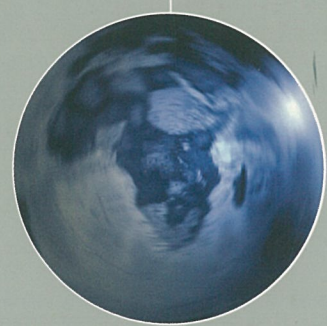


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The CSIR Technology Impact 2000



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 - As a uniquely South African organisation, the CSIR is committed to innovation. We exist to support sustainable development and economic growth in the context of national priorities and global challenges. We create value for our clients, partners and stakeholders by providing technology solutions and information, establishing ventures and licensing intellectual property.

Our values - CSIR people • have a passion for Excellence • live Service, striving to anticipate, meet and exceed the needs of our clients and stakeholders • recognise that it is People who make things happen - and work towards others' growth and development • strive always for Relevance - finding solutions to real needs, making a difference - national priorities are our priorities • are committed to Innovation - our lifeblood: from idea generation through to practical implementation •...always with unshakeable integrity
ESPRIT - The spirit of the CSIR

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OUR BUSINESS UNITS

This millennium issue of *Technology Impact* celebrates the CSIR's contributions during the transitional 1999/2000 year. We are indeed proud to present a rich canvas that portrays technology solutions and informa-

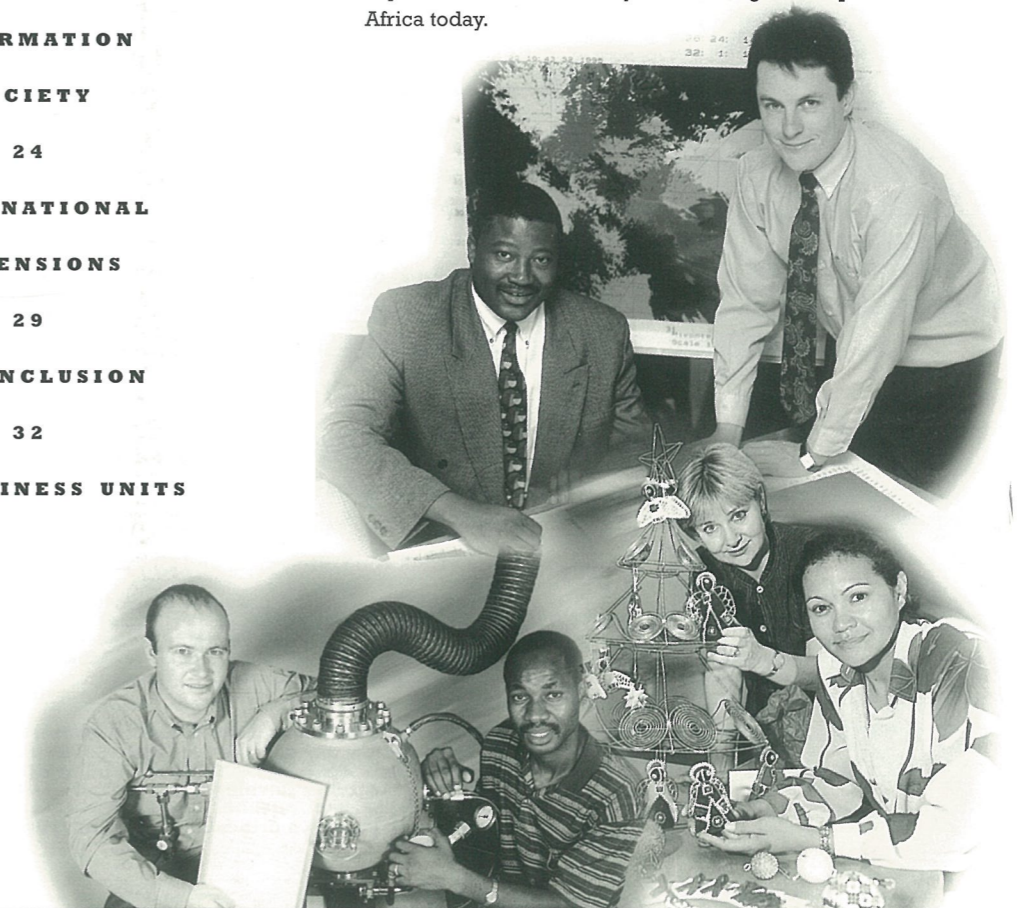
tion that have touched the lives of people both within and beyond South Africa's borders.

As a uniquely South African organisation, we have tailored our endeavours to retain and enhance our world-class status in niche fields, while at the same time increasing our efforts to support national imperatives. For South Africans, as well as the people of Africa and beyond, this means having a technology partner linking them to the best expertise the world has to offer.

Our strategic vision continues to be driven by the objectives of the National System of Innovation as outlined in the White Paper on Science and Technology. This year we report on a number of DACST-led initiatives and Innovation Fund projects in which we have participated. Our work with a wide range of local, provincial and national government stakeholders is reflected.

We have also assessed our current performance regarding the Presidential Imperatives of crime prevention, HIV/AIDS, human resource development, job creation, regional integration, rural development and urban renewal. This will continue to grow and develop as we work with our partners in Science Councils and other agencies. In crime prevention, where the CSIR acts as the convenor, there have been some remarkable achievements in ensuring a more secure, safer life for all.

However, innovation is much more than having a good idea - it's about putting that idea effectively into the market. It is our hope that *Technology Impact* will be of value to you in sharing in the spirit of innovation in South Africa today.



Competitiveness and job creation

NATIONAL PRODUCT DEVELOPMENT CENTRE

The National Product Development Centre (NPDC) was recently established at the CSIR and launched by Dr Ben Ngubane, Minister of Arts, Culture, Science and Technology (DACST). The primary focus of this facility is to help local industry distinguish their products in the global market place through excellent cultural, industrial and engineering designs.

DACST has strongly supported this CSIR-managed initiative, which serves as a single point of contact for design and manufacturing assistance, intellectual property protection and high-level training in the country.



Significant technological innovation is required to boost South Africa's international competitiveness, expand our economic base and create significant numbers of new jobs. Innovation doesn't happen by chance, and therefore all leading companies manage innovation. The CSIR is a partner in this process, assisting clients to realise their ideas through products and services that give them an edge in the marketplace.

World-class medicinal plant extraction facility

A medicinal plant extraction facility for the production of complex botanical mixtures for use in human clinical trials, the first of its kind in the world, has been established at the CSIR. The facility extracts and supplies plant-derived medicinal substances used in clinical trials. The facility has been approved by the US Food and Drug Administration.

The establishment of the facility is a significant milestone in the CSIR's Bioprospecting Programme, aimed at investigating the biopotential of South Africa's 23 000 indigenous plants and producing botanical products of the highest quality. Overseas collaborators include UK-based Phytopharm plc and US pharmaceutical giant Pfizer.

Creating critical mass in food, biotechnology and fine chemicals

Two CSIR business units, Foodtek and Bio/Chemtek have merged to create CSIR Food, Biological and Chemical Technologies. With over 300 professional staff it provides powerful technological support for the agrofood, fine chemicals and pharmaceutical industries, SMMEs and developing communities.

Bio/Chemtek became part of the CSIR in 1999 with the acquisition of AECI's Research & Development (R&D) Department. Its merger with Foodtek creates a critical mass of innovative scientists and

engineers in the fields of food technology, biotechnology, analytical services, bioprospecting and fine chemicals.

Chemical traceability for international trade

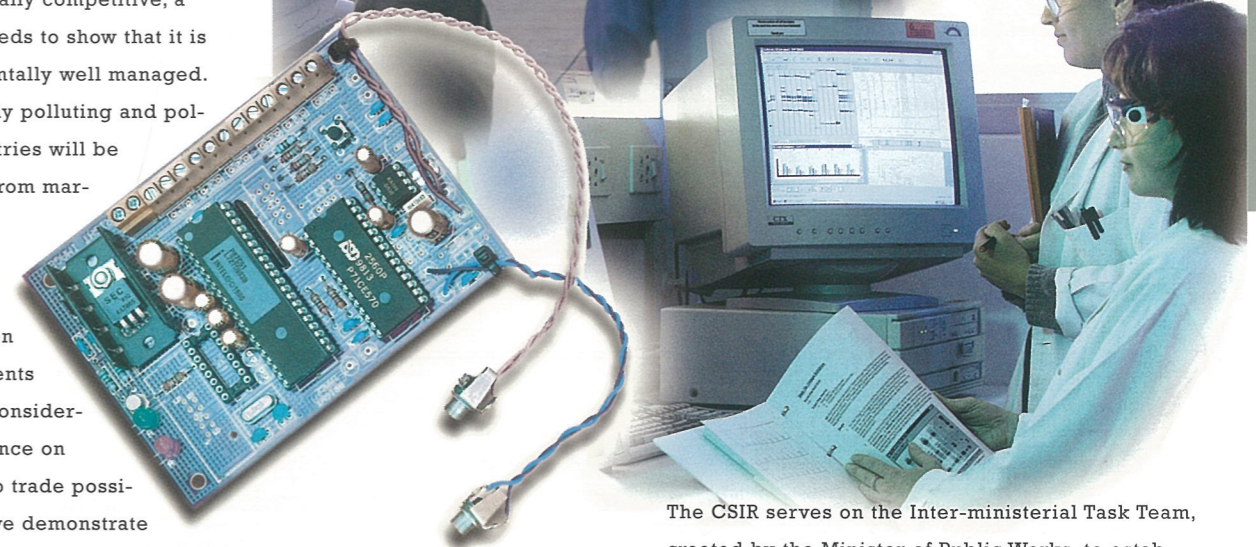
To be globally competitive, a country needs to show that it is environmentally well managed. Increasingly polluting and polluted countries will be excluded from markets. South Africa's industrial air pollution measurements will have considerable influence on opening up trade possibilities if we demonstrate the integrity and comparability of our results.

The CSIR's National Metrology Laboratory (NML) has established a chemical metrology capability, which enables South Africa to join metrology institutions globally in making such chemical comparisons and declaring the equivalence of the results.

The CSIR NML's facility for the accurate preparation of gaseous reference materials by mass prepares reference materials for air pollution monitoring for local gas suppliers. This new facility also enables the preparation of audit samples for proficiency testing schemes to establish comparability of measurement results amongst the calibration laboratories accredited for air pollution monitoring.

Transforming the construction industry

With one of its key clients, the Department of Public Works, the CSIR has played a significant role in formulating strategy, developing policies and creating legislation to take the South African construction industry into the 21st century.



The CSIR serves on the Inter-ministerial Task Team, created by the Minister of Public Works, to establish the Construction Industry Development Board (CIDB), which drives development and transformation on behalf of all stakeholders. The CIDB's mandate will be to promote and co-ordinate an integrated industry development strategy, and provide leadership in the national interest. A Framework Plan and Draft Legislation has been developed for the establishment of the CIDB as a statutory body, pending approval by Parliament.

Moving it all about

Excellence in logistics - the art and science of moving things from one place to another - is a key lever to reduce costs, improve efficiency and achieve higher profitability. The CSIR's logistics team is taking the lead as an innovative logistics solutions provider to help our clients in gaining a competitive edge and improving customer service.

Clients have been attracted by our expertise in policy and regulatory issues, to supply chain optimisation, logistics modelling, and decision support systems for large, small and emerging businesses. The development and application of superior technologies, software, GIS applications and unique methodologies are major support tools in the CSIR's logistics platform.

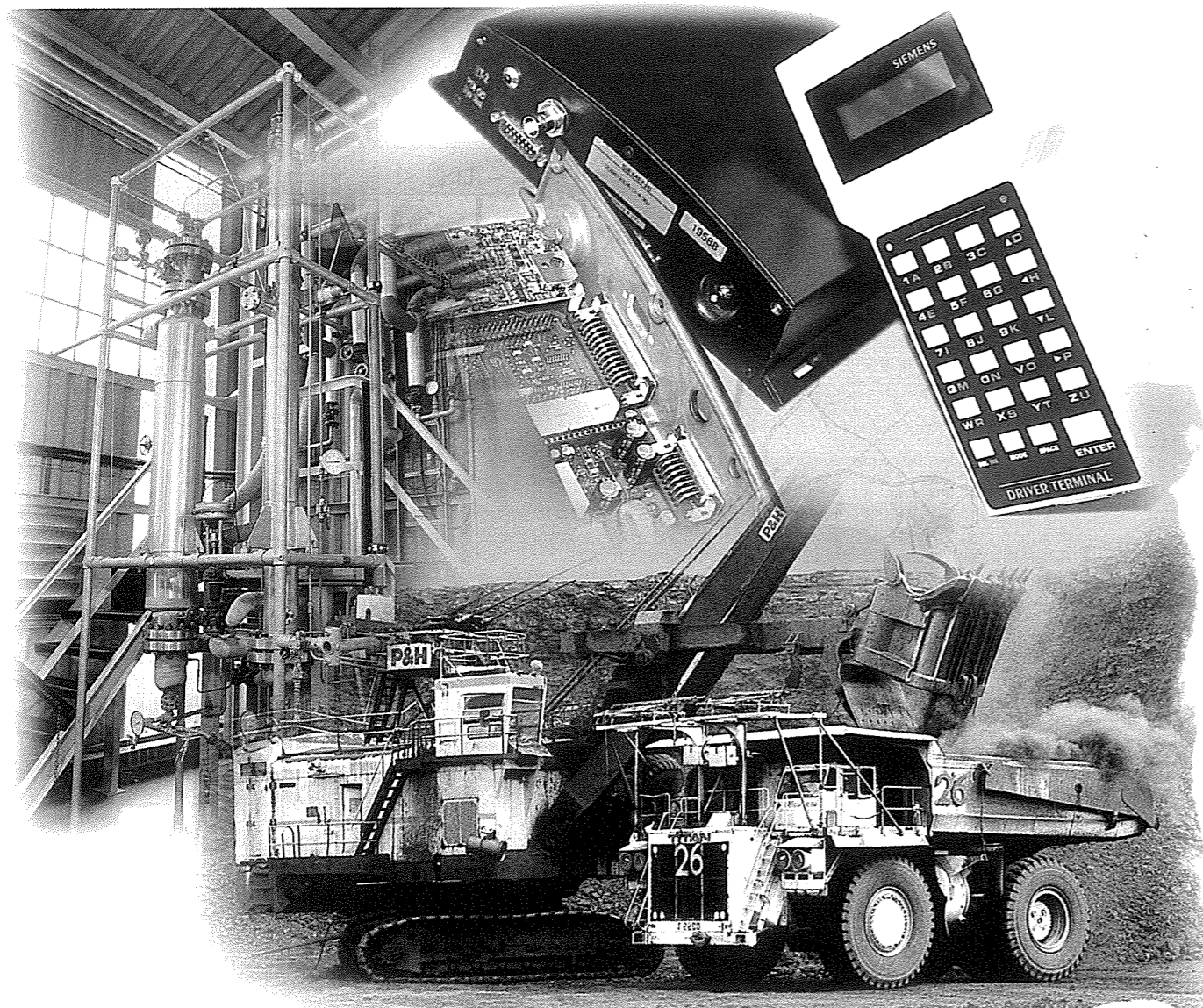
A CSIR client found it was losing a part of its market share between Durban and Gauteng to road hauliers. The CSIR was contracted to investigate and found that the company's logistics supply chain was more complex and costly than that of the road hauliers. As an ongoing part of this project, the CSIR will be conducting a logistics audit on all the client's distribution functions to come up with practical solutions.

Boost for anti-tetanus vaccine

Rapid characterisation of a key vaccine chemical saves time and money compared to previous lengthy screening by fermentation.

Casein hydrolysate is a major component of the fermentation medium for the production of tetanus toxin used by South African vaccine producers to manufacture anti-tetanus vaccine. A CSIR-developed analytical technique uses Near Infra-Red (NIR) spectroscopy to rapidly (within minutes) characterise batches of casein hydrolysate and to predict the likely yield of toxin in fermentation. This process previously took several weeks.

As a result of this development, South African manufacturers can now improve productivity and keep their businesses at the cutting edge, even when they don't have the key instrumentation in-house.



Composite fan for Titan mine vehicle

Massive Titan trucks move coal from the Grootgeluk Coal Mine to a collection site at the mine. The vehicles were subject to critical failures of the centrifugal fan used to cool the electric motors that drive the rear wheels.

The CSIR was contracted to design the fans from composite material - in this case glass-fibre reinforced epoxy - selected for its long life, lower density and its non-conductive nature. The strength of the CSIR-developed composite fan not only matches the strength of the existing metal fan but also weighs only half as much.

Jet reactors for fine chemicals

Jet reactors are devices within which chemical processes are carried out for experimental or manufacturing purposes. World-class gas/liquid and gas/liquid/solid reaction equipment installed at the CSIR this year opens new business and research opportunities in the field of speciality and fine chemicals production. Jet reactors have major advantages over conventional tower gas/liquid/solid reactors that require forced circulation of the liquid phase. The CSIR's reactor operates at the 25-50 litre scale up to 150°C and pressures of up to 12 bar.

Using biotechnology innovatively

D- or L-amino acids are the intermediates in many pharmaceutical products. Traditionally these intermediates are produced by conventional chemistry. There are considerable environmental and energy-saving benefits in using bacteria and enzymes to produce bio-products. A biotechnology project to do this is being supported by the DACST Innovation Fund. The CSIR and Rhodes University's Department of Biochemistry and Microbiology have partnered to create the necessary expertise for the multifaceted project, which requires genetic engineering, biocatalysis, organic synthesis, fermentation, and downstream processing capabilities.

The process is being scaled up to pilot plant volume. Commercial ventures are envisaged should techno-economic targets be met. Through this project our nation's capacity in biocatalysis is being developed in a very practical, market-led initiative.

World-class small businesses

Small and medium enterprises (SMEs) wanting to compete

in the global market are being assisted in implementing world-class business practices through the CSIR's Competitiveness Improvement Centre (CIC).

We have developed a capability for assessing whether individual SMEs are ready to contemplate exporting their products or services. This Export Readiness Assessment identifies company practices that can be considered world-class, as well as shortcomings, and offers expert services for improving and implementing world-class manufacturing techniques.

The CIC has been appointed by Ntsika Enterprise Promotion Agency to undertake the export readiness assessment for the Trade Investment Development Programme (TIDP) financed by the European Union. With each of the following companies that have been assessed the CIC team has developed individual improvement action plans to be implemented in the next phase of the TIDP.

Turning slag into a valuable product

Highveld Steel and Vanadium Corporation Ltd (HSVC) produces about one million tons of slag containing up to 30% titanium dioxide every year. This creates the potential for a world-scale titanium dioxide plant with the raw material available at virtually no cost. However, there is no commercial technology available in the world to recover titanium dioxide economically at such low concentrations.

A CSIR/HSVC partnership identified and patented a two-stage chemical route to recover the titanium selectively some years ago. The technology has been refined to the point where it has been assessed as economically viable. The process is presently being scaled up.

Knowing where you are - and where you're going!

Accurate positioning technology is a core competence required by many different industries, from precision agriculture to freight companies.

Utilising its competencies in navigation technology and sensing technology, the CSIR has combined these technologies creatively to provide an effective, low-cost continuous positioning system. Potential applications include Vehicle Tracking and enhanced Fleet Management.

The navigation system exploits the strength of a Dead Reckoning (DR) system in combination with a Global Positioning System (GPS). DR ensures continuous coverage with no position jumps, regardless of GPS gaps, while GPS limits the accumulation of DR errors.

Composites replace steel containers

Composite marine containers to replace welded steel ones have been designed by the CSIR for De Beers Marine. The lightweight containers have improved handling, as they are one-third of the weight of the steel version.

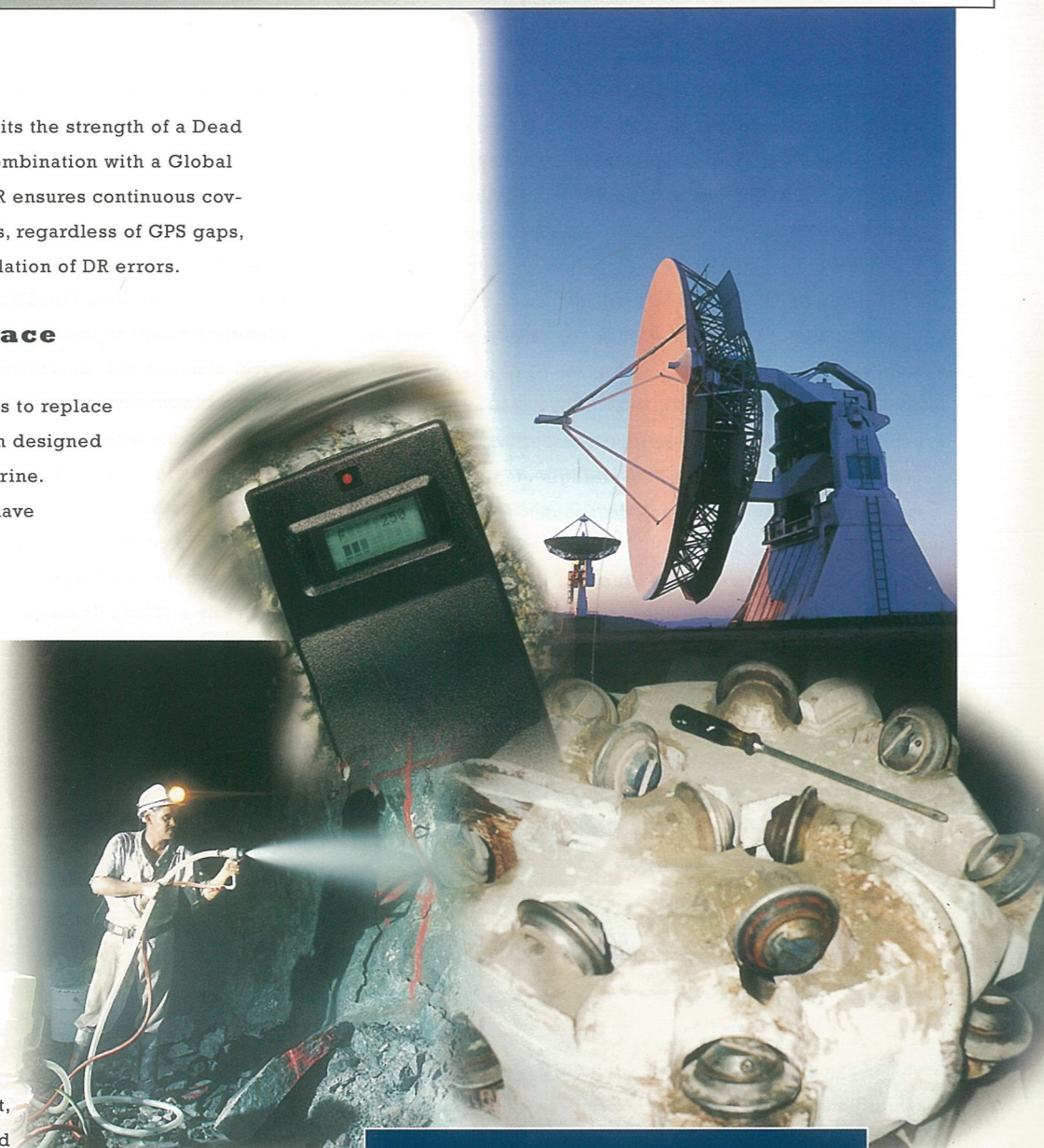
De Beers Marine has been using the CSIR custom-designed containers for its re-supply runs between Port Nolloth and coastal mining ships for the past 18 months with excellent performance.

The state-of-the-art containers were designed utilising a glass-fibre composite sandwich structure with a marine ply core. They are watertight, UV and weather resistant and met all the requirements of the client from operations and cost perspectives.

Pivotal role in emergency support of a satellite

The CSIR Satellite Applications Centre (SAC) was contracted through NASA/Boeing to support the launch vehicle carrying an Orion 3 Satellite. However, the second stage ignition did not take place as planned and the spacecraft was projected into a low orbit, approximately 30 000 km below the planned position.

The SAC was contacted by Hughes Space and Communications and requested to provide emergency support. The SAC reacted within two hours and successfully acquired and tracked the satellite.



Innovation, and a readiness to see and grasp opportunities - keys to gaining competitive advantage - are qualities the CSIR offers through the ideas of creative scientists, engineers and thinkers who seize the moment.

The SAC is still involved in the project, rendering support for 12 hours, once a week, for Hughes.

Mini-disc™ cutters give impetus to mechanised mining

The potential of new technology to achieve a five-fold increase in stope face advance in the mining industry is reaching the technical demonstration phase in the CSIR.

Mini-disc™ cutters cut hard and soft rock with forces and power requirements that are a fraction of those required by a full size disc cutter. Laboratory tests show that the high performance of the Mini-disc™ cutter has the potential to replace and raise current tunnel boring technologies. This saves energy and reduces machine size and cost. Replacement of the discs is simple and cheap. A mechanised mining machine using Mini-disc™ technology could fundamentally change stope management and operations underground.

Fast detection of gold-bearing reefs

A low-cost, hand-held instrument, which can be used to scan rock faces to delineate gold bearing reefs in real time, has been developed at the CSIR. Currently the specialist skills of a geologist are required to delineate the reef, but this new instrument can be used by production personnel trained in its use.

The Reef Detector works on the principle that major gold-bearing reefs frequently contain higher levels of uranium than the surrounding rock and therefore emit higher levels of gamma radiation. The instrument detects these changes in the uranium levels in rock. Other applications on the surface and underground include testing for uranium contamination in water and rock.

Taking shrinkage out of wool

While the natural tendency of wool to shrink or "felt" is an advantage in the manufacture of certain products such as berets, it is a major disadvantage in products such as duvets. Felting of the fibres used as filling material can render the product unusable because of a loss in bulkiness. Wool fibres that are used as filling material for wool duvets therefore need to be chemically treated with an oxidising agent prior to the manufacture of the duvets to prevent shrinkage.

MAKING MICROWAVES EVEN BETTER

The CSIR has developed a unique family of patents based on an invention utilising the properties of microwaves in, among others, five-sided cavities.

This patent portfolio is currently the subject of licensing negotiations with key players in the household and industrial microwave markets.

Potential benefits to end-users and manufacturers include the elimination of turntables from microwave ovens, more uniform and rapid heating and cooking, and reductions in the weight of microwave ovens, with the possibility of a truly 'portable' oven on the horizon.

A circular inset image showing a man with a beard and glasses sitting at a desk, looking at a computer monitor. He is wearing a dark jacket. The monitor displays some graphical information.

An anti-shrink process, together with the equipment, was developed and incubated at the CSIR. The technology has now been transferred to SMMEs in the textile sector, supporting the Government's wool beneficiation initiative. A number of jobs will be created as a result of this development.

Safeguard against PC viruses

Responsiveness to market trends, coupled with a sense of responsibility for stimulating an indigenous ICT industry, has led the CSIR onto a new road for commercial venturing. The first steps towards this end were taken during 1999. These included the spinning out of CSIR-developed anti-virus software as a business in its own right, together with Aqua Online, who obtained shareholding to form a new company - Virus Protection Systems (VPS), which is making inroads into this competitive market.

The CSIR, as a shareholder in the venture, continues to play an active role by providing insight into the technical strategy for the future development of VPS and related security products within Aqua Online. The Aqua Group provides functional e-commerce solutions across a full spectrum of on-line and off-line services, and security products are therefore a key component of its portfolio. This joint venture will continue to provide invaluable learning, which will be built into the CSIR's future business focus of growing its impact in the South African market through such ventures.

Take your seats please

Pilots and passengers in helicopters of the future will be safer in their seats as a result of CSIR research focusing on "crash resistant" seats.

The CSIR has been in the helicopter seat design business since the early 1980s, when seats were developed for Denel Aviation's Oryx helicopter. As requirements have changed, the need for seats that are more 'crash-resistant' has increased. The CSIR has used a 'dummy' in a series of crash simulations, using smart modelling and analysis software to establish the best basis for design from a weight minimisation and aircrew survival perspective, in the event of a crash. The results have shown that the survivability of the occupants could be significantly enhanced using the crash-resisting technologies that have been developed.

Farm-based essential oil businesses

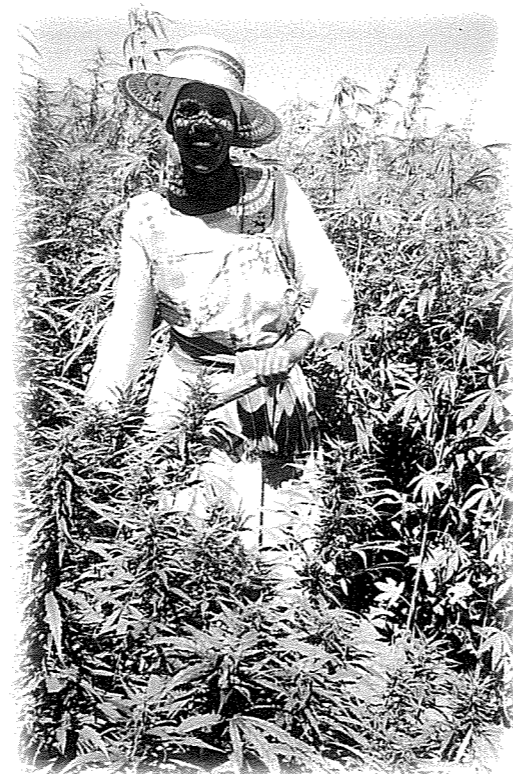
South Africa has the potential to develop further essential oil products and companies. The CSIR is conducting the research to develop the required know-how, which, up to now, was not available to small businesses in the country. We currently support developing essential oil businesses on about 35 farms nation-wide in the formal agricultural and community development sectors. Production, based on CSIR technology, is under way and contracts to supply the international market are being secured.

Production and processing of hemp

The Eastern Cape pilot project aimed at the commercial production of low-narcotic (dope-free) hemp has been launched following a pre-feasibility study conducted by the CSIR.

The South African Government is funding the agronomic trials aimed at the cultivation of hemp for industrial and commercial purposes. The CSIR and the Agricultural Research Council (ARC), in collaboration with other government and private sector stakeholders, are partners in the creation of this "value chain". The CSIR serves on the Hemp Steering Committee as the technology partner in hemp processing, the focus being on textiles, which is one of the key applications of hemp fibres.

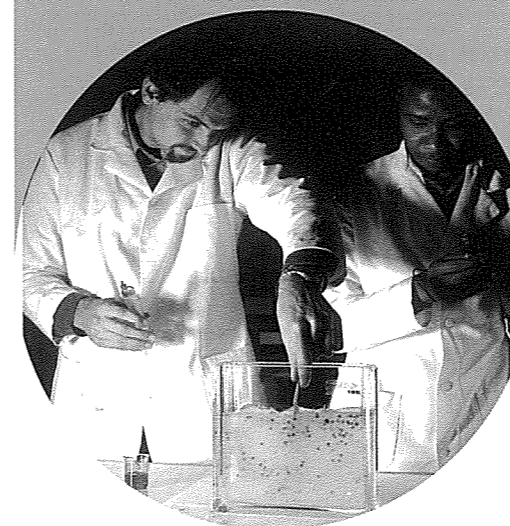
The project forms part of a comprehensive programme to establish an SMME-based natural fibre value-added industry in South Africa, to supply the growing local and global demand for natural fibre products.



Quality of life

BOOSTING A HEALTH-CONSCIOUS LIFESTYLE THROUGH ACTIVE BEADS

A technology to encapsulate micro-nutrients, vitamins, minerals and trace elements has been developed at the CSIR. These active beads can be incorporated into energy drinks, energy bars and snacks to enhance nutritional content. The active-bead technology has further potential application in the encapsulation of other active substances, such as herbal extracts, enzymes, appetite suppressants and drugs, for easy and efficacious administration.



We are determined to make a positive and enduring impact on the quality of life of all South Africans. In striving towards building a better, safer and more secure future for the citizens of our country, we are contributing to the creation of a more humane and people-centred society.

People-friendly protein

The CSIR is a partner in an international collaboration of African and European institutions developing the technology to make a dried fish product from small pelagic fish that can be used as a source of low-cost protein for developing countries. By making the fish attractive for human consumption, considerable value will be added to what is currently a low-value by-catch.

The challenge is to dry the fish, which has up to 20% fat, without destroying natural antioxidants or losing valuable nutrients. The drying process is being developed at the Fraunhofer Institute in Germany, with European Commission (EC) funds. The drying technology will be transferred to South Africa and the rest of Africa.

Ongoing experiments have produced a number of products, which are being tested for suitability for use in Africa by the CSIR. In addition, systems for desirable types of packaging and effects of transport are being investigated and assessed.

On-line traffic management

More than 500 000 accidents occur on South Africa's roads annually, costing the country approximately R13 billion. Road authorities are under increasing pressure to reduce road trauma by managing traffic along certain "corridors" more efficiently, such as the route from Johannesburg to Durban. Up to now there has been no integrated methodology to manage traffic along these corridors (or shorter road sections) over peak times, such as during the Easter holiday period. To address this, the CSIR is developing an Integrated Corridor Management System (ICMS) to assist road authorities. This system will offer a geographic information decision support system, delivered via the Internet, which provides simple and easily accessible management without the necessity of making investments in expensive GIS software.

HIV/Aids community project

Vaccines and expensive drugs are not the only way to deal with HIV/Aids, and simply increasing "public understanding" is not enough either. The West Rand mining town of Carletonville is the focus of a community-based intervention project, co-ordinated by the CSIR, to develop a means of reducing, through effective management, the incidence of Human Immunodeficiency Virus (HIV) infections.

The project, which has drawn considerable international support, focuses on the development of effective interventions and the evaluation of their impact.

Interventions are focused in two areas: the management of sexually transmitted diseases (STDs), which essentially involves teaching medical staff to treat patients with suspected STDs immediately on the basis of their symptoms alone, and community-based education and condom distribution.

The effectiveness of the project is assessed through medical and socio-economic surveys, supplemented by focus group discussions, and in-depth interviews. Results to date have been sufficiently encouraging to warrant extending the project to adolescents.

Drug release system achieves constant plasma profiles

To be clinically effective, most drugs need to be maintained at a level concentration in the human body over a period of time. Traditional dosage forms release the drug into the blood stream all at once, and the concentration maintained is governed by the half-life of the drug alone. The CSIR has developed a hydrogel drug-release technology, which releases the drug at a constant rate (zero order) as the dose travels through the gastrointestinal tract. A more constant drug plasma concentration profile is therefore maintained over an extended period of time, ranging between 12 and 24 hours depending on the individual. Medius (UK) is in the process of licensing the technology internationally.

Doppler probe for foetal monitoring

The proper development of a foetus during pregnancy

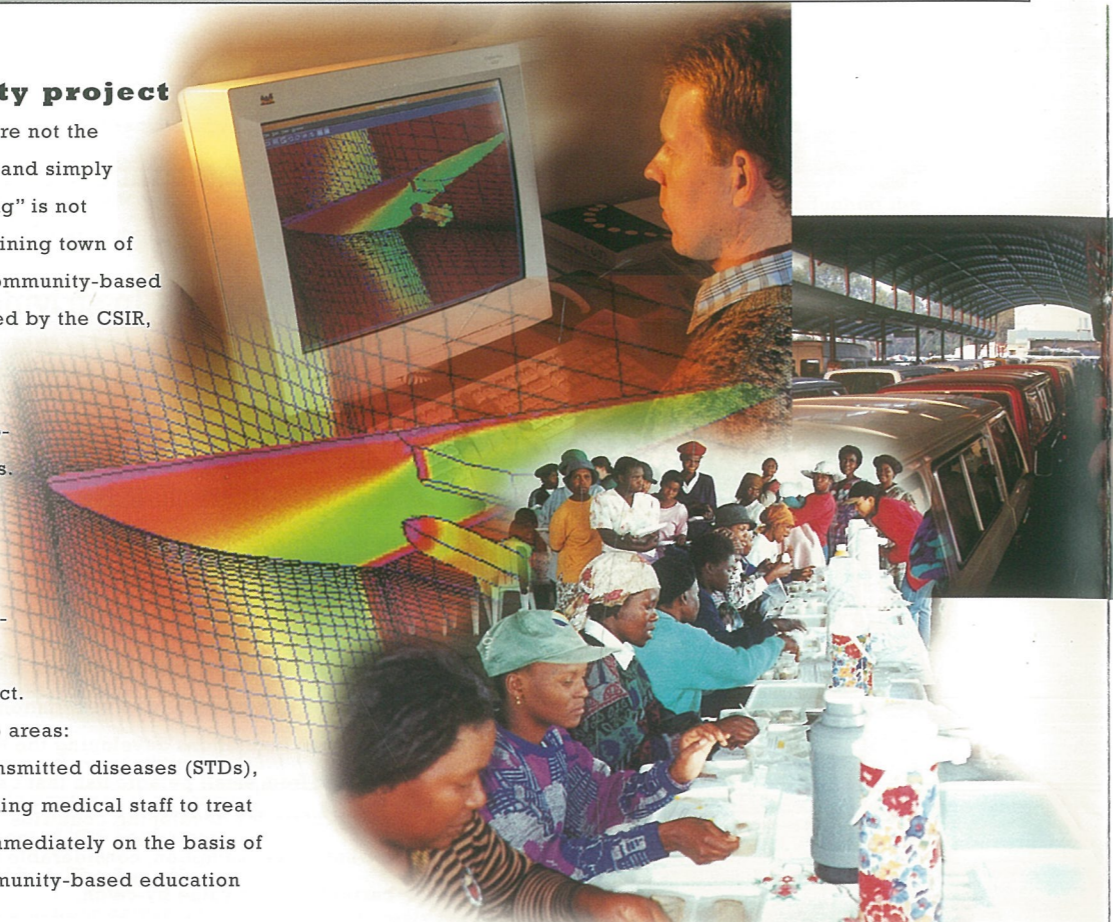
can be assessed using an ultrasonic Doppler technique that monitors blood flow in the umbilical chord. Widespread use of this technique in primary health care facilities is considered important. However, the cost of such equipment tends to restrict its application to major health care centres, thereby limiting access to the measurement.

A joint CSIR/Medical Research Council project has resulted in the development of a low-cost "stand-alone" measurement device, consisting of an electronic probe and an off-the-shelf computer, which performs this diagnostic function. Pre-trials to assess the technology in a medical environment are under way and full clinical trials will be undertaken in the latter part of 2000.

National strategy to improve road safety

A national strategy to curb the high number of pedestrian fatalities is being spearheaded by the CSIR. As part of this initiative the Departments of Transport in Gauteng and the Western Cape appointed the CSIR to develop Pedestrian Management Plans for their provinces.

Priorities that are being addressed include the development of a decision-support database listing casualties by



The CSIR is actively pursuing social and technology solutions that improve the quality of life in urban and rural developing communities.

magisterial district and the identification of the most hazardous locations. Educational material is being developed to improve the quality of road safety education and educational outcomes and practise are being evaluated.

Health for all

South Africa is in urgent need of community health facilities that are affordable, accessible and acceptable to the communities they serve, as well as providing an efficient and equitable service.

The CSIR has been involved in the Hospital Reconstruction and Rehabilitation Programme, enabling the strategic planning of health care services and facilities. The information/data gained during the strategic planning process and the subsequent capital planning is made available to administrators at all levels to facilitate informed decision-making regarding the future of health care facilities.

Key role in transforming the minibus taxi industry

The CSIR is playing a key role in the transformation of the minibus taxi industry, which is under way as a result of the implementation of the recommendations of the National Taxi Task Team (NTTT), which focuses on:

- Economic empowerment by establishing taxi co-operatives.
- Regulation and control through the registration of legal operators and a special legalisation process for certain categories of operators.
- Formalisation of taxi governance structures.
- Training and capacity building of drivers, operators and other stakeholders.

The CSIR has provided specialist advice on road traffic safety and related matters to the NTTT. Our involvement also includes the implementation of the NTTT Final Recommendations at provincial level in Gauteng and the Northern Province. In the Northern Province, the CSIR was involved in a mentorship programme with the Chairperson of the Taxi Board of Control. In Gauteng, the CSIR played an important role in the implementation of the recommendations of the Gauteng Taxi Initiative (GTI).

What commuters really want

In the move towards a more customer-based public transport system, the CSIR is applying Stated Preference, a market research tool that is extensively used in transport planning worldwide.

This technique is based on the observation that people choose between different service and mode alternatives because of the benefits they expect in terms of fare, travel time, safety, convenience, and a number of other factors. In a research project in Daveyton, Gauteng, the CSIR applied the Stated Preference technique to predict future travel behaviour. The CSIR is also using the technique to assist in the Fundamental Restructuring of Public Transport Services in Durban. The aim of this project is to determine the preferred mode of transport per corridor based on economic principles, as well as passengers' needs and willingness to pay.

Accurate missile aerodynamics

In support of the SANDF's 'smart buyer', approach the CSIR applies its weapons integration capabilities to match new aircraft with new weapons, and sometimes-new weapons with existing aircraft.

Computational modelling, in which a missile's aerodynamic flow field is simulated, is an essential tool used to predict aerodynamic behaviour.

During a project involving a specific missile designed by local missile producer Kentron, the CSIR enhanced its accuracy in predicting aerodynamic forces using computational methods. The predictions compared well with experimental data obtained from the CSIR's wind tunnel tests.

Simulation or accelerated reality?

By performing dynamic real-time evaluation and validation of anti-missile countermeasures against 'real threat' weapons in a simulated environment, CSIR scientists and engineers have helped to increase the survivability of aircrews.

South Africa's re-entry into the global community has brought new responsibilities, which are not without risk. Slow-moving aircraft come up against a variety of threats, including portable surface-to-air missiles. The CSIR, as technical advisor and technology partner to the South African Air Force (SAAF) and the South African National Defence Force (SANDF), was tasked with assisting in the development and evaluation of infrared anti-missile countermeasures for aircraft.

We harnessed years of practical experience in the field, blended it with a unique collection of software models, hardware components and human skills, to take the plunge into a virtual world. The commissioning of a 3-axis motion simulator at the CSIR embodies the paradigm shift from the evaluation of individual components to the integrated evaluation of complete systems in a simulated high-fidelity environment, in real-time.

Smart buyer support for defence acquisitions

CSIR teams participated in the technical reviews that formed part of the contract negotiations for the Gripen fighter aircraft. The CSIR plays this role in support of the Department of Defence, which has, as one of its key objectives, a 'smart' procurement practise.

The CSIR teams identified shortcomings in the proposals for several of the aircraft's systems and made recommendations for improvements prior to contract finalisation.

SORGHUM MADE MORE NUTRITIOUS - SIMPLY

The protein quality of sorghum can be improved by applying technologies such as malting and fermentation. These simple techniques can be used in households. This helps overcome the problem of the poor quality of sorghum protein in terms of digestibility and essential amino acid content compared to other grain foods.

The breakthrough is the result of a multi-national research effort by the CSIR, the University of Pretoria, the Institute of Food Research in the UK, the University of Aveiro in Portugal, Eduardo Mondlane University Mozambique and the Kenya Industrial Research and Development Institute.

The project, funded by the European Union, is nearing completion of the technical phases.

Workshops to communicate the findings to commercial food processors, entrepreneurs, community organisations, and other interested parties are being planned. Simple handbooks in English and Portuguese will facilitate implementation of the technologies.



Crime prevention

As Convenor of the Science Council Working Group on Crime Prevention, the CSIR is playing a key role in creating a safer, more secure environment. We have a vision of mobilising science and technology in the fight for safety, security and justice, and have been active in crime prevention projects since the beginning of 1997. We work with other Research Councils - the South African Bureau of Standards (SABS), the Medical Research Council (MRC), the Human Sciences Research Council (HSRC), the Agricultural Research Council (ARC) and Mintek.

Putting criminals behind bars

Advanced technology and expert interpretation provided by the CSIR were used as vital evidence in helping convict members of a brutal gang in Cape Town this year.

The so-called 'New Year's Gang' was responsible for a spate of murders during the holiday season in Cape Town in 1998. After sophisticated computer-based analysis had been supplied by the CSIR, two gang members were found guilty on 13 counts of murder, hijacking and robbery, and were sentenced by the Cape Town Supreme Court to 30 years in prison.

Two of the gang's victims were hijacked in central Cape Town and then murdered. The CSIR's expert in Geographical Information Systems (GIS) was able to track the movements of gang members during the hijacking and murders through two cell phones used by the criminals - one their own and the other stolen from the victims.

The CSIR has since been approached to map similar data for other cases in which cell phones were used.

Boost for anti-hijacking initiative

The CSIR is assisting the SAPS in an extensive Anti-Hijacking Initiative. One outcome of the CSIR's involvement is that for the first time crime pattern analysis will be routinely applied on a wide scale at different levels in the SAPS.

The CSIR's contribution is the innovative use of information technology (IT), especially crime mapping and analy-

sis, which empowers the police to better manage information concerning hijackings, and be more effective in preventing crime.

It also provides an information-based capability to fulfil the needs of law enforcers at different levels within the SAPS (operational, tactical and strategic) and enables detectives to compare information, such as the modus operandi and characteristics of suspects. This could strengthen cases in court and ultimately lead to more convictions.

Central depot of crime information

Availability and intelligent use of information are effective weapons in the fight against crime. A joint venture between the CSIR and Business Against Crime (Gauteng) aims to achieve this through the Crime Information Centre, which provides subscribers with packaged information. This includes regular provincial crime bulletins, a Website featuring key crime indices and in-depth analysis of critical issues associated with crime.

At the core of the Crime Information Centre is a well-managed data warehouse, which serves as a central repository of all crime-related information.

Curbing vehicle crime

Vehicle theft has been targeted as a priority in the national effort to curb crime in South Africa. In a project with the Vehicle Crime Task Team, the CSIR is assessing technologies that will make it more difficult for criminals

involved in vehicle crime and easier for authorities to identify stolen vehicles.

One focus area is looking at ways of securing the identity of vehicles. This deals with the unique Vehicle Identification Number (VIN) containing information on the type of vehicle, model, country of manufacture, etc. The 17-character number is generated according to international ISO standards and allocated when a vehicle is manufactured.

A variety of technologies are being considered to prevent VIN numbers from being removed. This includes two-dimensional bar coding, radio frequency identification transponders and multiple parts marking.

Intelligent solution to protect large sites

An artificial intelligence perimeter protection system developed by the CSIR for defence and commercial applications has been commercialised. The CSIR has transferred this technology to our partner PIDS International.

The CSIR's ACL20 uses active infrared beams to provide accurate information on intrusions on large perimeters and boundaries. Various options, such as lamp posts, wall-mounted light fixtures and palm trees with full electronics built in are available to suit the environment and needs of the client.

The advantages of the system are:

- Extremely low false and nuisance alarm levels.
- Intelligent information on the types of intrusions and exactly where they occur.
- Integration with a range of commercially available perimeter sensors, such as CCTV cameras.
- Automatic built-in test functions for easy maintenance.

Drugs and crime are linked

Half of the participating arrestees in a national study tested positive for at least one drug. Substantial variations in the nature and extent of drug use were found in Gauteng, Durban and Cape Town.

This, the first study of its kind in South Africa, investigated the link between drugs and crime. The study also yielded information on arrest patterns, illegal immigrants and HIV prevalence.

The first phase of this multi-site, 3-Metros Arrestee Study was conducted at police holding cells in Gauteng, Cape Town and Durban. With funding from the DACST Innovation Fund, it is part of a larger project on drugs and crime being co-ordinated by the CSIR and aimed at understanding the factors influencing crime to help inform interventions.

Closing in on serial criminals

Geographic Profiling is a new investigative tool, which is gaining ground worldwide in investigations of violent serial crimes and is being promoted as one of a set of tools to be used in the battle against crime in South Africa.

Geographic profiling is a process by which the typical "hunting patterns" of serial violent criminals are used to identify the residence from which they operate. The underlying assumption of this technique is that criminals operate in geographic areas in which they feel comfortable. Based on this assumption, the locations at which crimes are committed, or the locations at which bodies of victims are found are used to identify the locations where the criminal is most likely to reside. Complex algorithms are used to define the relationship between these various locations.

At a seminar hosted by the CSIR, the South African security establishment was introduced to the principles of Geographic Profiling by Dr Kim Rossmo, Detective Inspector in charge of the Vancouver Police Department's Geographic Profiling Section.

The seminar, funded by DACST, formed part of a project by the CSIR aimed at employing quantitative processes such as optimisation techniques and statistical analysis to assist the SAPS in investigation processes.

FOCUS AREAS

- Improving law enforcement as a deterrent (i.e. the effectiveness of the Criminal Justice System).
- Addressing priority crime areas such as vehicle crimes, gun control, border control and organised crime.
- Analysis of crime prevention.
- Improved social crime prevention to address the root causes of crime.
- Combating crime in commerce and industry.

The CSIR Crime Prevention Centre was established in response to the national imperative of crime prevention. The two key competencies are knowledge management and technology integration - drawing on the expertise and skills in the CSIR and the research community. In addition, we work closely with key partners in the public sector security establishment, Business Against Crime, University of Pretoria and other tertiary institutions, industry and international R&D organisations. Some examples:

Improving the Criminal Justice System

- Technology such as crime analysis and decision support has been developed and integrated by the CSIR to assist the SAPS in the fight against crime. The technology includes data capturing, data retrieval, crime mapping and Geographical Information Systems (GIS).
- A Crime Prevention Research Resources Centre (RRC), funded by DACST, has been developed by the CSIR to provide research information on the prevention of crime and violence and to act as a conduit between government and the research community.

Combating priority crimes

- Refining and promoting national use of an Anti-hijack Database developed for Johannesburg.
- Developing laser technology for multiple vehicle parts marking and a Vehicle Information Verification System.
- Support to the National Interdepartmental Structure for Border Control includes developing Seaport Border Control plans, logical organisational processes and a recommended practice document for airports.

Analysis of crime information

- Developing a Crime Information Centre as a central repository of crime-related information.
- Drug/crime nexus: Introducing the Arrestee Drug Monitoring Programme in South Africa.

Local level crime prevention

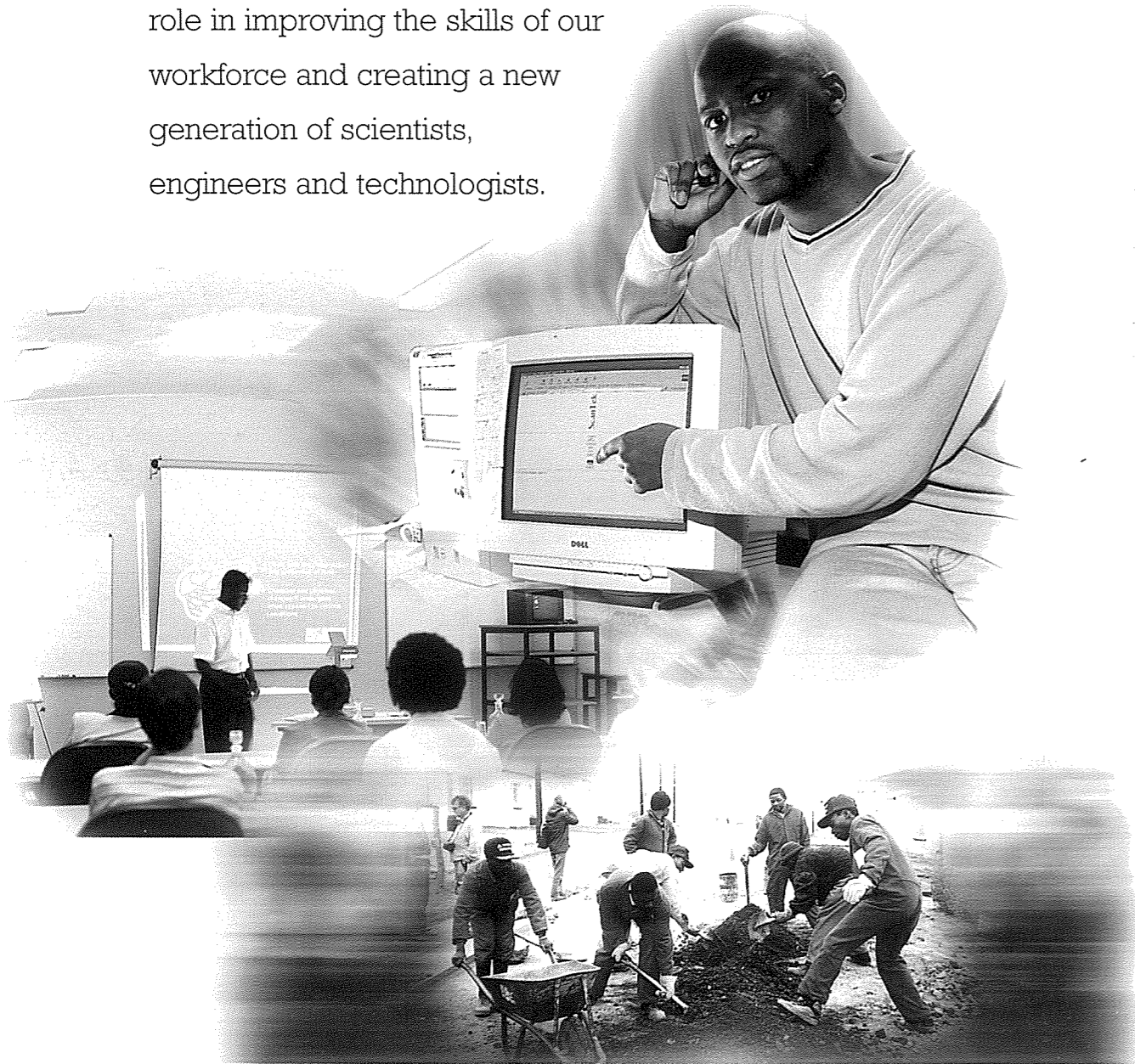
- Guidebook for Crime Prevention Through Environmental Design and a step-by-step guide supporting the preparation of local safety plans for municipalities.
- Crime on board public transport - insight into modus operandi, under-reporting and the most common types of crimes.

Crime in commerce and industry

- A prototype system to foil cash-in-transit robbers is now being commercialised.
- The security theme for the Soccer World Cup 2006 Bid was developed in collaboration with the SAPS, private security companies and the government.
- A risk-reducing Information Security Management Methodology was developed.

Human resource development

Human resource development is intimately linked to the imperatives articulated by President Mbeki and will catalyse the African Renaissance. At the CSIR we know that people make things happen. In the choice and implementation of our organisational and management approaches, we are playing a key role in improving the skills of our workforce and creating a new generation of scientists, engineers and technologists.



Boost for small-scale mining sector

The CSIR achieved an important first for southern Africa's mining and minerals sector with the launch of gemology courses, which specifically address the needs of the Southern African Development Community (SADC) in terms of the transfer of skills and technology to member states.

The courses are aimed at training small-scale miners and Government employees in the science of gems (gemology). Fifteen candidates, including five women, who came from as far afield as Tanzania, Angola and Mozambique, attended the pilot course at the Witwatersrand Technikon in Johannesburg.

Comprehensive training for Food and Allied Industries

A range of nationally accredited courses pertaining to the Food and Allied Industries was offered by the CSIR this year. These included scheduled courses in various centres as well as customised, in-house courses for clients throughout the SADC region.

The courses range from Hazard Analysis Critical Control Point (HACCP) workshops to such topics as Supplier Quality Assurance and Supplier Audits, Hygiene Awareness, Food Microbiology for the Non-Microbiologist, Basic Principles of Product Development and Hygienic Equipment Design, Canning and Canning Principles, Retort Operator's Training, Bakery, and Sorghum Malting and Brewing Technology. A total of 1 350 people were trained through these courses in the last year.

Vibrant living environments

Vibrant human-friendly living environments and thriving communities are the aim of well-designed human settlements. As a contribution towards ensuring that the built environment reflects the best practices in conserving the country's natural resources, the CSIR has compiled the new 'Red Book', *Guidelines for human settlement planning and design*. Professional engineers, planners and policy makers will be able to create sustainable settlements by implementing these best practices. The book is the result of a collaborative effort with several Government departments under the auspices of the Department of Housing.

The qualities that should be aimed at, as well as guidance on how to achieve them in settlements, are covered. Urban planning and engineering principles for the development and upgrading of residential areas are presented in an integrated set of guidelines.

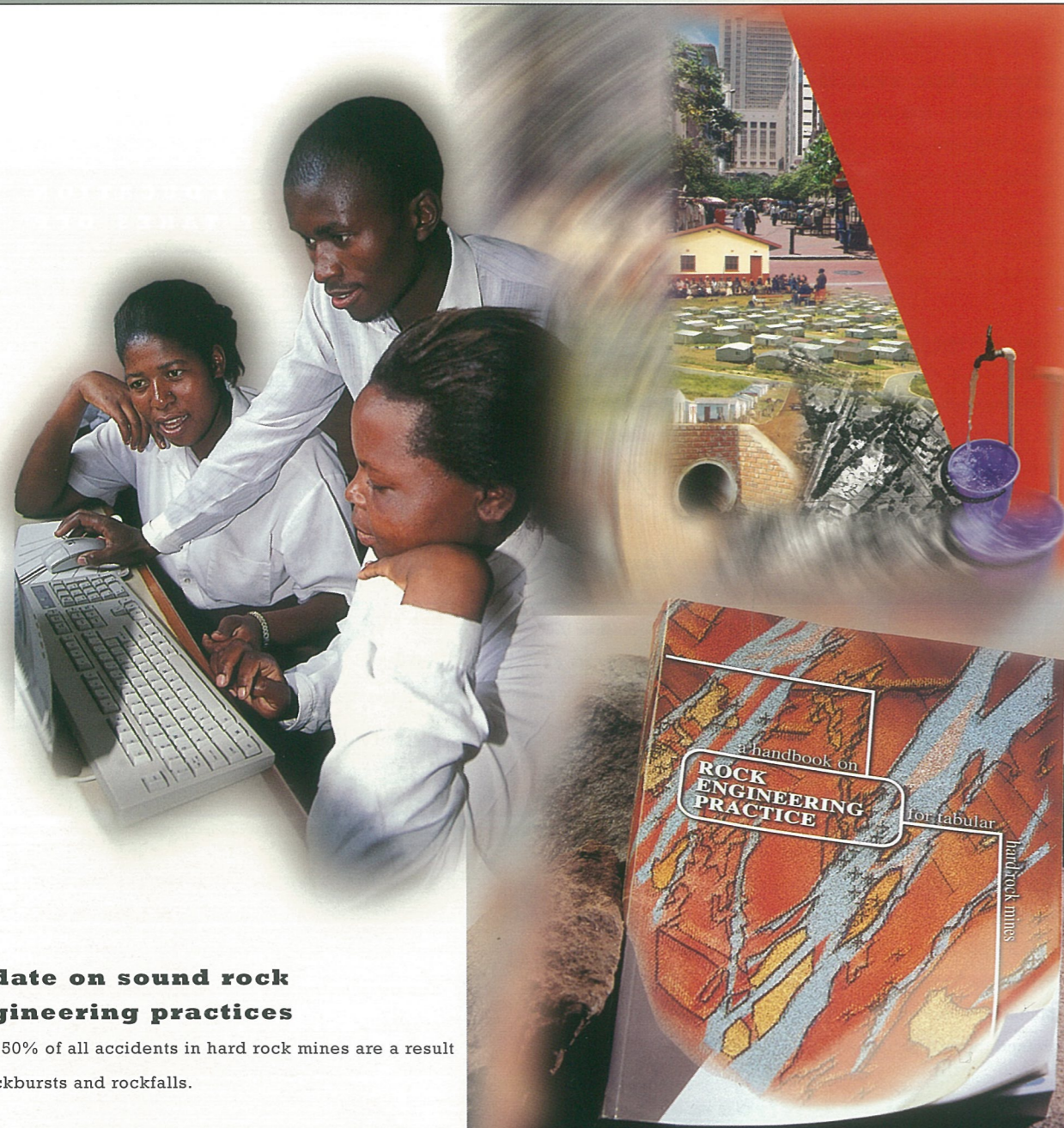
TEXTILE EDUCATION PROJECT TAKES OFF

The CSIR is playing a leading role in the highly successful Textile Education Programme, which has been implemented at 12 schools in the North-West Province.

The project is based on the relationship between textile arts and crafts as fields of creativity, expression and craftsmanship, and textile science and technology as a source of innovation.

Technology education is one of the eight learning areas in our education curriculum. The Textile Education Programme is playing a vital role in providing participants with skills and knowledge that can help with job creation, acceptance and understanding of technology development. This includes indigenous plant fibre utilisation, producing saleable products and developing the textile industry within the province.





Update on sound rock engineering practices

Over 50% of all accidents in hard rock mines are a result of rockbursts and rockfalls.

"A handbook on rock engineering practice for tabular hard rock mines" incorporates significant advances in rock engineering practice that have occurred over the past decade.

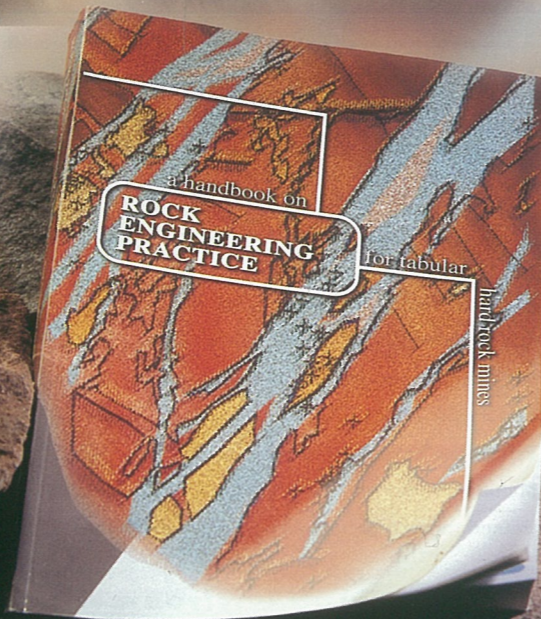
The publication furthers the application of sound rock engineering practices on South African gold and platinum mines. The CSIR, under contract to the Safety in Mines Research Advisory Committee (SIMRAC), compiled the handbook.

The book provides guidelines which, together with innovation adapted to local conditions, should contribute to a significant reduction in rock-related accidents.

Training in computer-aided technologies

In support of the national imperative to create a globally competitive manufacturing sector, the National CAD/CAM/CAE Training Centre has been incorporated into the National Product Development Centre managed by the CSIR.

The Training Centre was established during 1999 with financial support from the DACST as a national initiative to co-ordinate and enhance the application of computer-



SPECIAL PROJECT TO DEVELOP CRAFTS

Product development, with a strong indigenous knowledge and design component, is crucial to craft development in South Africa and the region. The CSIR's successful involvement in various craft-related projects has led to our appointment as implementation agent for the DACST's Craft Special Project.

In support of the Presidential Imperative for rural development and job creation, the CSIR has taken a leading role in providing the necessary services in the craft-development sector together with our partners, provincial government departments such as Welfare, Labour, Agriculture and Environmental Affairs and Tourism, as well as local community organisations, NGOs and local support business centres.

Our craft-related expertise includes product development and design, technology and technical transfer, business skills training and support, systems implementation in quality and production, branding and image creation and project management.



aided technologies in the manufacturing and materials industry. Apart from software-specific CAD/CAM/CAE training courses, the Centre also offers a series of workshops, short courses and seminars on Concurrent Product Development technologies and methodologies.

Since its inception, 46 designers, engineers, technicians and lecturers from industry, tertiary training institutions and Science Councils have attended the Concurrent Product Development workshops and short courses. The CAD courses have been attended by 172 people from industry, tertiary training institutions and secondary schools. The keen interest of educators from secondary schools is expected to result in students who are much better prepared to enter industry in the future.

Training to make mines safer

Human error is a significant contributor to injuries and fatalities on mines. To assist with mine safety, the CSIR has drawn up safety-related rock engineering training requirements for gold and platinum mine workers at all levels.

The material is formatted in a SAQA/MQA format, which is outcomes-based and provides a matrix of training requirements for use in structuring a unit of learning at a specific level. The material can also be used to assess the competency of an individual.

Performance appraisals made easy

Version III of Aviator - an effective, Internet-based, fun way of completing staff evaluations with all processing and calculations done behind the scenes - was introduced to the market in late 1999 after undergoing stringent testing within the CSIR. It was also successfully installed in numerous South African companies, including Old Mutual, Tsogo Sun, Rand Merchant Bank, Internet Solutions and Dimension Data.

Since it is Web-based, worldwide performance evaluations in real time are a possibility for global companies, with employees or supervisors able to complete and submit assessments regardless of location. Automatic archiving enables instant tracking of performance development over a longer period - all within the confines of a desktop computer.

Sustainable environment

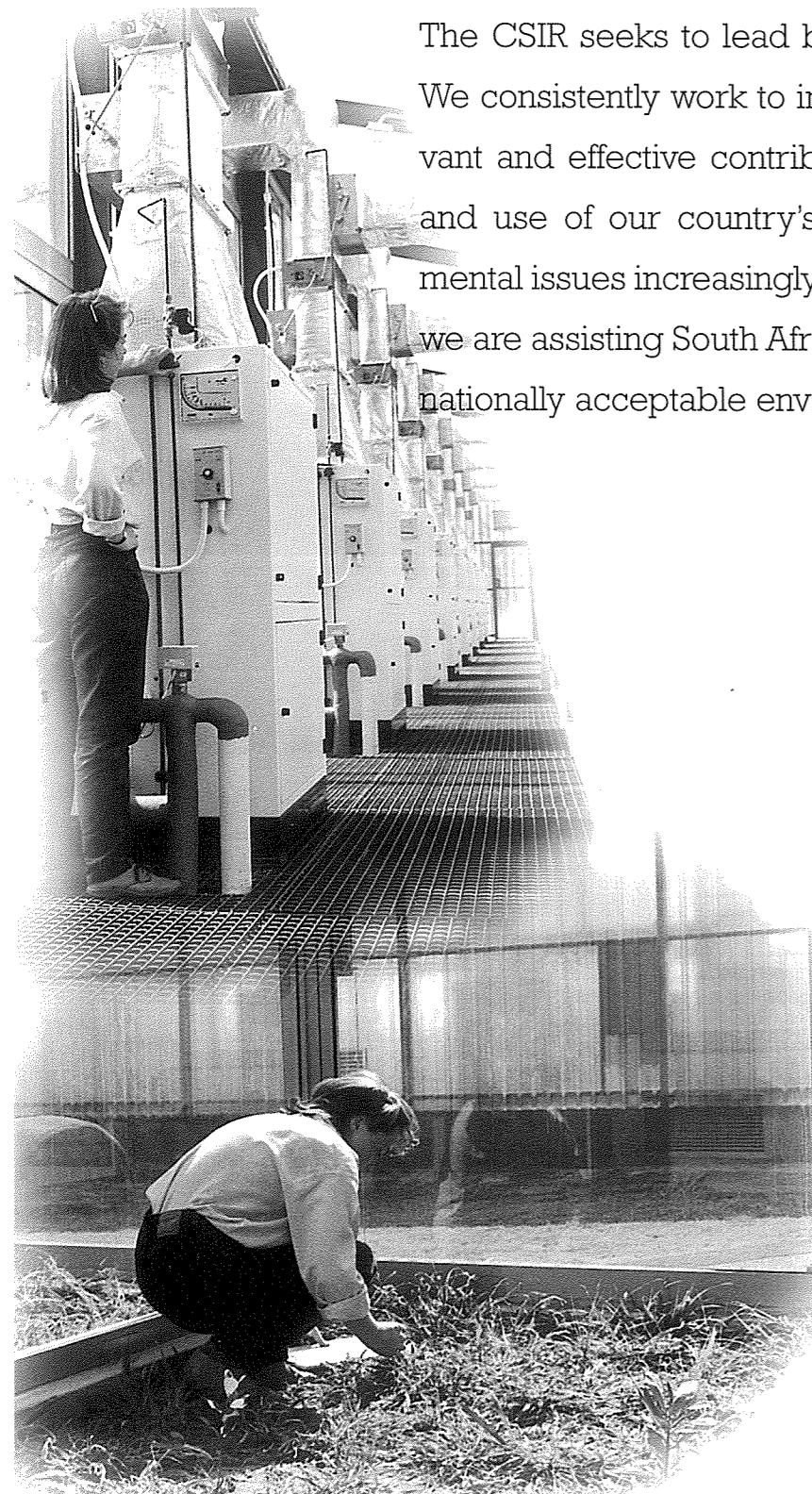
The CSIR seeks to lead by example and to deliver quality. We consistently work to improve our track record as a relevant and effective contributor to the effective conservation and use of our country's natural resources. With environmental issues increasingly coming to the fore in global trade, we are assisting South African companies in achieving internationally acceptable environmental practices.

Up to date on climate change

South Africa is one of relatively few countries that ratified the UN Framework Convention on Climate Change in 1997. The CSIR is playing a key role in ensuring that the country meets its obligations.

In a programme of research and policy development, we are providing southern African-derived data for the global study on climate and atmosphere change.

- A national collaborative project, the South African Greenhouse Experiment on Savannahs (SAGES), has been completed after a three-year exposure of savannah ecosystems to a range of carbon dioxide concentrations. Savannahs cover about a third of South Africa and two-thirds of Africa, and the investigation will reveal how they function under increased carbon dioxide concentrations. The results will be published towards the end of the year.
- The CSIR co-ordinated the first official South African greenhouse gas inventory, an obligation in terms of the treaty.
- The CSIR has co-ordinated the Global Soils Database, a project led on behalf of the International Geosphere-Biosphere Programme.
- The CSIR is executing two "flagship" projects involving international collaboration - SAFARI 2000, a project to study the sources and sinks of



GREEN HEART OF CENTURY CITY

Developers of Century City in Cape Town were faced with the need to conserve important features on their site: a sand plain fynbos habitat, an ephemeral pan habitat, and the bird breeding populations on the fringes. In addition, Monex also needed to improve water quality and provide a means for attenuation of run-off water during periods of high rainfall.

A multi-purpose constructed wetland was proposed, with the CSIR providing the conceptual design and Gibb Africa the technical design. Together with Monex, a team of specialists from the CSIR, the University of Cape Town and Cape Nature Conservation prepared a plan to incorporate this artificial wetland into a 16-ha nature area in the heart of Century City.

The multi-purpose wetland consists of four cells, which filter, aerate and purify the water. The water quality is closely monitored since it flows into canals winding around the site past hotels, restaurants and shops. The wetlands have been successful in meeting all the water objectives and birds are breeding in the new heronry established in the wetland. Furthermore, the ambience created by the wetlands has enhanced the value of surrounding properties.



atmospheric chemicals over southern Africa, and the establishment of a ground validation site in the Kruger National Park for the new-generation NASA TERRA satellite.

Upgraded earth-building success

The potential of upgraded traditional earth-block construction has been demonstrated with the opening of the Lekgophung Development Centre in the North-West Province.

The Centre, in the village of Lekgophung, was built using traditional earth technologies, integrated with more modern technologies like pre-cast concrete lintels and windowsill tiles to prolong life. In the process, the CSIR and the community have demonstrated how earth-block houses could be made stronger, while at the same time requiring less maintenance and minimising cost.

Ecological risk assessment comes of age

The CSIR is at the forefront of applying Ecological Risk Assessment (ERA) in South Africa as a valuable tool in support of sustainable environmental management.

ERA supports water and environmental legislation, for which we are developing local guidelines in collaboration with the Water Research Commission, the Department of Environmental Affairs and Tourism and the Department of Water Affairs and Forestry.

ERA is a structured, scientifically verifiable approach to determining the effects of change on ecosystems and identifying the causes of ecosystem change. Most importantly, it provides a predictive capability for the relationship between exposure of the environment and the effects of that exposure.

Cape fires targeted from the sky

Satellite imagery was used to map the extent of the devastating fires that destroyed large areas of the Cape Peninsula in January 2000. The CSIR acquired the imagery from the French SPOT satellite, which was programmed to target the area specifically for the purpose of monitoring the fires.

An ongoing programme to acquire imagery from Earth Observation satellites over southern Africa helped our team to respond to the disaster at short notice. The applications of the imagery included mapping the extent of the fires, disaster management, risk zone mapping and environmental impact assessment.

Key role in fire management plan

Fires in the Cape Peninsula and surrounding areas are frequent occurrences that need to be managed. With growing human populations and increasing development encroaching on natural areas, the risk of damage to property increases. However, fires are necessary in the fynbos ecology. Fynbos needs to burn about once every 15 years in order to maintain the vast diversity of unique plants.

The CSIR is assisting in developing solutions to these problems by compiling a fire management plan for the Cape Peninsula National Park, which will focus on the roles and responsibilities of various management agencies. The plan will also look for scientifically sound and ecologically sustainable solutions to the problem aspects of fires, such as the control of alien vegetation, which increases fire intensity dramatically.

The CSIR has also been appointed by the Department of Water Affairs and Forestry (DWAF) to design a national fire danger rating system, as required by the new Fire Act. There will be a single system, applied nationally, with frequent warnings broadcast. The system should be implemented by the end of 2000.

Promoting sustainability from cradle to grave

Knowing the impact of a product, process or service throughout the life cycle is important in this environmentally conscious age. The environmental performance of South African companies could become a technical barrier to trade without such information. To assist the manufacturing industry in quantifying the environmental performance of its products and services for international traceability, the CSIR has developed a competence in life-cycle analysis in support of a national product declaration system.

Life-Cycle Analysis (LCA) is an instrument for determining and reducing the environmental impact of products or services, and addressing environmental sustainability as a fundamental design element. It takes account of environmental liability from cradle to grave in the life cycle of the product or manufacturing process.

Decision guide for healthcare waste in remote areas

In most developing countries management systems for healthcare waste are poorly developed and enforced, especially at remote rural primary healthcare facilities. This results in illegal dumping or co-disposal of healthcare waste with general waste on unsuitable or non-permitted landfill sites. Such unsafe practices can lead to the spread of disease among both healthcare staff and surrounding communities.



The SA Collaborative Centre for Cold Chain Management (SACCCCM), of which the CSIR is an equal partner, jointly with the Department of Health and the Pharmaceutical Society of SA, has developed a set of guidelines for effective healthcare waste management in developing countries, with specific attention to waste management at remote rural primary healthcare centres.

The guidelines were based on the concept of "Best Practicable Environmental Option" (BPEO), i.e. the waste management option that provides the most benefit or causes the least damage to the environment and human health as a whole in the short as well as the long run, at a cost acceptable to society. The SACCCCM is now collaborating with the WHO on the implementation of the guide for waste management in other developing countries.

Treading lightly on our roads

Tyres damage roads by causing surface deterioration, bleeding or "flushing" of surfacing seals, permanent deformation of the road surface, and shape distortion and permanent deformation resulting from increased moisture in the upper untreated layers of the road pavement.

This results from a combination of poor tyre maintenance, mixing of old and new tyres in dual groups, tyre damage, incorrect tyre inflation pressure, unequal tyre inflation pressures on a dual set of tyres or poor axle alignment. It not only increases the running cost of trucks, but also causes road damage, especially shallow damage on the road surface.

Mapping Swaziland's forests

Up-to-date information on the current status of indigenous forests and woodlands in Swaziland was needed by the Swaziland Forest Policy and Legislation project to address the deforestation and degradation of these forests.

The CSIR Satellite Applications Centre produced a landcover map of the whole country's forestry resources at a 1:50 000 scale. Landsat satellite images were used as they allow the classification of various land covers and detailed vegetation discrimination, including being able to distinguish the quality of growth.

The landcover map is playing a key role in future sustainable management decisions on the country's resources.

Tree breeders of the new millennium

Tree breeding is known to have one of the largest impacts on plantation productivity, and therefore on the profits of companies. Breeding and deployment strategies are often the point at which most impact can be made on genetic gains.

Tree breeding courses, designed to empower participants to develop, optimise and implement effective breeding strategies for forest tree species, were held at the CSIR during 1999. Over the past seven years, these courses have attracted participants from 22 countries and have facilitated the exchange of ideas and experiences with scientists and technicians from countries such as Spain, Japan, Australia and Chile, as well as African countries, including Botswana, Zambia and Zimbabwe.

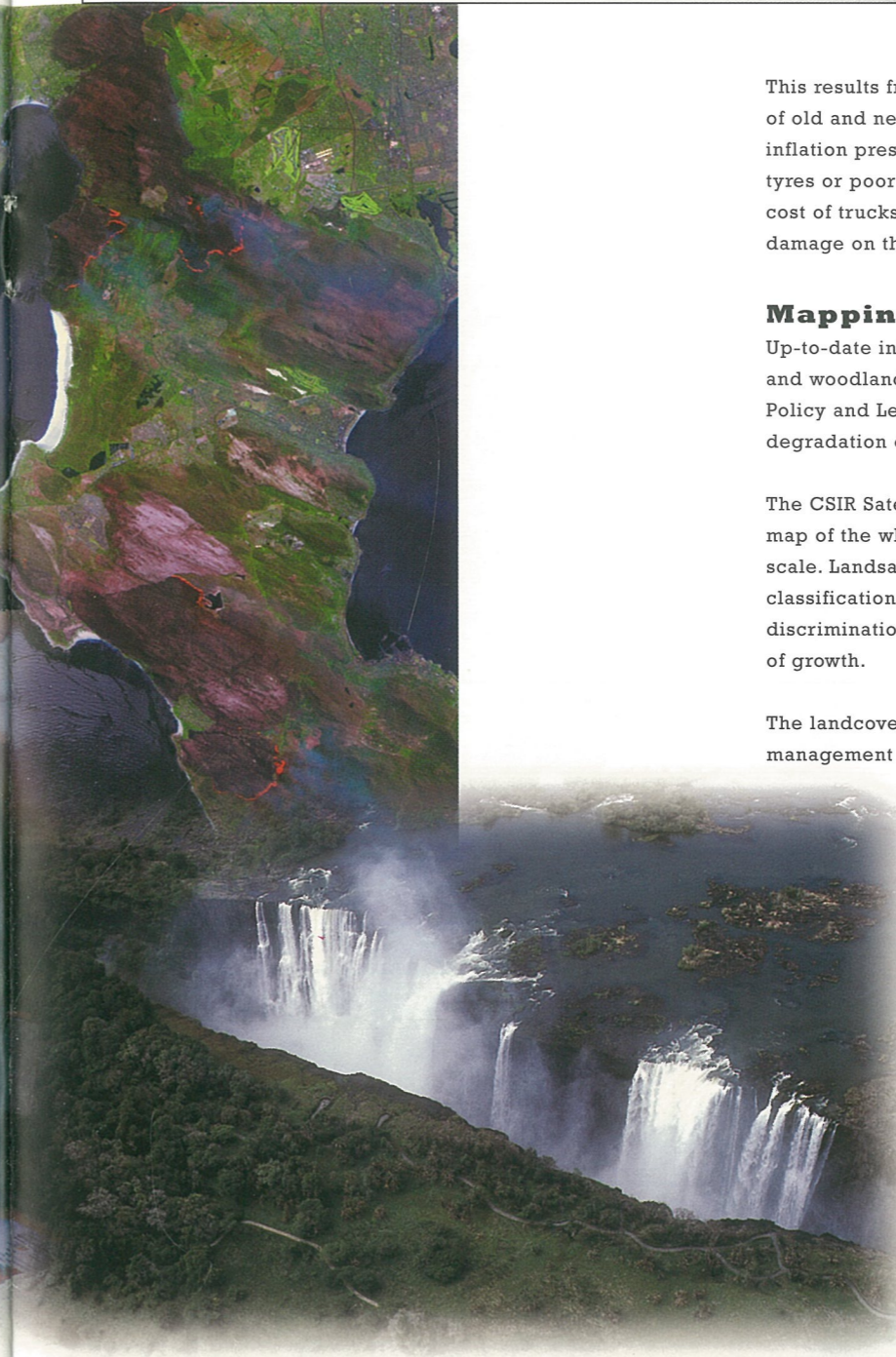
They have also played a key role in providing enhanced opportunities for previously disadvantaged tree breeders in South Africa and Africa.

The primary focus of the CSIR tree-breeding programme over the past four decades has been on the genetic improvement of subtropical and tropical eucalypt species and hybrids for both pulp and solid wood products. A pine improvement programme has also been developed which focuses on the *Pinus elliottii* X *P.caribaea* hybrid and on *P.patula*.

The CSIR also concentrates on developing the tools and sound breeding techniques to optimise gain and accelerate breeding so as to maximise return on investment in breeding.

The actual tyre/pavement contact stresses caused by moving pneumatic tyres on road surfaces has been quantified in Stress-In-Motion (SIM) technology studies by the CSIR. With this new technology, researchers, pavement engineers, road authorities and road owners will be able to undertake more effective, sustainable design and rehabilitation of road surfaces.

Focusing on the actual contact stresses between tyres and the road surface revealed that tyre inflation pressure, in addition to tyre loading, plays a significant role in the shape of contact stress patterns. Tyre contact stresses are not only highly non-uniform, but may exceed the tyre inflation pressure by 1,5 to 3 times.





Information society

We leverage our intellectual capital and knowledge resources through harnessing the power of information and communications technology. We utilise the best approaches to knowledge management to grow and develop our contribution, offerings and performance, in and through ICT, as a fast-follower in the global context and leader in the Information Society in South Africa, the SADC and the continent.

A first for tourism in South Africa

Tourism growth in South Africa requires high-quality, effective provision of information. South Africa's first integrated tourism package is being developed by the CSIR, in a joint venture with SATOUR and in co-operation with private sector companies, to meet this need.

The South African Tourism CD-ROM series, called VEZA - Visit and Explore South Africa, will provide a tool for planning, packaging and marketing tourism in an integrated approach. The first version of the product was launched at the Tourism Indaba in Durban in May 2000. Users will have access to South Africa's tourism attractions and tourist-related services, supported by photos, videos, sound clips, maps and graphics. No specialised software is needed: it runs on standard PCs.

Sectors such as accommodation, conferences and exhibitions, entertainment, services and transport, as well as tour operators and travel agencies, will be able to advertise in the series. Website: <http://www.veza.co.za/>

Watch wind tunnel tests from your own office

Any CSIR clients, both local and international, can now view wind tunnel testing as it is taking place in real time via the Internet. Faced with the problem of long distances from potential clients, and the costs involved in travel, the CSIR has set up web cameras at the Low Speed Wind Tunnel (LSWT).

One camera covers the model in the test section of the wind tunnel and another camera gives access to the operator in the control room. The wind tunnel results are displayed graphically in real time during the test.

Clients get the benefit of remote engagement, without significant loss of the feel of 'being there'. It also provides the potential for creating a 'living' record for future re-use. CSIR researchers are convinced that the 'Web benefit' will not reduce but enhance client visits that build long-term relationships.

Easier information management

Sharing and exchanging information is often difficult on complex projects, which often involve many people from different companies. Managing information in the building, construction, and other industries has become much easier with the CSIR's new Integrated Project Services (IPROS) application.

Using the program results in significant savings in time and money, as team members can exchange information and update project records 24 hours a day via the Internet. The information is stored on a physically and electronically secure platform that uses the latest encryption and security technology.

IPROS assists with project administration, document management, activity scheduling, project events and project planning. Five clients have successfully applied IPROS in their operations.

On the path to future information dominance

The SANDF has identified information warfare (IW) as an important future technology area. Information warfare is based on the realisation that information access and quality will be a deciding factor in the wars of the future. Such wars do not include only military conflict but also economic and political conflict. The increased connectivity of modern communications infrastructures (such as the Internet and cellphones) also increases vulnerability to attack. These attacks are no longer restricted to traditional nation states but can come from anywhere in the world. The CSIR has been providing support in the field for the past five years; this has included the drafting of the IW constitution, which stipulates the general areas to be addressed and the priority.

The SANDF Chief of Joint Operations has approved the forming of an Information Warfare Control Board. This also provides a mandate and support for the technology research performed by the CSIR as it will be one of the permanent members of the Board.

Improving on-site efficiency

Project teams in the construction industry can control and monitor site activities more easily with a new project management service from the CSIR.

CALIBRE is a real-time performance measurement tool that enables clients, contractors and project managers to measure on-site construction productivity and performance. It was developed by the Centre for Performance Improvement in Construction (CPIC) at the British Research Establishment (BRE) in the UK, based on 30 years' experience in the field.

Trained observers are on site from day one and record the entire construction process from the moment the first operatives set foot on site to when the last one leaves. Comprehensive training brings each observer up to the same level of understanding, and the CSIR's process managers provide full-time back-up. The CALIBRE South Africa team provides all hardware and software as well as technical support.

New and unique broadcasting

The CSIR's vision of implementing a new and unique, national FM Radio Data Broadcasting Service in South Africa has gained momentum with the commercialisation of Radio Data System (RDS). The service will be based on the 'multiple-channel', multiple-user system and related receiver technology developed, piloted and patented by the CSIR. The system essentially uses the spare RDS capacity on public and private FM radio transmissions to allow users to broadcast small data packets to any number of addressable receiving sites or devices in a managed and controlled way.

The unique selling point of such a service is the fact that it is the most cost-effective medium for broadcasting small amounts of data to virtually any location in South Africa, and the receivers can be very low-cost OEM devices.

Soccer bid assistance

During 1999 the SAFA 2006 Bid Company contracted the CSIR to assist in the preparation of South Africa's Bid Document. The assistance included research and compila-

tion of various sections of the Bid Document ranging from transport infrastructure to security and communications.

The CSIR was tasked with preparing all aspects of the Bid relating to communications. The project included forecasting the communications requirements and associated infrastructure in 2006; determining whether the South African communications industry could meet the estimated demands; and obtaining proof of industry's support.

Wireless data network for lottery

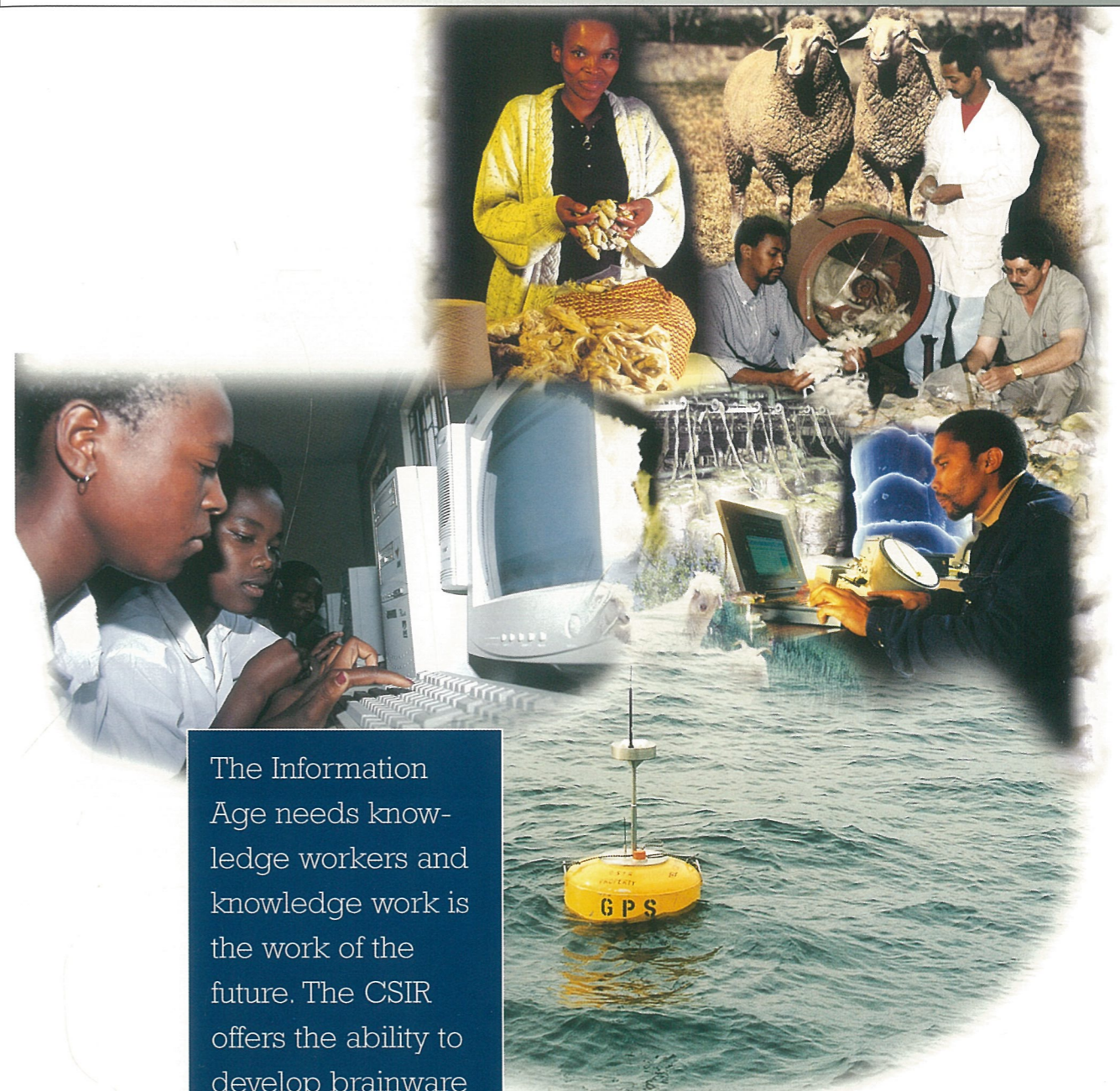
Communications engineers at the CSIR played their part in the design of the wireless data network of the country's first national lottery. The network was designed at the CSIR on behalf of the licensed company, Wireless Business Solutions (WBS). As one of only two licensed wireless data operators in the country, WBS was selected for the network roll-out by the winner of the National Lottery Bid. It has been designed to accommodate rapid growth with a limited number of frequencies and varying capacity needs.

Culture packaged electronically

Funded by the DACST Innovation Fund, the Cultureware project provides a framework within which a diversity of cultures, cultural artifacts, cultural voices and cultural experiences can be innovatively linked to emerging information and communication technologies.

The project is run by a consortium comprising the CSIR, the University of Fort Hare, SATOUR and WesGro, and aims to develop a methodology and digital facility that supports electronic packaging of Cultureware in a financially viable and economically sustainable way.

The project's four main focus areas are the development of a curatorial framework, content co-ordination and an instructional design framework, and legal and technology frameworks. One of the first tangible outputs of the project is a database that captures information on most cultural repositories in South Africa.



The Information Age needs knowledge workers and knowledge work is the work of the future. The CSIR offers the ability to develop brainware in partnerships, bringing people up to speed to equip themselves for tomorrow's work.

Joint venture on textile information

The CSIR and the Department of Trade and Industry are addressing the need for a textile information 'hub' for southern Africa to assist in the globalisation of the textile and clothing industries.

Two related Websites are being developed. The first, TexWeb, will provide a company and product database, trade enquiries, relevant links, summaries of industry studies, expert views, a discussion forum, environmental issues and an overview of the industry in the SADC.

The second site, TIMSSA, will comprise a complete analysis of production, trade and demand in the textile pipeline in each of the SADC countries.

The availability of this type of information on the Internet will help to facilitate international and regional trade, support investment and other decisions, identify opportunities for the textile pipeline in the region, enable discussion and dialogue around key industry issues, and facilitate the access of information from local and international sources.

Maintaining a wave-recording network

Although waves can be great fun when encountered during a holiday, some wave conditions create risk for shipping and port management. A network of wave-recording buoys around South Africa is operated and maintained by the CSIR. The Wave-Recording Network consists of wave-recording buoys and base stations on shore which receive data from the buoys, and display and transmit data to the central station. This station is located at the CSIR's premises in Stellenbosch, where all the data are processed and archived.

The wave data, combined with those for winds and tides, are used to offer port authorities guidance on the safe operation of ships. The archived data are also used for establishing design parameters and for sea-state reconstructions. At present, a wave information system which will allow users access via the Internet is being investigated.

For 30 years, the CSIR has been Portnet's technology partner in the design, operation and development of ports, including Cape Town, Durban, Mossel Bay and Richards Bay. One recent study was an investigation into a possible new deep-water harbour at Coega, north of Port Elizabeth.



**REMOTE SCHOOLS
GET CONNECTED**

In an exciting new development, rural schools in Manguzi, KwaZulu-Natal, have been provided with a completely wireless Internet connection. A team at the CSIR set up a network that uses a combination of satellite and radio technologies to link the schools to the nearby Manguzi Multi-Purpose Community Centre.

The CSIR provided the wireless technology, which was deployed in partnership with Wireless Business Solutions, a black-owned licensee and telecommunications provider, and Siyanda, a local Satellite Internet broadcast service provider.

CSIR involvement at Manguzi is a High Impact Integrative Project in which communities are being assisted in developing comprehensive plans to bring prosperity to their region. A key element of the CSIR's contribution is the creation of a fully equipped telecentre with Internet connectivity.

The Manguzi project is a pilot network, but similar networks can be rolled out in partnership with development agencies and local governments.



**International
dimensions**

Nothing is more important for the long-term design of the CSIR in the 21st century than enhancing its network of strategic alliances. As a knowledge provider, we have to remain at the cutting edge of science and technology, not only to build the competency of our own people to be the best in the world, but also because only an extended organisation drawing on global S&T knowledge can help solve global problems.

Key role in SADC and beyond

The National Metrology Laboratory (NML) at the CSIR is responsible for managing the SADC Co-operation on the Metrology Traceability (SADCMET) Secretariat - the key driver to harmonise the region's measurement standards which is an essential component for establishing a free trading block.

The CSIR's NML has also been contracted to co-ordinate the Quality Module (including Metrology, Accreditation and Import/Export Inspection) of the United Nations Industrial Development Organisation's Integrated Industrial Development Programme for Capacity Building to Enhance Industrial Competitiveness and Sustainability in Tanzania and Ethiopia.

Activities include the organisation of a workshop, review of existing legislation, extensive studies on existing and required infrastructure for Standardisation, Quality, Accreditation and Metrology (SQAM), visits to key organisations and in-depth studies of the Tanzania Bureau of Standards and the Quality and Standards Authority of Ethiopia (QSAE).

Under a twinning arrangement with the QSAE, the CSIR's NML offers specialised training to Ethiopian metrologists and performs calibration of various standards for QSAE.

Unprecedented North-South link

The CSIR has received funding from DACST to participate in the European Commission (EC) DG14 project with partners in Iceland, Germany, Denmark, South Africa, Kenya and Mozambique.

This is the first DG14 award with a South African participant and is a demonstration of the achievements possible through North-South co-operation within the EC's Fourth Framework Programme. The project will develop and transfer technology to South Africa to dry fish without destroying the natural antioxidants or losing valuable nutrients (see page 9).

Tops internationally

CSIR expertise in Geographical Information Systems (GIS) computer mapping has been recognised by international peers. We received First Prize for the most innovative use of mapping at the First International Crime Mapping Competition for our map "Breaking Alibi's through Cellphone Mapping", which was used to generate evi-

dence for the arrest and conviction of criminals in a high-profile murder case in Cape Town.

Building capacity in Ethiopia

The CSIR, with its vast experience in environmental management, has been involved in capacity building in the practice of Environmental Impact Assessment (EIA) in Ethiopia. The World Bank commission was to deliver a five-day introductory course on EIA to the Ethiopian Environmental Protection Authority and to modify and update the Draft EIA regulations for the country.

Phase 2 of the project - to complete the Draft EIA Guidelines for Ethiopia - has also been completed. The 3rd phase is on-going and includes regional training courses and workshops to comment on and further refine the EIA guidelines.

Developing small-scale processing in Africa

A project to support the growth of the small-scale African Food Manufacturing sector has been launched by the CSIR with funding and support from the US Agency for International Development (USAID) Bureau for Africa.

The Strengthening African Food Processing Project (SAFPP) will run over five years. It is enterprise-focused and will develop support systems (technological, business and market), facilitate transfer of technology and run projects that will promote food processing enterprises, especially in added-value products such as cut flowers, fresh vegetables, specialist foods, organic products and off-farm processing, such as essential oils.

National standards go global

The increase in global trade has heightened the importance of ensuring international equivalence of measurements and test results which leads to mutual confidence in the quality of goods or services and increases the volume of trade between countries.

The CSIR's National Metrology Laboratory signed a Mutual Recognition Arrangement (MRA) with 38 other member states of the International Committee of Weights and Measures (BIPM) in Paris, France. In the process, South Africa's schedule of calibration and measurement capabilities was included in the MRA.

The MRA establishes equivalence of national measurement standards, provides mutual recognition of calibration

and measurement certificates issued by national metrology institutions and makes available to governments and other interested parties a secure technical foundation for wider affairs related to international trade, commerce and regulatory affairs.

South Africa is the only SADC member country which is now a member of the Metre Convention and a signatory to the global MRA, putting the country in a good position to support other SADC countries by offering access to internationally equivalent measurement standards.

Doing our best for World Heritage Site

A high standard of environmental performance is required for a proposed hotel and resort development by Sun International on the Zambian side of Victoria Falls. The CSIR provided a report on the environmental impact of the proposed 46,6 ha development on the banks of the Zambezi as well as a management programme for the project, which is a part of the important World Heritage Site.

The proposed US\$55m resort in the Musi-Oa-Tunya National Park consists of a five-star hotel and conference centre. Two derelict hotels exist on the proposed site.

Environmental parameters which could be adversely affected during construction and operational phases were: soils; surface water; indigenous vegetation; wild fauna; archaeological and cultural resources; social values; aesthetic values; infrastructure and roads and access.

An Environmental Management Programme (EMP) was designed to provide guidance to Sun International on the day-to-day on-site environmental management of the project. A "cradle to grave" approach was taken with consideration given to all stages from pre-construction to decommissioning. It deals specifically with measures for the prevention, minimisation or compensation of the predicted negative effects, and enhancement of the potential beneficial effects.

In addition, a framework provides guidance for the evaluation of Sun International's environmental performance, and its compliance with Zambian legislation, the policies of the Musi-Oa-Tunya National Park, as well as the guidelines of the EMP.



A SELECTION OF INTERNATIONAL BUSINESS DEVELOPMENTS

- The CSIR has been contracted by the International Lead and Zinc Research Organisation (ILZRO) in the US to develop a new creep-resistant zinc alloy for automotive applications.
- General Electric (GE) awarded a contract to the CSIR for the development of a repair procedure for the refurbishment of GE 4000 horsepower locomotive engines.
- The Mauritius Small and Medium Industries Development Organisation (SMIDO) has contracted the CSIR to assist in structuring and improving its Technology Services Centre.
- The UK-based Transport Research Laboratory (TRL), an independent, internationally recognised centre of expertise in transportation research, has signed a Memorandum of Understanding with the CSIR. Pooling of expertise allows both organisations to improve services to their clients.
- The CSIR's digital radio frequency memory technology is used in the simulator of our UK-partner EWST. Orders have been received from international defence research organisations.

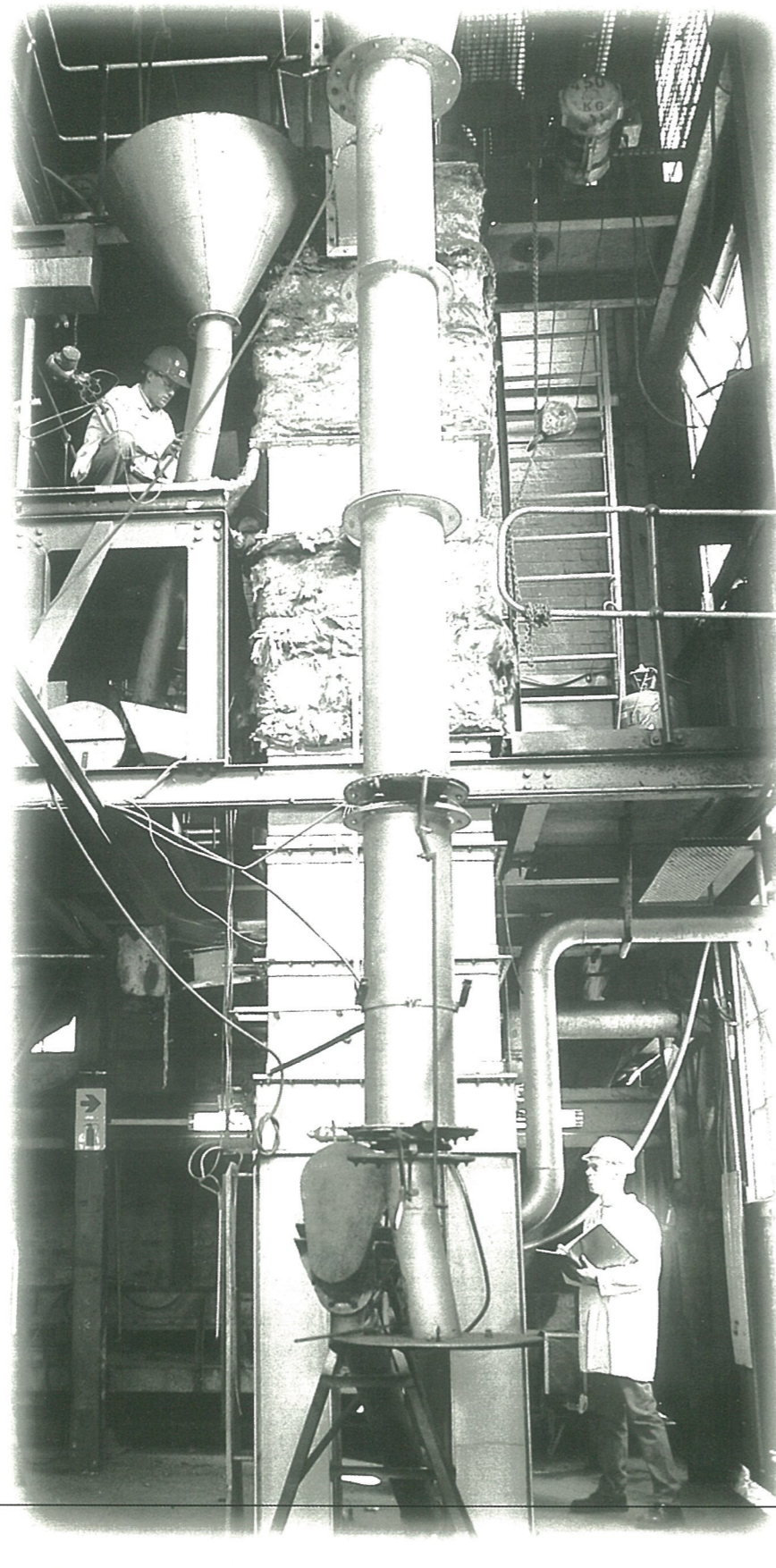
In conclusion

We believe that the future of South Africa and the continent lies in the imaginative pursuits of the children of science and technology.

By continually striving to unleash this creative energy, we are positively touching the lives of every citizen in our country.

As a premier knowledge institution, the CSIR is at the heart of the adventure to make the African Renaissance a reality. Our own people's prospects and future closely align with those of our country. It is our mission to help create a new energy, a new vision and renewed hope for this continent by forging together the power of the human spirit and the ingenuity of the human mind as we embark on the African Century.

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 lead innovatively in whatever new challenges the future has in store for us all.



The CSIR's "engine room" consists of nine market oriented operating business units.



Building and Construction Technology

Director: Mr Neo Moikango Email: nmoikang@csir.co.za Tel: (012) 841-2478

Research and technology solutions for serviced land, housing and related social infrastructure in urban and rural areas; policy and decision support relating to job creation, quality of life and the capacity and performance of the building and construction industry.



Food, Biological and Chemical Technologies

Director: Dr Petro Terblanche Email: pterblanche@csir.co.za Tel: (012) 841-4220

Multi-disciplinary support from concept to commercialisation for new and improved products or process development in the food, pharmaceutical and chemical industries. A world-class plant-based drug and nutraceutical discovery programme opens up global partnerships in novel compounds for the food and pharmaceutical industries.



Defence Technology

Director: Mr Johann Ahlers Email: jahlers@csir.co.za Tel: (012) 841-2725

Simulation, design, testing and evaluation of aircraft and air weapons, stores integration, advice on and technology support for radar, artificial intelligence products, information warfare, electronic warfare, command and control, modeling and simulation, electronic systems engineering, geomagnetic field information services, magnetic navigation support services, magnetometer and navigation systems technology.



Information and Communications Technology

Director: Dr Brian Armstrong Email: barmstro@csir.co.za Tel: (012) 841-4686

Information technology, communications and space technologies. Activities range from satellite launch support and providing geo-information solutions, to custom solution development and consulting in IT and communications, to seeding future technologies through to start-up ventures and digital business creation.



Manufacturing and Materials Technology

Director: Dr Hoffman Maree Email: hmaree@csir.co.za Tel: (012) 841-2057

Research and technology solutions leading to trade promotion, policy, manufacturing enterprise optimisation, process development and optimisation, product design and development and materials engineering. Offers integrated solutions to complex manufacturing challenges through combining technology with business process optimisation and the necessary training and education.



Mining Technology

Director: Dr Güner Gürtunca Email: ggurtunc@csir.co.za Tel: (011) 358-0072

Rock engineering expertise and the development of tools to maintain safe working excavations while maximising extraction; the development of new methods and tools for preventing explosions underground and reducing airborne pollutants such as heat, dust and radiation, and improving productivity and safety levels through mechanising the mining operation and developing tools and techniques to optimise short- and long-term mine planning.



Roads and Transport Technology

Director: Mr Phil Hendricks Email: phendric@csir.co.za Tel: (012) 841-2717

Appropriate and innovative technological solutions in the areas of transportation research, traffic management, transport infrastructure and technology and information management.



Textile Technology

Director: Mrs Tina Eboka Email: teboka@csir.co.za Tel: (041) 508-3297

Natural fibres R&D and beneficiation; textile models for sustainable development; SMME support models; new fibre based industry development; textile machines and instruments; textile processing technologies; training and education; decision support systems; performance improvement advisory services; production and quality management systems; laboratory testing, product evaluation and technical advisory services.



Water, Environment and Forestry Technology

Director: Dr Anthos Yannakou Email: ayannako@csir.co.za Tel: (012) 841-3225

Technologies for environmental assessment and management, terrestrial resources, forestry, water resource management, coastal development forestry and forest products.