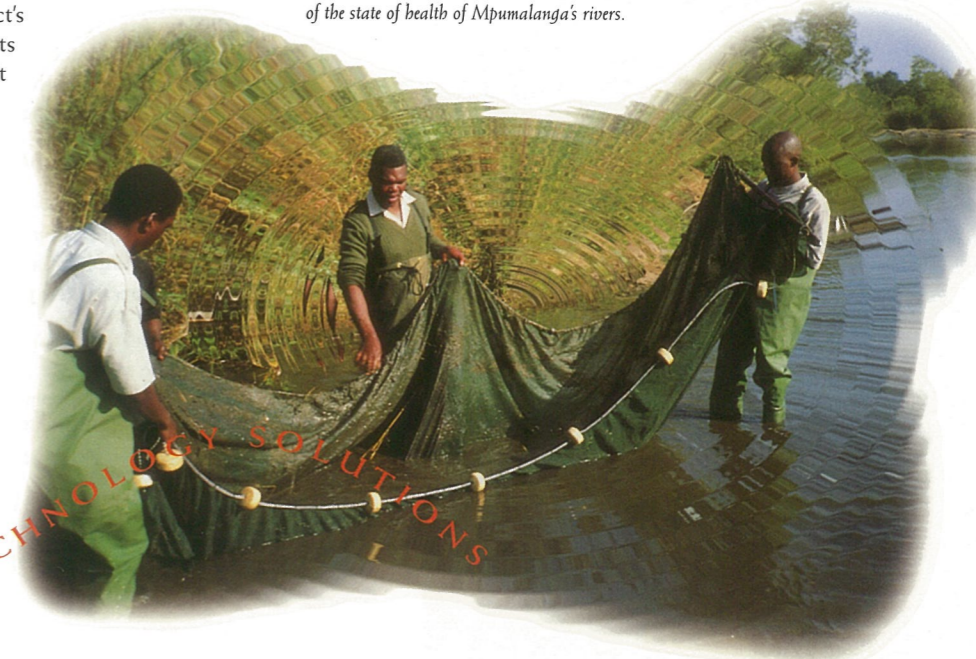


#### Tornado country...

The CSIR collaborated with the Weather Bureau in publishing a book on tornadoes in South Africa.



The CSIR is part of a river monitoring team which is keeping track of the state of health of Mpumalanga's rivers.



THE CSIR'S GOAL IS TO BE A LEADER IN THE DEVELOPMENT AND TRANSFER OF TECHNOLOGY FOR NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT. ITS STRATEGY IS HIGHLY INCLUSIVE AND SEEKS TO BUILD ALLIANCES TO PROMOTE JOINT RESPONSES TO OPPORTUNITIES.



**Monitoring off Richards Bay**  
Fourteen years of detailed monitoring by the CSIR shows that the environment offshore at Richards Bay is not being adversely affected by effluent disposed through submarine pipelines.

The CSIR became involved when the pipelines were first proposed in 1972. The monitoring began in November 1984 and has been conducted twice annually since then.



During each cruise samples are collected on a grid pattern at 54 stations each 400m apart with the pipe ends centrally located in the grid. This sampling provides sufficient data in just a single survey to highlight any adverse impacts.

In addition, toxicity tests on the individual components in the effluent to each pipeline have led to a marked improvement in quality of all contributing effluents to the pipelines over the years of the study. Unusual high results have been useful incentives for investigation of the causes, as well as managerial action to avoid recurrence, the CSIR's latest report noted.

#### New book on tornadoes in South Africa

The probability of tornadoes striking certain parts of South Africa is statistically similar to that of the US Midwest "Twister" region. This is one of the conclusions of a new book, "Inkanyamba: Tornadoes in South Africa", a joint effort between the CSIR and the SA Weather Bureau. The publication, aimed at the meteorological, environmental and engineering fraternity, describes the relevance and scale of tornadic events in South Africa and gives meteorological background and statistics.

#### Coega harbour's future is in the SEA

A Strategic Environmental Assessment (SEA) was undertaken by the CSIR on behalf of the Coega Industrial Development Zone (IDZ) Initiative. SEA differs from an Environmental Impact Assessment (EIA) in a number of ways. Most notably, it looks at the effect of the environment on development, whereas an EIA would look at the effect of development on the environment.

The ultimate goal of the SEA was to answer the question: Under what conditions could the proposed Coega IDZ and harbour be allowed to proceed? This was done by assessing the opportunities and constraints created by the environment and their implications for planning and development.

As part of the assessment of the Coega Harbour project a scale model of the seabed around the proposed harbour and the breakwater was built in the model hall facility at the CSIR in Stellenbosch.

#### Vital signs of rivers monitored

The CSIR is helping to keep watch on the health of Mpumalanga's rivers. The Mpumalanga river monitoring team plans to establish a three-yearly sampling frequency for each of the three main rivers which flow through the province.

A brochure entitled "State of the Crocodile River" has been published which describes the outcome of the first river health monitoring survey undertaken by the Mpumalanga Parks Board and the Kruger National Park, assisted by the Water Research Commission (WRC), the Institute for Water Quality Studies and the CSIR.

A survey of the Sabie River has been completed and data is being assessed and interpreted. Another is planned for the Olifants River which will involve agencies from the three provinces through which it flows.

The exercises are part of the River Health Programme (RHP) jointly developed by the Department of Water Affairs and Forestry, WRC and the Department of Environmental Affairs and Tourism.

#### Seaspace – a new look at our oceans

The colour of the sea helps scientists understand where marine resources are located and how they are changing. The CSIR's Satellite Applications Centre (SAC) receives and distributes imagery from SeaWiFS, a new satellite launched last year.

It enables scientists to increase their knowledge of fluctuations in important fish resources in the Benguela current and southern Cape seas. It will also aid understanding of the environmental factors influencing these changes.

#### Monitoring tailings dams from space

Mining engineers can now use space technology to monitor and manage their slimes dams. In partnership with SPOT-Image from France, SAC has shown how satellite imagery can provide early warnings of potential disasters.

Satellite imagery is still underutilised in southern Africa. But it can make a difference in disaster management; natural resource management and its exploitation; navigation (for example to Antarctica through ice packs); and in monitoring illegal fishing.

#### New bracket pillar design methodology

A methodology that uses design charts for estimating a safe bracket pillar width in mine layouts affected by geological discontinuities, has been made available by the CSIR.

Knowing the planned span of mining and having established a tolerable seismic magnitude for the respective mine region, engineers are able to select the pillar width required from the appropriate chart that characterises the prevailing mining conditions.

#### To scale...

About 25000 miniature dolosse and core loc units for the scale model of the proposed Coega Harbour breakwater were manufactured at the CSIR using plastic injection moulding.



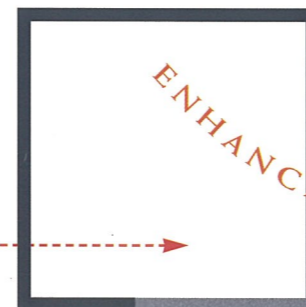
#### Safe design...

A new methodology uses design charts for estimating safe bracket pillar width in mine layouts.



#### Caring for our seas...

The Marine Water Quality Management group is able to supply predictive information to support decision making linked to the management of coastal resources.



The CSIR's Satellite Applications Centre receives and distributes images from SeaWiFS, a new satellite launched last year, which can be used to provide valuable information about the oceans.

# Information society

INFORMATION TECHNOLOGY IS PLAYING AN INCREASINGLY IMPORTANT ROLE IN DEVELOPMENT AS THE GLOBAL SOCIETY ENTERS THE INFORMATION AGE. THESE STORIES DESCRIBE HOW THE CSIR IS HELPING TURN INFORMATION TECHNOLOGY INTO A POWERFUL TOOL, NOT ONLY TO HELP SOUTH AFRICA MEET THE GOALS OF THE GOVERNMENT'S MACROECONOMIC POLICY, BUT ALSO TO PREVENT OUR SOCIETY BEING FURTHER DIVIDED INTO "KNOWS" AND "KNOW NOTS".

## Connecting communities to the world

The high-speed wireless Community Information Delivery System (CiDS) developed by the CSIR is being used in semi-urban and rural-type communities to provide online information access. The system is designed to be easily installed and requires little maintenance. Its key feature is that it can be configured in a cellular manner, meaning one access point to the Internet can serve a number of out stations.

CiDS is invaluable in applications such as distance education and training, where its wide bandwidth permits the exchange of multimedia information. Apart from allowing cost-effective Internet access, it can also link existing networks and buildings. The system offers a full suite of services – routing, firewall protection, network management, system monitoring and public network interfacing.

## Implementing the new radio frequency band plan

Work is continuing on implementing a new radio frequency plan for South Africa. The CSIR is supporting the South African Telecommunications Regulatory Authority (SATRA) in this project.

It follows on from Project SABRE, an extensive replanning of the country's radio frequency spectrum between 20 MHz and 3 GHz, which took place last year as a joint project between the CSIR, the Department of Communications and Smith Systems Engineering in the UK.

## Keeping an eye on transport

The old saying used to be "Keep your eyes on the road". But a new initiative by the CSIR sets out to ensure that the road, as well as even the vehicle itself, will keep their "eyes" on you – and everything else that's going on.

The CSIR is doing research on the use of Intelligent Transport Systems (ITS) in South Africa to improve transport efficiency and road safety. ITS collects data regarding vehicle locations, speeds and traffic conditions from sensors on vehicles or within the roadway itself. This is then used by road authorities to manage transportation and by service companies as a basis for providing information services for people in transit.

ITS combines information, communications and transport technologies to help ensure sustainable accessibility and mobility – and ultimately the efficiency of the transport system itself, which is essential to the competitiveness and growth of the country's economy.

The project aims at ultimately developing a National Systems Architecture. It will also identify specific ITS technologies that are appropriate for the South African transport environment.

Partnerships with industry are being developed through the formation of an industry interest group which will be responsible for giving the project direction and vision in the medium to long term.

## Developing winning strategies for the sports field

An essential attribute of a modern sporting nation is its ability to objectively analyse performance and then apply this information to developing winning strategies.

Currently, performance in sport at the highest level is being enhanced by a wide range of advanced tactical technologies, central to which is notational analysis. The CSIR has established a Technology for Sport task team which is researching and testing notational analysis products and services. Notational analysis offers mechanisms to describe performance through a disciplined approach to observation and analysis; the provision of a permanent record of performance; and objective description and measurement of performance.

Such analysis can interrogate any aspect of a player's performance with a view to raising future performance and determining coaching.

## Ideal sawmill tool ensures best value

The CSIR's PC-based software program, SIMSAW 5, is the ideal means for sawmills to optimise sawing patterns of logs and ensure the best value recovery. It is also an educational and training tool which is being used at Saasveld and the University of Stellenbosch. SIMSAW 5 predicts a sawmill's recovery of logs sawn, given various user-defined inputs. By choosing the most appropriate sawing patterns, the best fit between log supply and market demand can be obtained.

SIMSAW is an invaluable tool for setting production standards in terms of recovery potential, as well as for planning various production scenarios. Copies have been sold to major timber companies in South Africa and Zimbabwe.

*A high-speed wireless system developed by the CSIR has proved invaluable in distance education and training. The Community Information Delivery System provides underserved areas with Internet-based online information access.*

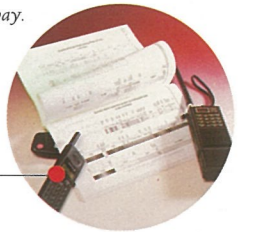
*Under investigation...*

*Intelligent Transport Systems technologies collect data on vehicle locations, speeds, occupancy and traffic conditions from sensors on vehicles or within the roadway.*



*Air waves wake up...*

*The CSIR has started implementing a new radio frequency plan for South Africa.*



*Sporting chance...*

*The Technology for Sport facility is developing and applying notational analysis products and services for all sports codes.*



ENHANCING QUALITY OF LIFE, EFFICIENT GOVERNANCE AND CUSTOMER VALUE THROUGH INFORMATION AND COMMUNICATIONS TECHNOLOGIES ARE THE MAIN FOCUS OF THE CSIR'S EFFORTS TO PROMOTE A SOUTHERN AFRICAN INFORMATION SOCIETY.



#### Sessions in ATM technology

Training in Asynchronous Transfer Mode (ATM) for IT and network specialists is offered by the CSIR. The sessions are presented twice a month over five days at the CSIR's premises in Pretoria in a dedicated ATM training facility, or upon request by interested groups.



ATM is a homogenous technology which spans and successfully integrates Local Area Network (LAN) and Wide Area Network (WAN) environments. It offers Quality of Service (QoS) which guarantees bandwidth on demand in order to support seamlessly voice, video and data simultaneously on the same networking infrastructure.

The training courses offered combine theoretical training with hands-on exercises. The experience gained in the hardware and software components of an ATM network will enable students to implement ATM in their own environments.

#### Getting to grips with change from space

The CSIR's Satellite Applications Centre (SAC) has over many years established an archive of satellite imagery from space, covering South Africa and the area south of the equator. With this space picture library it is possible to find images of a particular area at different times over the past 20 years – in some areas, images date back to the early 1980s.

With the use of advanced image processing techniques available today, comparisons of these images allows the detection of changes. It is also particularly useful in providing accurate predictive demographic information to enable timeous planning and implementation of infrastructure support systems.

#### HUIS is home to all kinds of housing information

An information system that not only addresses the needs of the Department of Housing but also provides information to the total housing sector and the international housing community is being developed by the CSIR and its joint venture partner, Systems Programming (SPL).

The Housing and Urbanisation Information System (HUIS) provides the housing fraternity with national management information, inter alia on the allocation of housing subsidies, progress on projects, human settlement indicators, demographics and economic modelling. It allows national and regional comparisons and assists with the design and targeting of housing and urban development policy, co-ordination of developing initiatives and monitoring of housing delivery.

#### Asset manager for small towns

A system which allows a small municipality to keep track of its existing assets has been designed by the CSIR. The Asset Maintenance Management System (AMMS) assists with the planning of maintenance expenditure so that the overall benefit to the community is maximised for a given annual expenditure plan.

The system has been developed for communities of a few thousand people. It consists of modules: Central Data Register; Deterioration Model predicting deterioration and assessing the effects of maintenance; Plans and Budgets, which is an optimisation system disbursing funds to each project; and an Optimisation System which calculates the best pattern of expenditure. A viewer has been developed which allows true visualisation of the condition of the assets, and provision has been made to link it to a Geographic Information System.

#### All you need to know about water quality

The national surface water quality database is being made available on CD-ROM for Windows environment. The "Water Quality on Disc" package developed at the CSIR enables users to access the Department of Water Affairs and Forestry's macro-chemical database directly on their PCs. This database, containing data dating back to the early 1970s, forms part of the Department's National Water Quality Monitoring Network.

The database includes information on sampling stations and water quality variables. The map-based interface supplied with the CD-ROM allows users to quickly identify sampling stations, examine data in summary or graphical form and export data selectively for further analysis. It is particularly useful for identifying historical trends and variations in the data. The "Water Quality on Disc" CD-ROM database is expected to be updated annually.

#### Supporting strategic development initiatives

Spatial Development Initiatives (SDIs) are part of a programme of strategic interventions being undertaken by the Government to generate long-term internationally competitive growth and development and to restructure the spatial economy.

The CSIR is part of the technical unit created to assemble information, analyse the status quo, identify anchor projects, prepare documentation and provide overall logistical and technical support to the Department of Trade and Industry (DTI) and industry in general which are driving the initiatives.

#### Best value...

The PC-based software program SIMSAW predicts a sawmill's recovery of logs sawn, given user-defined inputs.



#### Asset manager...

Small municipalities can keep track of their assets with the Asset Maintenance Management System developed by the CSIR.



#### Maputo Corridor...

The CSIR is involved in a number of Spatial Development Initiatives aimed at generating long-term growth and development, the most well-known being the Maputo Corridor.



The Housing and Information System (HUIS) provides the housing fraternity with national management information.





NETWORK-BASED COMMUNICATIONS, MODELLING AND SIMULATION TOOLS, DATA SENSING, CONTROL SYSTEMS, DATABASE MANIPULATION AND DECISION-MAKING FOR COMPLEX SITUATIONS ARE CORE COMPETENCIES AT THE CSIR.



#### Virus Protection System

The CSIR researches, develops and releases the Virus Protection System (VPS) – the only locally produced virus protection program that offers protection against the macro viruses that commonly affect Microsoft Word and Microsoft Excel documents.

The Computer Virus Research Lab's quarterly release handles more viruses and handles them better and faster with more functionality than previous versions. It is easy to use and smaller than similar anti-virus packages. The CSIR uses VPS on its own multi-user network system.



Apart from its use on stand-alone and workstation PCs, VPS is LAN-aware and can be installed and upgraded automatically through the network, which makes upgrading software a simpler matter for network managers. The virus lab is also continually improving the ease of managing VPS over the network.

Interventions in which the CSIR is involved include the Trans-Kalahari Transport Corridor; Rustenburg Spatial Development Initiative; West Coast Investment Initiative; Phalaborwa Secondary Corridor; Lubombo SDI; KwaZulu-Natal SDI; Maputo Corridor SDI; Wild Coast SDI; Fish River SDI; and Beira Development Corridor.

#### Key role in Botswana telecommunications tender

The entire tender process for GSM Mobile Telecommunications in Botswana was successfully managed by the CSIR. The highly complex process involved guiding and managing multi-disciplinary and multinational teams towards meeting the objectives of the Botswana Telecommunications Authority (BTA). This regulatory body is similar to the South African Telecommunications Regulatory Authority and is guided by the Botswana Telecommunications Act 1996 [No 15 of 1996].

The CSIR supported the BTA in providing technical expertise with regards to Global Systems Mobile (GSM) technology which was selected because of its widespread use in the International Telecommunications Union (ITU) Region One (Africa and Europe).

The CSIR also led the entire tender evaluation process, including the use of local and overseas consultants. To handle the complex process in a systematic, fair and accurate manner an analytical hierarchical process was used. This software-based process, renders a final score for each tender, which allows for a fair and accurate quantitative assessment of the tenders in relation to each other. The six evaluation "yardsticks", or evaluation areas, mentioned in the Invitation to Tender were subdivided several times. This provided the evaluation team with more than 50 items to consider for each tender.

The CSIR also played a key role in the negotiations and writing of the GSM Mobile Telecommunications Licence.

#### A mighty powerful macroeconomic tool

The CSIR has completed a model of transport and the economy (MOTE) as a means of linking the transport sector in South Africa with broader macroeconomic policy.

MOTE is a powerful tool in macroeconomic analysis. It shows sales from the transport sector to other sectors of the economy and purchases by the transport sector from these sectors. MOTÉ also shows final demand by the end consumer for the products and services of all the sectors of the economy. MOTÉ can therefore be used to assess the demand for transport.

To enhance economic analysis within the transport sector, MOTÉ contains a transport sector disaggregated into 11 subsectors along modal lines – land, sea and air transport, which each have subsections.

The model can also be disaggregated along spatial lines, such as provinces or economic regions, e.g. the Maputo Development Corridor. This assists in the assessment of the impacts on transport infrastructure of economic development in a particular region.

#### Satellite applications workshops

The CSIR co-operated with CNES (the French Space Agency) and Spot Image (also of France) to present a number of workshops on satellite applications in South Africa.

The France Technology exposition and workshops were designed to bring French industrial and commercial technologies to South Africa and make these visible to possible partners, particularly in the areas of development and planning.

#### Much quicker mine ventilation and cooling simulations

The CSIR's ENVIRON computer program Version 2.5 for simulating mine ventilation and cooling systems was released this year and has a number of new features, the most significant being a doubling of the solution speed. Larger networks can be solved, which enables the modelling of complex underground situations with greater accuracy. In addition, improved results reporting facilities now have the added option of viewing and editing using spreadsheet programs (Lotus 1-2-3, Excel and Quattro Pro).

Water quality...  
The national surface water quality database is available on CD-ROM for Windows environment.



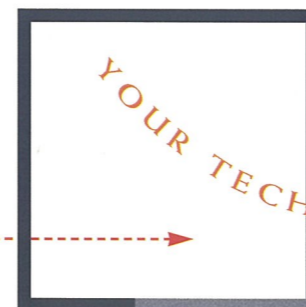
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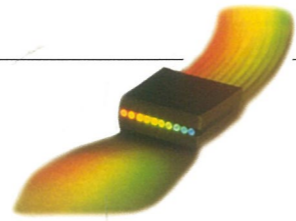
Powerful tool...  
The demand for transport services by other sectors of the economy can be assessed with a model of transport and the economy (MOTÉ).



Ten countries have pledged to form a global network of Construction Information Technology Centres. The CSIR will drive the initiative in South Africa.



"INFORMATION INTENSITY" IS INCREASING IN ALL ASPECTS OF THE CSIR'S ACTIVITIES AND REPRESENTS A SIGNIFICANT INVESTMENT TO ENSURE THAT SOUTH AFRICA, AS A LATE ENTRANT IN THE INFORMATION AGE, ACHIEVES ITS FULL POTENTIAL.



**Global information Africa**  
The African Information Society received a fresh boost recently with the launch by the Global Information Infrastructure Commission (GIIC) of GIIC Africa, a new regional commission which will advance the interests of the global information society, and generate finance and champion programmes to aid African development.



The first members of GIIC Africa are the five African commissioners of the global GIIC, which includes CSIR's president Dr Geoff Garrett. Also, the Executive Director of GIIC Africa is Dr Derrick L Cogburn, Africa Regional Director of GIIC and director of the CSIR's Centre for Information Society Development in Africa. The CSIR will also be one of two institutions in Africa hosting the secretariat of GIIC Africa.

Originally targeted for use on mines, ENVIRON is also finding increasing application in universities where it is used for training in mining engineering departments.

#### Building management headaches solved

The new Building Maintenance Management System (BMMS) for the North West Department of Public Works will provide an asset register and management system for 30 000 sites managed by the department.

Boutek is undertaking this project in collaboration with Ninham Shand, PMT and Farrow Lang Ntene. The backbone of the system is PREMIS, an estate management information system designed by the CSIR.

BMMS includes an audit system of condition and maintenance requirements; comprehensive budgeting and cost control systems; systems for managing planned and ad hoc maintenance work; control systems for labour, materials and plant; and a stores management system. Costs and manpower will be linked into the Department's financial and personnel systems.

#### Leading role in development of FreeBSD Unix

The latest versions of the FreeBSD single and multi-processor operating system are being recompiled daily by staff at the CSIR and are available for downloading on the Internet. This is the second site in the world to provide this service on a daily basis, the original providers being in the US.

FreeBSD is an advanced BSD UNIX operating system for the Intel 486 and Pentium range of "PC-compatible" computers. Available at no cost, FreeBSD comes with full source code which is developed and maintained by a large team of individuals from around the world. FreeBSD is aimed specifically at advanced networking, performance and security systems.

The new service will make use of the idle processor time of a new dual-Pentium-processor computer system, which achieves approximately double the normal speed at which the FreeBSD operating system is recompiled (4 hours as opposed to 8). After recompiling is complete, the operating system is immediately transferred to the CSIR's FreeBSD mirror site server.

This mirror site is also one of the main FreeBSD source code repositories outside the US. It is the main FreeBSD repository for

network security programs such as "Kerberos", originally developed by MIT (Massachusetts Institute of Technology) and used by many institutions and universities worldwide both for research as well as application purposes.

#### Metadatabase – an invitation to participate

The need to locate and access useful data is being met with the development of a Southern African Metadatabase (SAM), a joint project by the Geographic Information Systems (GIMS), Integrated Spatial Solutions (ISS) and the CSIR.

So far SAM has been developed and populated with data provided by the partners in the consortium. It consists of two main components: a metadatabase based on the Federal Geographic Data Committee (FGDC) contents standard, with an easy-to-use on-line interface that allows the database to be queried and metadata to be entered and edited.

While SAM has been developed by the three partners, the project is open for any individual or organisation to participate. Once registered with the SAM consortium, a user can query the database, as well as updating, editing and adding their own metadata records.

Organisations that maintain their own metadata systems are welcome to contact the consortium so that the availability of their system is known, and the possibility of linkages can be explored.

#### Metadatabase...

The CSIR is collaborating in the development of a Southern African Metadatabase, which is open for participation by any individual or organisation.



#### Faster and better...

The popular computer program Environ 2.5 to simulate mine ventilation and cooling systems, is now in routine use locally and overseas.



#### Key role...

The CSIR developed a software-based process for evaluating tenders for GSM Mobile Telecommunications in Botswana.



The CSIR's archive of satellite imagery contains images of a particular area at different times over the past 20 years.



# International dimensions

THE CSIR HAS TAKEN SIGNIFICANT STRIDES IN CEMENTING SEVERAL KEY INTERNATIONAL ALLIANCES, PARTICULARLY IN THE SADC REGION. IN ADDITION, WE HAVE EXPANDED OUR INTERNATIONAL NETWORKS WHICH NOW EXTEND INTO SEVERAL NEW REGIONS AND WE HAVE PLAYED AN INCREASINGLY SIGNIFICANT ROLE IN SOUTH AFRICA'S INTERNATIONAL RELATIONS IN THE FIELDS OF SCIENCE AND TECHNOLOGY.

## High-speed wireless system for Tanzania and Mozambique

The CSIR was involved in a project for the University of Dar es Salaam for the installation of a Community Information Delivery System (CiDS) that connects the campus to the Internet.

Distances between buildings, poor telecommunication lines and a lack of sufficient telephony infrastructure made the high-speed wireless system ideal. By means of CiDS, the medical school and the faculty of architecture are now linked to the computer centre to allow access to information services and networks as well as the Internet.

A similar system was installed at the University of Edwando Mondlane in Maputo, Mozambique.

## African groundwater professionals get a taste of the Cape

This year for the third time, the CSIR, in collaboration with the Institute for Groundwater Studies (IGS) at the University of the Free State, presented a course on Groundwater Resource Management to participants from all over Africa.

The course follows the normal BSc Honours schedule but includes one month of practical instruction by the CSIR. It is one of 75 courses offered by Carl Duisberg Gesellschaft (CDG) and is funded by the German government.

This year there were 16 participants representing nine African countries, including South Africa. For the first time there were participants from Lesotho and Namibia. The other countries represented were The Gambia, Ghana, Kenya, Tanzania, Uganda and Zambia.

## International forum for coastal and port engineers

The CSIR has signed a Memorandum of Understanding with the permanent secretariat of the International Conference on Coastal and Port Engineering in Developing Countries (COPEDEC) and the Ministry of the Flemish Community and Flanders Hydraulics, Belgium.

The memorandum specifies the duties and responsibilities of the COPEDEC secretariat as the organiser, the CSIR as the local host and chief sponsor on behalf of the coastal engineering community of South Africa, and the Ministry of the Flemish Community and Flanders Hydraulics as the main bilateral cosponsor, in holding COPEDEC V.

The overall theme of COPEDEC V is Sustainability in Coastal and Port Development, and it will be held in April 1999 in Cape Town.

The main objective of the conference is to provide an international forum where coastal and port engineers from developing countries can exchange know-how and experience with each other and with their colleagues from developed countries.

## Southern Africa up for Global IT Challenge

Contributing to social upliftment has become an important keystone in business today. Now information technology companies have their chance to show what they can do through the Global Bangemann Challenge - an international award recognising IT projects which have a positive impact on people, communities and the environment.

The Challenge is being co-ordinated in southern Africa by the CSIR which is also managing a number of projects which will be entered in the Challenge. The CSIR's projects focus on information delivery and connectivity to communities which lack standard IT infrastructure.

## Survey of the Port of Beira

Pioneering research into ocean conditions off the Mozambican coast was done by the CSIR during a multi-disciplinary environmental survey of the Port of Beira.

The CSIR was contracted to carry out the survey because the 26-km-long shipping access channel to the Port of Beira is to be deepened with the financial assistance of the Japanese International Co-operation Agency (JICA).

The CSIR team's research area covered 370 square km and it was the first time that any detailed oceanographic and environmental work had been done in that part of the world. From a technical and logistical point of view, the study showed that the CSIR is capable of successfully executing projects in relatively distant parts of the world where there is a shortage of resources.

The CSIR is upgrading its facilities in a strategic partnership with the US-based Hughes Space and Communications and to support spacecraft operators in Region One (Africa, Europe and the Middle East).

### Vital role...

The CSIR will act as host for the international Conference on Coastal and Port Engineering in Developing Countries to be held in Cape Town in April 1999.



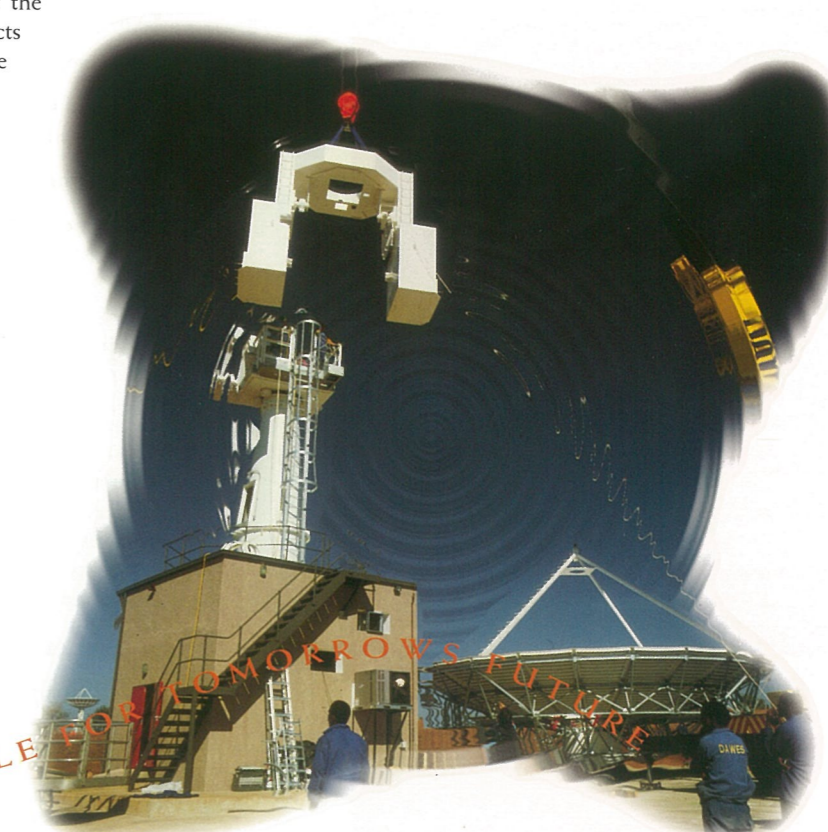
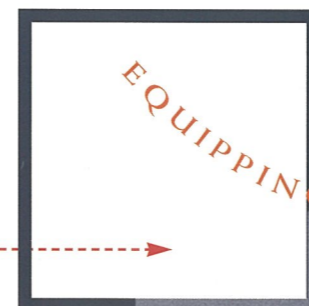
### Bioprospecting...

A CSIR collaboration with the National Cancer Institute in the US will transfer world-class technology for screening natural products for anti-cancer drugs.



### International award...

The CSIR is co-ordinating the Global Bangemann Challenge in South Africa. The award recognises IT projects which contribute to social upliftment.



THROUGH ITS STRATEGIC ALLIANCE POLICY, THE CSIR SEEKS TO BECOME PART OF THE GLOBAL RESEARCH AND DEVELOPMENT BUSINESS BY ENTERING INTO PARTNERSHIPS WITH GLOBAL CORPORATIONS.



#### Boost for SADC Free Trade Area

The formation of a Southern African Development Community (SADC) free trade area took a significant step forward with the release of a draft Memorandum of Understanding (MoU) on "Standardisation, Quality Assurance, Accreditation and Metrology" (SQAM).

The MoU will formally establish an essential support framework for implementing the Trade Protocol which was signed last year by the State Presidents of SADC countries and is aimed at establishing a free trade area in southern Africa.



The draft MoU was completed by a task team under SADC's Industry and Trade Co-ordinating Division. Dr Franz Hengstberger, sectional manager at the National Metrology Laboratory (NML) at the CSIR, is a member of the task team.

The MoU sets out the infrastructure and institutions SADC countries need in order to produce quality goods and services.

#### Closer ties with CSIR India

The CSIR in South Africa is forging closer links with its counterpart, the CSIR in India. As part of this collaboration, the CSIR's National Metrology Laboratory and its equivalent facility in India, the National Physical Laboratory (NPL), are to sign a Memorandum of Understanding in 1998 to promote closer co-operation.

Metrology and accreditation are tools by which countries harmonise standards and quality assurance, and establish equivalence. These in turn are factors which facilitate trade and create opportunities for industries to take advantage of each other's markets. Capturing 5% of the market in India with its population of nearly 1 billion, would be 50 million people – larger than the population of the whole of SA.

CSIR representatives have visited CSIR India and at least five collaborative projects have been identified:

- Harnessing biodiversity.
- All-composite aircraft for civil aviation.
- Audit of CSIR India, presently spread over 40 institutions and facilities employing over 20 000 people.
- Leadership development.
- Utilisation of industrial waste.

#### New high technology communication satellites

US-based Hughes Space and Communications is expanding its worldwide network of satellite tracking, telemetry and command ground stations through a strategic partnership with the CSIR's Satellite Applications Centre (SAC).

With its upgraded facilities, which includes a new antenna, receivers and other equipment, SAC will support the future missions of Hughes in the Ku/Ka band and other spacecraft operators in Region One, which covers Europe, Africa and the Middle East. Inclusion of SAC as part of the ground support network will enable satellite operators to meet expected increase in launch demand.

#### Environmental programme for Mozal Smelter

The CSIR completed an Environmental Management Programme (EMP) for the Mozal Smelter. This follows on from the comprehensive Environmental Impact Assessment (EIA) that was

completed last year. The smelter, which will provide a dramatic economic boost to the region, is planned to be situated in a free trade zone on the outskirts of Maputo some 17km from the harbour.

The purpose of an EMP is to ensure that, in implementing a new development, negative environmental impacts are managed and monitored, positive impacts are maximised and affected areas are rehabilitated. In keeping with these requirements, the EMP formulated for the Mozal Smelter serves to ensure that:

- Recommendations in the EIA are effected in the implementation of the project.
- Outstanding issues from the EIA are addressed and assumptions contained in the EIA are tested and verified.
- Provision is made for the evolving nature of the project without compromising on the environmental management requirements.

#### Joining global R&D business

The CSIR has been successful in securing European Commission (EC) contracts. The opportunity to work with European and African partners is vital to the long-term growth of the CSIR's science and technology base. Successes this year include:

- An appetite suppressant derived from a local plant which is being commercialised in partnership with a UK pharmaceutical company, Phytopharm. As a next step, Phytopharm and CSIR are collaborating in further developing the appetite suppressant. The agreement with Phytopharm provides for the transfer of drug development technology to South Africa, including establishing an FDA-approved phytomedicine pilot plant at the CSIR.
- The CSIR's Fishing Industry Research Institute was selected as a consortium member, with partners in Iceland, Denmark and Germany, to co-operate in a project investigating the potential for human consumption of fish caught in northern waters and currently utilised as fish meal.
- The CSIR signed an agreement with Fundación Chile which will allow the CSIR to acquire unique aquaculture technology.

Screening indigenous plants for biologically active constituents has yielded an appetite suppressant which is being commercialised in association with a UK pharmaceutical company.

#### Pioneering research...

A multidisciplinary environmental survey by the CSIR of the Port of Beira was the first of its kind in that area.



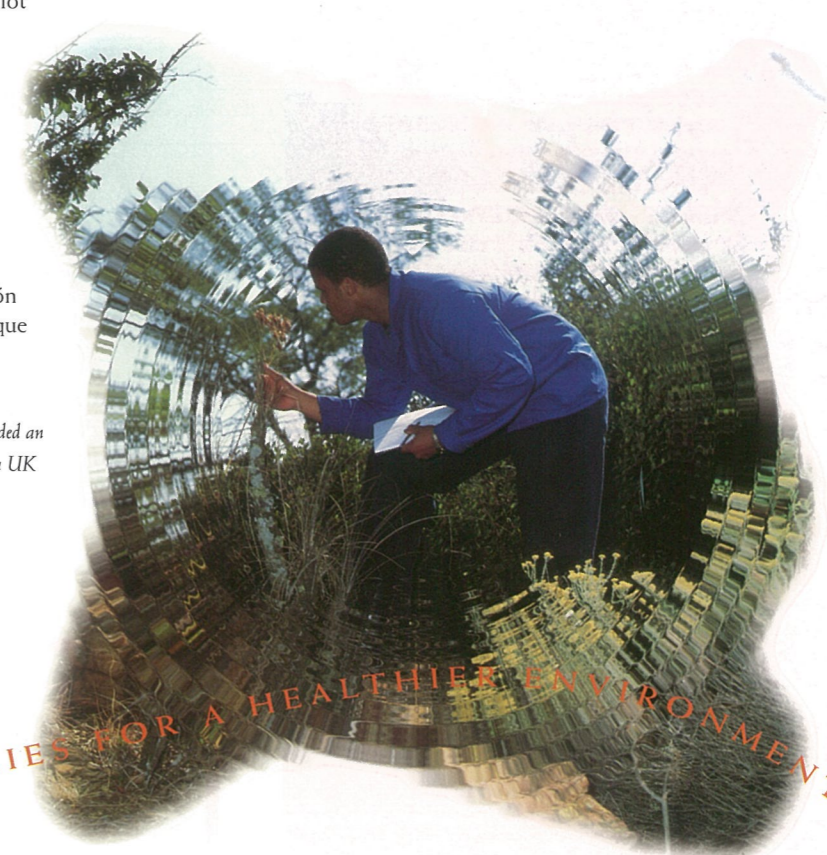
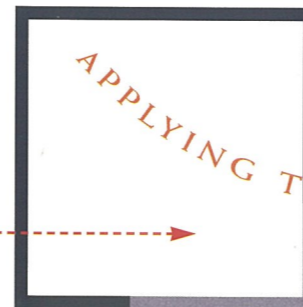
#### African professionals...

Sixteen participants representing nine African countries attended the CSIR's Groundwater Resource Management course this year.

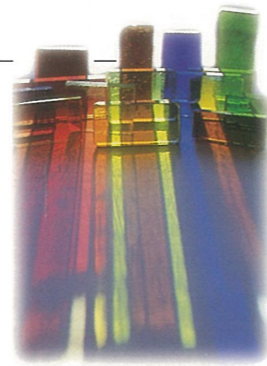


#### Global linkages...

The CSIR is involved in several international projects to transfer knowledge and know-how in the use of its Heavy Vehicle Simulator which simulates 20 years of traffic in three months.



THE CSIR CREATES WEALTH AND JOBS IN SOUTH AFRICA BY PRODUCING LOCALLY THE PRODUCTS DERIVED THROUGH CONTRACTUAL ARRANGEMENTS WITH FOREIGN COMPANIES.



New radar signal processor  
The CSIR's Defence Electronics programme has successfully completed and delivered a concept study commissioned by Dasa (Daimler-Benz Aerospace) of Germany for a new generation radar signal processor. The contract was awarded on the basis of Dasa's acquaintance with the CSIR's capabilities in this field through previous contacts.



Radar signal processing technology is applied in radars used for surveillance and weapon fire control and air traffic control.

The Dasa project involved a signal processor for a multi-beam electronically scanned phased array radar. The signal processor is estimated to operate at 20 to 30 giga operations a second (billion operations per second). This is equivalent to the processing power of 200 to 300 state-of-the-art desktop PCs.

#### Making an impact in world market

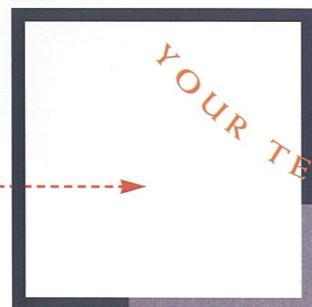
The South African Heavy Vehicle Simulator (HVS) has recently made a significant impact internationally, particularly in the US. The HVS has been used in a joint project with the University of California at Berkeley and Dynatest Consulting to conduct research for the California Department of Transport (CalTrans).

The CalTrans project has been particularly successful over the past 3 years in assessing four innovative asphalt pavement structures. The success of the first project has subsequently been followed up by the initiation of a second project using an HVS on a major concrete freeway at Palmdale, Los Angeles.

The HVS will be used to evaluate the performance of several sections of rapid hardening concrete. A CSIR team of operators is manning the machine on a 24-hour basis and CSIR researchers are contributing to the analysis and interpretation of test results.

New HVS Mark IV machines are currently being used by the Cold Regions Engineering Laboratory (CREL) in the USA and in a joint project between VIT in Finland and VTI in Sweden.

In addition, a new doubled sized HVS (nicknamed "Bigfoot") for testing airport runways and taxiways is currently under construction for the US Corps of Army Engineers. The CSIR is involved in several projects to transfer knowledge and know-how in the use of these machines, as well as in the interpretation of data and results.



YOUR TECHNOLOGY PARTNER

# ln conclusion



The CSIR's focus during this past financial year can be summarised in one word: growth – growth of people, growth in innovation and growth towards becoming a world-class organisation.

Despite a tough business climate and huge changes in the science and technology sector, the CSIR continued to set ever higher standards of scientific and technological excellence. Testimony to these achievements was, among other things, the favourable DACST-led international Review of our activities, and our appointment as the Regional Focal Point (RFP) for Africa of the World Association of Industrial and Technological Research Organisations.

The nature of our business demands that we anticipate the scientific and technological forces that will shape the years ahead. This means devising a strategy that will secure our competitive position and strengthen our ability to fulfil our statutory obligation to acquire and transfer technology.

The local and international environments in which the CSIR operates remain very fluid. This has meant that we have had to regularly review our strategy to ensure that we are able to continue contributing to the attainment of national objectives.

As a result of our Foresight process, initiated in 1997, all CSIR's operating divisions have defined the drivers of social change that will shape their specific sectors and industries in the next two decades. These drivers have now been used to identify the technologies that could be produced or adapted to suit South Africa's needs in the years to come.

We are confident that with the dedication, effort, knowledge and expertise of our staff, partners and associates, the CSIR will continue to adapt creatively and innovatively to whatever new challenges the future has in store for us all.

The CSIR's Pretoria headquarters where, as at all its other sites nationally, CSIR people are striving to set ever higher standards of excellence.

# CSIR Divisions

The CSIR's "engine room" consists of nine market oriented operating divisions. In addition, in striving towards being a "boundaryless" organisation, there are many cross-cutting and integrating initiatives which draw on skills from across the organisation.



Director:  
Johann Ahlers

**Manufacturing and Aeronautical Systems Technology (Aerotek):**  
SERVES: The manufacturing industry, the National Defence Force and the safety and security sector as a systems technology partner.



Director:  
Gaby Magomola

**Building Technology (Boutek):**  
SERVES: The building and construction industry - and government at national, provincial and local level with the provision of cost-effective solutions relating to materials, methods and systems.



Director:  
Dr Petro Terblanche

**Food Science and Technology (Foodtek):**  
SERVES: Companies, SMMEs and developing communities in the fields of food, feed, beverage, biotechnology and fine chemicals through a wide range of technological products, services and solutions.



Director:  
Anthos Yannakou

**Water, Environment and Forestry Technology (Environmentek):**  
SERVES: Industry, government at national, provincial and local level, and urban and rural communities through comprehensive environmental assessment and management services.



Director:  
Dr Neville Comins

**Materials Science and Technology (Mattek):**  
SERVES: Public and private sectors in manufacturing, mining and minerals, chemical and defence. Adapting and transferring technologies for SMMEs through analysis, large team processes and product development.



Director:  
David Bath

**Information and Communications Technology (Mikomtek):**  
SERVES: Government and business by adapting existing technologies to local needs and developing information and communications products and services to enhance competitiveness, aid efficiency and support development.



Director:  
Dr Güner Gürtunca

**Mining Technology (Miningtek):**  
SERVES: Local and international gold, platinum, base metals and coal mines and associated industries, mining houses, government and unions, by adapting and transferring technology to improve health, safety and productivity.



Director:  
Tina Eboka

**Textile Technology (Textek):**  
SERVES: Textile, clothing and related industries in formal and informal sector to improve the competitiveness of the textile and clothing industries.



Director:  
Dr Hoffman Maree

**Roads and Transport Technology (Transportek):**  
SERVES: Public and private sector in the fields of transport policy, planning, infrastructure and operations.

