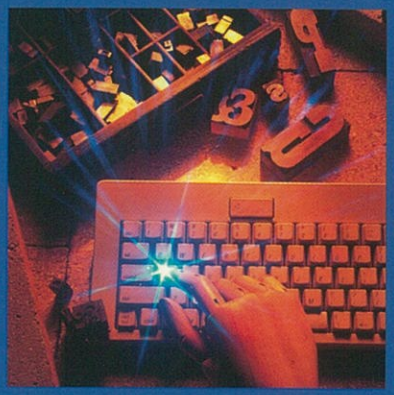


CSIR

CSIR TECHNOLOGY IMPACT 1996

Mission statement

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

Established in 1945, the CSIR is a statutory scientific research council governed by an Act of the South African Parliament. With a staff complement of over 3 000 and a turnover of R600 million per annum, it is the largest community and industry-directed scientific and technological research and development organisation in Africa.

The CSIR provides technology solutions through contract research and development, specialist consulting, systems engineering and information services in areas ranging from aeronautical and manufacturing systems and advanced materials, through to roads and transport, housing and environmental management.

The CSIR's research, development and implementation functions are centred in ten operating divisions which aim to:

- support technological competitiveness of South African industry in both the formal and informal sectors;
- provide technological solutions to improve quality of life in urban and rural communities;
- provide scientific and technological support for decision-making in the private and public sectors.

In 1995 the CSIR celebrated its 50th anniversary. It has played an integral part in the development of South Africa as a nation and as a technologically advanced society. This Technology Impact is published as a supplementary document to the CSIR's annual report. Through a series of short case studies, it aims to provide a glimpse of the scope of the organisation and the range of its activities in serving the needs of our country.

Contents

CSIR, PO Box 395, Pretoria 0001
Tel (012) 841-2911
Fax (012) 349-1153
Technical enquiries (012) 841-2000

ISNB 0-7899-5354/9 June 1996

C o m p e t i t i v e n e s s

Country-wide UHF Radio Network Planning for the SAPS

The CSIR, with Armscor as the project coordinator, was contracted by the South African Police Services (SAPS) to plan a country-wide UHF (Ultra-High Frequency) radio communication system. The SAPS had been using UHF equipment, which is generally associated with superior voice quality and higher reliability, only in urban areas. Structured planning was necessary to implement UHF as a national system.

The planning of a country-wide UHF radio network was an enormous task which took just over two years. The project team had to consider design parameters for a network which would give the SAPS communication 99,9% of the time over 95% of the country. Radio coverage prediction inputs and equipment specifications had to be chosen so that this high system availability could be achieved.

The SAPS is now in a position to deploy their UHF radio equipment so that South Africa will have complete radio coverage. The impact of this project will be felt throughout the country, as SAPS officers will be able to perform their duties more effectively.

Planning the UHF radio network system for the SAPS

Thermal spray coating facility launched

As part of the growing portfolio of surface engineering products and services provided by the CSIR, a new state-of-the-art thermal spray coating facility has been established.

Thermal spraying is a generic term for a group of commonly used processes for depositing metallic, ceramic, and composite coatings. It is a cold process, which means that the bulk substrate temperature can be kept below 150°C. Because of the low processing temperature, distortion of the component and changes in component material properties are eliminated. Since most surface engineering applications are aimed at minimising the damage caused by wear and corrosion, the expertise of the facility ensures that the most suitable surface engineering solution is applied.

The CSIR has the most advanced coating metallography laboratory in South Africa, and is capable of providing rapid information to ensure that superior coating quality is maintained. The thermal spray coating facility comprises four different thermal spray systems, each with very specific properties and applications. These are production systems capable of handling large component volumes. The facility can perform quantitative coating adhesion measurements to international specifications, which is a local first. The quality control systems are also available to industry on a consulting basis for the third party evaluation of coatings applied by other local or overseas thermal spray vendors.

Thermal spray coating facility at the CSIR

Genetically engineered cereals

Cereals represent 60% of the value of all South African field crops, and success in this area to improve production will have a major impact on producers, whether they are emergent or established commercial farmers. Cereal biotechnology has come of age at the CSIR's Division of Food Science and Technology, which has succeeded in changing the properties of a maize cultivar by introducing foreign genetic material into the plant genome. This achievement is a first using the breeding lines of maize in South Africa.

The genetically engineered maize produces a novel enzyme which destroys a particular herbicide when it comes into contact with the maize plant. This leaves the maize unaffected, while the herbicide kills the surrounding weeds, greatly improving the quantity of maize produced.

Genetic engineering improves quantity in maize production

Internet technology for the South African environment

The CSIR launched its Internet-based information and communication service, Worldnet Africa, in August 1995. Aimed at individuals, local businesses of all sizes, communities and government, the service offers indexed or categorised access to the Internet, as well as access to a comprehensive and growing source of local information. This is being put onto the system by South African business people and entrepreneurs who act as information providers to the service. Worldnet Africa has thus positioned itself as a single point of entry to the largest source of local content in South Africa.

By providing a technological platform for the display and exchange of information, Worldnet Africa provides South African businesses with a basis to compete and promote their services, utilising the advantages of the information age. This was highlighted by the signing of a Statement of Intent between the CSIR and South African Chamber of Business (SACOB) regarding the use of Worldnet Africa to enhance the competitiveness of the South African business sector, both locally and internationally.

Worldnet Africa is currently the Internet access provider for two Cyber Cafés in Pretoria – a first for the city – where it is being used for entertainment and professional purposes, mostly by small businessmen and students.

Worldnet Africa is an Internet-based information and communication service

Textile performance improvement

The CSIR has developed a portfolio of products aimed at improving the international competitiveness of the South African textile industry.

Expertise in applying Total Quality Management (TQM) in textile environments has been developed with a strong emphasis on optimising manufacturing operations. A number of performance-improvement projects have been completed at textile mills in southern Africa, and a large intervention at a weaving company is currently under way. This project involves extensive training and the design and implementation of suitable management systems and performance measures. Quality and efficiency levels have improved markedly since the CSIR's involvement.

The Division of Textile Technology of the CSIR was recently accredited as a consultant by the Department of Trade and Industry to assist companies to meet the requirements of the Duty Credit Certification Scheme (DCCS) for textiles and clothing. Participants in this scheme can earn import duty credits based on the value of their exports and their performance in the fields of training and productivity improvement.

3-D stress sensor joint venture

The CSIR's 3-D stress sensor simultaneously measures the vertical, transverse and longitudinal vehicle tyre:road interface stresses, which are important inputs for road structural design aimed at optimising the cost of roads over their design life.

Initial international acclaim for this technology has led to the University of the Delft in the Netherlands contracting the CSIR to measure three-dimensional stresses using the tyres from the Dutch testing equipment in the CSIR's Heavy Vehicle Simulator (HVS).

Using the 3-D stress sensor to optimise the cost of roads

C o m p e t i t i v e n e s s (continued)

Two Super Single truck tyres were sent for testing so that the stresses could be quantified to aid Dutch researchers to understand and explain currently unknown surface cracking on some sections of their 2 500 km asphalt-surfaced highway system. This information will also be available to local road engineers for the optimisation of the integrity of asphalt-surfaced roads in southern Africa. The technology puts South Africa and the CSIR in the forefront of road building technology, which will have a major impact on road building internationally. There is now considerable local interest in the application of this new technology in road structural and surfacing layers design.

Electron spectrometer for analysing materials

During 1994 a project was started in the CSIR's surface analytical laboratory on the development of a new IBM-compatible PC-based software and hardware package for instrument control and data acquisition, designed to replace the DEC PDP computer systems and MACS software on the Physical Electronics PHI 595 scanning auger microprobe (SAM) system. This is a sophisticated electron spectrometer used in surface chemical analysis of materials.

As the basic SAM instruments are still very useful to many industries, there was a real need for a hardware and software package using modern technology, which would interface efficiently and simply with both the PHI instrument and the user.

The project at the CSIR was initially aimed at solving an in-house problem, but as the product developed, other users abroad expressed interest. An agreement was reached between the CSIR and Physical Electronics Industries (PHI) of the USA, in terms of which PHI would sell the software product, SpecView, through their network as a PHI product under license to the CSIR. The scope of the project was broadened to include other spectrometer types with enhanced functionality.

A software and hardware package was developed for the PHI scanning auger microprobe

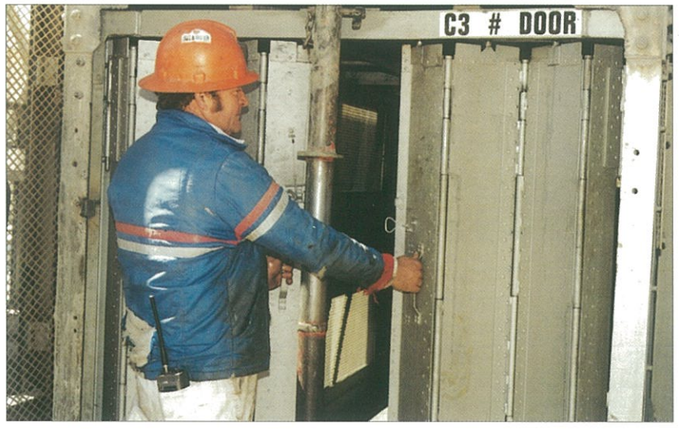
Light-weight mine hoist cage door

The CSIR, together with JCI, has developed a unique light-weight mine hoist cage door. The design is a double concertina door system with aluminium panels, opening to approximately 75% of the width of the cage. It can be mounted in any existing swing-frame to allow car handling.

The door replaces the roll-up door commonly used on mine hoist cages. It is designed to increase the utilisation of space within the cage, shorten loading time, reduce the overall weight of the cage and provide improved safety. For deep-level mining, it significantly reduces the required cage size, and consequently the shaft and rope diameters.

Although the door is costlier than existing doors, the improved productivity, safety and space utilisation, and low maintenance costs mean that it pays for itself within a short period of time.

The door passed practical tests with flying colours. After stringent testing at Randfontein Estates Gold Mine's Cook number three shaft, it was found that the door had lived up to expectations, and was a modern, user-friendly alternative to conventional doors. So far twenty-two doors have been installed at various South African mines.



Uniquely designed mine hoist cage door

ACL Perimeter Intrusion Detection System

The ACL infrared (IR) Perimeter Intrusion Detection System (PIDS) has been developed from technology initially aimed at the defence sector. The IR technology has since been married to an artificial intelligent neural network, enhancing the average performance of the system to that of a world leader in PIDS products. The ACL system has gone through three upgrades, the most recent in conjunction with an international security company based in the UK. This development and the subsequent approval has won the CSIR's Division of Manufacturing and Aeronautical Systems Technology its first international contract, with the ACL installed at a major military installation in Europe. Several other international contacts are being pursued while sales in South Africa are on the increase. The ACL has been extended to a product line available in 1-m, 2-m and 3-m IR beam poles and a smaller version, without neurals, for the local domestic market.

Novel innovative polymeric products developed

Arising from specific needs and marketing opportunities, and in partnership with industrial clients, a series of new polymeric products has been developed and refined during the last year:

- A novel rubber conveyor belt repair compound, previously developed by the CSIR, was redeveloped to withstand lower temperatures. The product will be distributed in South Africa, Africa and Australia.

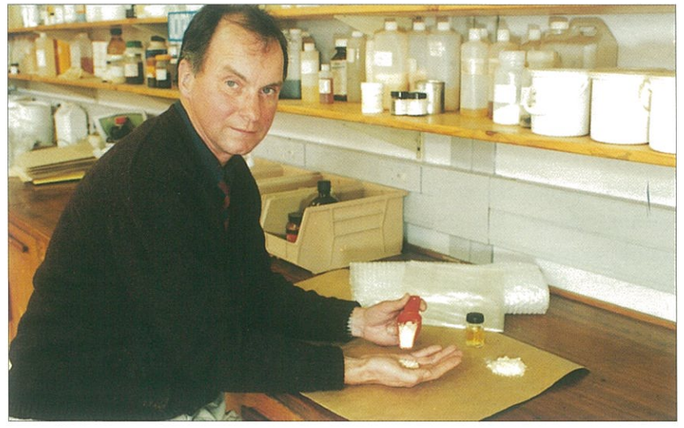
The product consists of a thermoplastic material that can repair damaged conveyor belts in the mining and paper industry with very little downtime needed for the repair work. The material is a solid at room temperature with physical properties very similar to those of a filled stiff rubber. On application of heat, the material melts and becomes fluid and can be shaped easily to repair the damaged conveyor belts, eliminating expensive repair and downtime.

- A novel sealant was developed for an entrepreneur to seal leaking and undergraded wine corks not suitable for sealing more expensive wines. The primary benefit of the sealing compound is that it seals the leaking wine corks and the undergraded corks so well that it competes favourably with the best quality corks. The entrepreneur has registered patents to protect the technology and is in the process of setting up a plant to produce the sealed wine corks.
- New VCI (Volatile Corrosion Inhibitors) formulations have been developed for the impregnation of packaging material and for master batches. The technology, which is used to combat atmospheric corrosion, uses a mechanism to absorb organic molecules onto metal surfaces, thereby rendering the surfaces passive to corrosive gases and vapours. A variety of VCIs are available – liquids for spraying, powders for dusting, foam devices for installation and films and paper for wrapping.

Novel compound for repairing damaged conveyor belts

Textile training

The CSIR's Division of Textile Technology established a training centre to help meet the skills development needs of an industry re-entering the very competitive global arena. Numerous training courses have been developed which are aimed at improving the product quality and operational performance of client organisations.



New VCI formulation for packaging materials

Competitiveness (continued)

Courses vary in length from one to ten days and can be offered regionally, at the client's premises or the CSIR's Port Elizabeth site. More than 1 500 managers, supervisors and operators in the formal sector have been trained to date. In the informal sector, the focus of training has been predominantly on entrepreneurial development through the delivery of train-the-trainer packages, implemented nationally in conjunction with various development and training thrusts. The CSIR, in partnership with Technisa and the Textile Industry Training Board, is also involved in the N4-N6 distance training scheme. The CSIR has reached agreement with the British Textile Technology Group (BTTG) on the implementation of computer-based textile training packages in South Africa.

Textile training course at Port Elizabeth

Plastic removed from wire

The CSIR's Division of Textile Technology in Port Elizabeth has developed and commercialised a way of separating the copper and plastic components of waste plastic-coated copper wire. Until recently, the method of recovery of copper from plastic-coated copper wire was to burn the plastic off the wire. This resulted in the waste of the plastic, deterioration of the quality of the copper and the release of noxious fumes into the atmosphere.

In the CSIR's granulation process, the copper wire is chopped into small granules. The plastic and copper are then separated on a specific gravity separator. The quality of the recovered copper is extremely high and is in demand for smelting. The recovered plastic can be recycled into a number of products.

The leader in virus detection

The CSIR's Virus Protection System (VPS) became the first local product to cater for a virus affecting the newly launched Windows '95 software. The new VPS software, designed to deal with 'BOZO', as the virus is called, was introduced in February 1996.

The system not only automatically determines which version of Windows 3.XX or Windows '95 is running, but also has improved scanning functions which enable it to scan for six macro viruses. The new software also caters for a number of new viruses and the detection of a virus engine known as SMEG, which has thousands of variants.

VPS is an internationally recognised anti-virus software producer and caters for all locally known viruses and the most common ones detected abroad. Regular reports on local viruses are published internationally, confirming the product's reputation in the international anti-virus industry. An Internet address has been created to prompt PC users to submit details of any viruses which they detect (attack @ vps.cis.co.29).

Developing anti-virus software

Expanded range of Goldilux light and UV meters

A new range of Goldilux light and ultra-violet (UV) meters has been launched by the CSIR. Customers are now offered a wider choice, particularly in more demanding measuring applications. The new series of meters and probes are microprocessor controlled and feature an innovative smart-probe technology, whereby all the information about a particular probe is stored in non-volatile memory in the probe. This development adds a high-end meter family to the existing general-purpose Goldilux range.

The new meters, as well as the existing range of Goldilux products, are being manufactured under license to the CSIR by local manufacturer, Measuring Instruments Technology (MIT) (Pty) Limited. They are being distributed by a growing number of local and overseas distributors, each with worldwide, non-exclusive distribution rights.

Newly developed range of light and ultra-violet meters

Environmental management in textiles

Environmental performance is becoming an increasingly important part of international competitiveness. The CSIR is helping textile companies understand and prepare for the pending ISO 14000 series of environmental management standards.

The CSIR's Division of Textile Technology has been accepted as the first associate member in Africa of the Oeko-Tex labelling scheme. This scheme, which originated in Europe, offers consumers assurance that textiles contain no chemicals harmful to their health. The availability of an Oeko-Tex service in South Africa will greatly assist local textile companies in gaining access to European markets.

New five-spoke carbon composite wheel

The CSIR has developed a completely new five-spoke carbon fibre composite motorcycle wheel as a second-generation improvement on its previous three-spoke design. The latest materials and manufacturing processes were used to create a light-weight and strong wheel for safe use on racing and street bikes. The main aim of the design was to construct a wheel which is lighter and stiffer than a conventional metal alloy wheel.

Light-weight and strong five-spoke wheel for motorcycles

The wheel has major outstanding features. It is functional and attractive; it is corrosion resistant; it has excellent fatigue behaviour; it has been optimised for ease of manufacture and low cost; it has a greater expected lifetime than conventional magnesium-alloy racing wheels; and it is a very highly loaded structure at the lowest possible mass, which at the same time maintains its integrity and hence guarantees total safety.

Once it is manufactured in large numbers, the new wheel is expected to compete very well with the currently available metal alloy wheels.

Advanced road analysis and design methods

The CSIR-developed Heavy Vehicle Simulator (HVS), which has provided the basis for developing advanced road analysis and design methods in South Africa, is now also contributing to such development overseas through the HVS international thrust.

While one machine continues to work in South Africa under contract to the Gauteng Department of Transport (Gautrans), the sale of two machines to the California Department of Transport (Caltrans) in 1994/1995 is providing impetus for increasing international interest.

Heavy vehicle simulator aids road analysis and design methods

Two new machines are currently nearing completion for the US army Cold Regions Research Engineering Laboratories (CRREL) and the Finland/Sweden road research programme. They are being built in South Africa by a licenced local manufacturing facility. Other countries have also shown interest in the HVS.

Competitiveness (continued)

New developments include dynamic loading and modelling; determination of actual behaviour at the road:tyre interface using the new 3-D Stress Sensor; enhancing the database of 20 years of test results in order to make this available as a support to international institutions; and upgrading associated instrumentation.

Self-correcting magnetic compass

The major problem when using a magnetic compass in a vehicle is the disturbing effect of the vehicle itself. The compass senses the earth's magnetic field in order to determine magnetic north, but the ferromagnetic material in the vehicle causes a distortion of the magnetic field, resulting in directional errors.

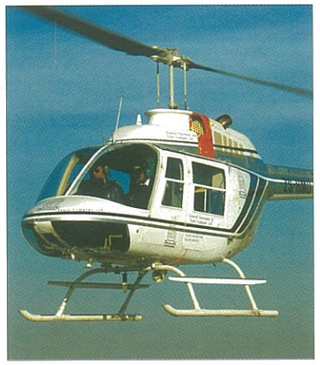
The CSIR's Magnetic Observatory in Hermanus (HMO) has developed an electronic vehicle compass which automatically corrects for the magnetic field distortion caused by the vehicle. The HMO's self-correcting electronic compass has several advantages over conventional compasses: there is no need for a reference compass once the electronic compass has been installed in the vehicle and its misalignment determined, no specific readings need to be taken, and no further external processing of data is necessary.

The technology was put to the test on the SA Navy's SAS Drakensberg with excellent results.

Electronic vehicle compass

Aeroflo supplies helicopter filters to the international market

Aeroflo, a joint venture business between the CSIR and the Atomic Energy Council (AEC), has entered the African market by supplying helicopter intake filters to Namibia. The filters were developed as a spin-off from another project linked to the SA Air Force, and have been operating on several SAAF helicopters. The filters have been installed on helicopters of the Namibian Defence Force – the helicopter crews are very impressed with the product, especially since it lessens their workload and improves the performance of their aircraft under all weather conditions.



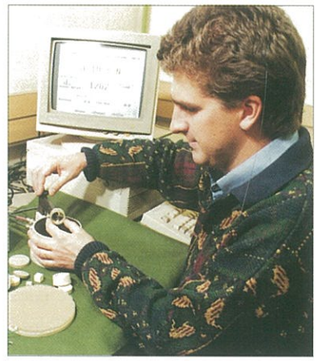
Helicopter filter improves aircraft performance

Piezocomposite materials

The CSIR is currently involved in developing the next generation of piezoelectric materials by applying an existing expertise in the field of structural composites. The so-called "piezoelectric composites" are functional materials which combine the desirable properties of a piezoelectrically active ceramic with a piezoelectrically passive polymer to form a new material. This material has a controlled microstructure and final properties which can be tailored for a specific application.

These advanced composite materials were specifically developed for use in the underwater acoustics field, but are currently being developed for other applications in solid-state electronic components and air-based ultrasonic instrumentation.

Piezocomposites often outperform traditional monolithic ceramic equivalents while offering reduced weight and improved acoustic matching and compliance. The composite nature of these new materials allows physical as well as electrical properties to be "fine tuned" to an application. In addition, the CSIR's materials processing competence allows in-house preparation of material tailored to each client's application.



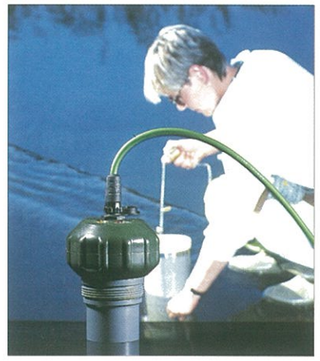
Developing the next generation of piezoelectric composite materials

Two innovative industrial measurement products launched

The first CSIR industrial level and range ultrasonic measurement device, the Sonic 10, was launched in 1994 with a local instrumentation and control company. Positive response and feedback from local industry on that initial product uncovered additional needs for other products.

In particular, the mining and chemical industries needed an intelligent panel-mounted instrument with a remote sensor to measure levels in reaction tanks, open channels and flotation units. The Sonic 20 product was designed, built and commercialised to meet this need.

The water-treatment industry needed a very low-cost, but robust open-channel and tank-level sensor and the "Airhead" product was developed to meet this need. Both local and overseas markets have already shown considerable interest.



Ultrasonic level and range meter

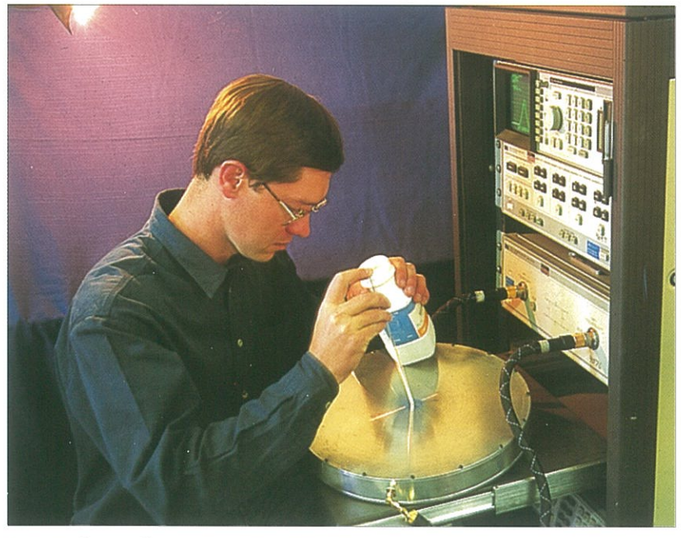
The "Airhead" is unique in its innovative design, providing reliable level information at a very low purchase price.

The Sonic 20 and the "Airhead" are just two of the many industrial sensor products which are being designed and commercialised by the CSIR.

Industrial microwave ovens

The CSIR has developed a number of industrial microwave ovens for clients in local industry. Microwave heating of products offers several advantages over conventional heating methods, since the heat is generated inside the material, allowing faster processing, increased product quality and more compact equipment. Meat tempering and drying of granular materials are just two examples of processes that benefit from microwave heating.

In order to achieve the full benefit from microwave processing, the oven has to be developed around the product. The dielectric constant and loss factor of the material are measured in an elevated temperature measurement facility, also developed at the CSIR. This information is then used to design an efficient oven that renders the required product quality.



Microwave heating offers advantages over conventional methods

D e v e l o p m e n t

Community involvement in water supply

Ground water, although not always readily available in all locations, can provide a cost-effective alternative to surface water in many rural areas where a critical shortage of adequate, clean domestic water supplies is a long-standing problem.

Experience has shown that it is essential to link good technology with community involvement to achievable sustainable water supply schemes. Without this link, water supply schemes are highly susceptible to failure. There may be a lack of a sense of ownership of the scheme within a community, which leads to neglect and possible vandalism of the installations.

As an example of the advisability of a community involvement approach is a recent project for the village of KwaNyuswa. The CSIR team undertook a feasibility study and helped the community to elect a suitable management structure. The community chose to have a combination of systems, including spring protection and the treatment of stream water by slow sand filtration. Water is pumped and distributed to taps at each of the scattered homes. In all, some 40 km of pipeline were laid, with all trenches being dug by community labour teams. The project was funded from a variety of sources, including various corporate funders and the community itself.

The CSIR helped with the design and training, and facilitated the implementation of spring protection works, construction of reservoirs, laying of pipelines and plumbing, installation and operation of pumps, a low-maintenance water treatment plant, and general management skills. The project continues to run efficiently, employing a full-time operator and a part-time accounts person, and the whole scheme is owned by the community.

Community water supply scheme

Needs assessment in agro-processing

The CSIR's Division of Food Science and Technology (Foodtek) first met with the Soetfontein Rural Development Association (SRDA) in 1994, and identified the needs in the food processing area as baking, maize milling and chicken slaughtering. Soetfontein is a 16 000-strong community northeast of Pietersburg. A survey carried out with the support and assistance of the SRDA started with a community workshop and ended with interviews being carried out by unemployed teachers trained by the CSIR. A needs assessment

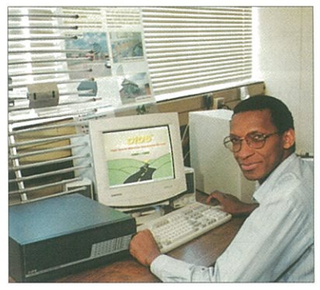
Food processing needs were identified in the Soetfontein community

carried out by the SRDA during the survey indicated a strong desire for micro and small enterprises in the community. This, with the food information from the survey, highlights a real opportunity to initiate local manufacture of food products, which currently have to be bought from outside the community.

The CSIR and SASKO have already established a small rural bakery in Soetfontein which is run by an entrepreneur from the community. The bakery is designed to operate without electricity, employs four workers and can produce 200 loaves of bread in a single shift. This project is an example of small business development in agro-processing, and illustrates the positive effect on rural poverty and food security at the household level. The whole approach makes food more accessible and affordable.

Community information delivery service – CIDS

CIDS is a high-speed wireless networking system which provides highly effective information access for distance education, training, business development, Internet access and inter-building connectivity. It is aimed at providing enhanced access to local and global information infrastructures for



CIDS – a high-speed wireless networking system

communities, private organisations and the public sector. Some of the key benefits of CIDS are rapid deployment, easy installation and low maintenance.

CIDS is currently deployed as a community network interconnecting schools, clinics, libraries, colleges, training centres and small businesses. It has major implications for education, as more people can now be reached more cost-effectively, and overcomes the restriction of a relatively small number of high-quality teachers who have to train a large number of people.

Other major advantages are that CIDS provides access to the Internet and the World Wide Web, can be used to interconnect Local Area Networks (LANs) to provide high-speed inter-building network access and can provide data connection where there is no existing infrastructure.

A consortium, with the CSIR as a founder member, has been founded to develop CIDS. Other members are some of the major players in telematics and distance education, including government departments, NGOs and private sector companies. The CSIR is enabling and supporting members of the consortium with the appropriate implementation of various technologies.

The current pilot network has three access cells and over twenty cell access nodes servicing over 500 people. The members of this pilot project are the CSIR, St Alban's College, Mamelodi Teachers' Centre, Ubuntu Centre, the SOS Children's Village and the Mamelodi Community Information Services.

Clearing the way for catchment management

The CSIR has played a leading role in the implementation of the Working for Water programme. This national programme, which is characterised by a partnership between the Department of Water Affairs & Forestry, the CSIR, other government bodies, the private sector and members of the public, is aimed at clearing alien plants from catchment areas and enhancing the availability of water. The CSIR provides the technological support and project management for the programme.

Twelve projects have been established around South Africa to clear alien vegetation from catchments and in just six months 33 000 infested hectares have been cleared. This is expected to increase run-off in rivers by up to an additional 3 500 cubic metres of water per hectare per year in densely infected areas.

These projects have created 6 686 direct employment opportunities, taking cognisance of gender equity

Clearing alien plants from catchment areas (Photo: Cape Times)

D e v e l o p m e n t (continued)

(55% of those employed are women), as well as creating employment opportunities for the disabled and the youth. In addition, many indirect employment opportunities have been created to take advantage of the secondary benefits such as the use of wood for fuel or for charcoal exports, furniture and crafts.

The focus for technology development centred on the assessment of how much water could be produced through catchment management (reducing the alien plants that take up large quantities of available water) as opposed to, for example, the building of dams.

The project, for which the CSIR prepared the motivation, undertook the preparatory scientific work and implemented the first stages, was started in October 1995 and has a projected life-span of 10-15 years. It has attracted the two largest Water Boards in South Africa (Umgeni Water and Rand Water), who have joined the partnership. This is an excellent example of how the results of scientific research and development can be practically implemented for the national benefit.

Community training in road maintenance and upgrading

The CSIR, jointly with the Department of Transport, successfully undertook a pilot project that trained 13 trainees from Phuthaditjaba, in the Free State Province, in general road maintenance and upgrading techniques on gravel and surfaced roads. The course covered road construction basics, materials, drainage, maintenance and upgrading. Each module consisted of lectures followed by practical training in the field. The trainees can now offer their services as contractors to local municipalities or road authorities.

With a high unemployment rate and non-existent road maintenance (owing to limited funds), the course offers a chance to establish new ways of community involvement in road

Training given in road maintenance and upgrading

building and maintenance, providing employment, transferring skills and promoting small business developments in areas such as Phuthaditjaba.

Following this success, the CSIR is developing other course material for further similar courses in other appropriate locations, e.g. Mamelodi and the Vaal Triangle. Interest in the project has come from the South African Roads Board and the USA Federal Highway Authority, who co-funded the development of techniques and course material, as well as from other large contractors.

Community-based Information Services

The emergence of the "information society" has brought with it an increased awareness of Community-based Information Services (CBIS) and the important role played by information technology in bringing information to the people. The CSIR is playing a leading role as a source of expertise on CBIS in southern Africa. Together with institutions such as UNISA and private schools, the organisation forms part of the Telematics for African Development Consortium responsible for undertaking pilot projects partially funded through the information development (INFODEV) programme of the World Bank. Current projects not only focus on addressing the welfare needs of people, but encompass all aspects of community life, such as social and economic empowerment and recreational needs.

The Mamelodi Community Information Services project

The technologies applied in the establishment of CBIS projects include multimedia public access information kiosks and Internet access centres set up in communities.

The CSIR is currently involved in pilot projects to develop appropriate community information systems for providing basic life skills information, such as the Mamelodi Community Information Services project (MACIS) which is in operation in a community library near Pretoria.

A kiosk has been deployed at Skukuza in the Kruger National Park to provide information to the large number of tourists on the arts and crafts in Mpumalanga.

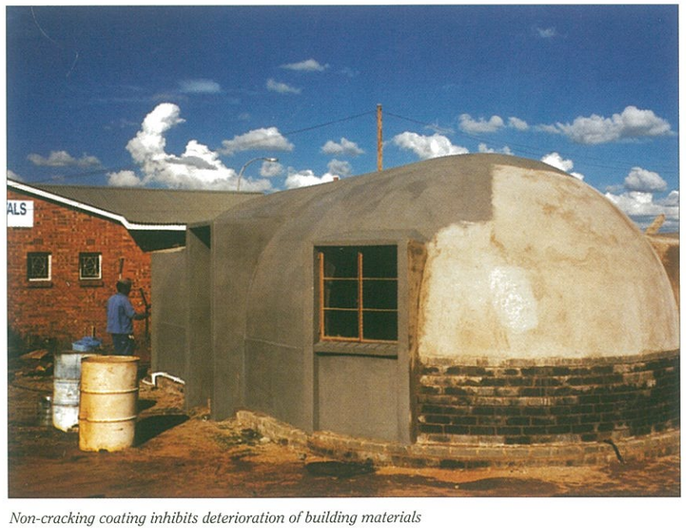
This serves as a marketing tool for SMMEs in the region.

Non-cracking coating for brick, mortar and plaster

Everbond, jointly developed by the CSIR and Stratabond SA (Pty) Limited as a rock-support coating for the mining industry, has considerable potential for application in the building industry as a non-cracking brick, mortar and plaster system.

The improved structural properties of this water-based, ready-mixed compound result from its flexibility and enhanced mechanical properties. The coating bonds readily to brick and other building materials, provides protection against damp and fungal, bacterial and UV degradation, and inhibits deterioration due to the movement of foundations.

The system is simple to use, inexpensive and easily portable. It is operated by a crew of two semi-skilled people, who can apply up to 100 m^2 per hour as an attractive, textured coating. Given its versatility, Everbond has a wide range of applications and can be particularly beneficial in low-cost housing due to its cost-effectiveness and the speed and ease of its application.



Non-cracking coating inhibits deterioration of building materials

Implementation of Agenda 21

Durban has been identified as one of 14 cities worldwide to be a "model community" in developing and testing the implementation of Agenda 21, the sustainable development principles which came out of the United Nations Conference on the Environment and Development

Local Agenda 21, a sustainable development project for Durban

(UNCED "Earth Summit") in Rio de Janeiro in 1992. At the local level where these principles are intended to be practically implemented, the programme is known as Local Agenda 21 (LA21). The East Coast Programme of the CSIR has been heavily involved as the technology partner of the Durban Metropolitan Authority (former Durban City Council) in designing the LA21 implementation process, and collating, analysing and synthesising information required for Phase 1 of the project. Phase 1 is a State of the Environment and Development assessment for the Durban Metropolitan Area (DMA). Phase 2 encompasses prioritisation of key actions by the Metro Authority, and Phase 3 will initiate implementation. This project is extremely complicated

Development (continued)

and difficult to manage for a number of reasons. Sustainable development is a new and not well defined nor understood concept. Implementation is difficult, particularly the process for inclusion of the vast number of diverse stakeholders, including all local communities, developing a set of implementation principles for the LA21 process which encompasses the full spectrum of environmental, social and economic sectors, and defining the urban 'footprint', the massive area which urban conglomerates draw upon for resources, acting as a vast resource sink. In essence it requires developing and implementing a wholly new development paradigm of sustainability which is convincing enough to obtain the buy-in of all stakeholders. Durban, together with the CSIR, is at the forefront of the international LA21 design and implementation process.

Delivering effective housing systems

Housing is one of the most emotive social and political issues in the new South Africa. The challenge is to supply a house that costs no more than R15 000, including the serviced site.

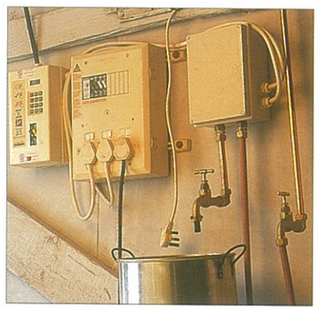
The CSIR verifies new building processes and materials

The CSIR's task is to ensure that proposed new building processes and materials will in fact work. The verification method being used is approval by Agrément South Africa, established in 1969 to evaluate the fitness-for-purpose of non-standardised construction products.

Although there is no legal obligation for importers or developers of new housing materials to approach Agrément South Africa, acceptance as contractors working under the Homeowners Warranty Scheme will be facilitated by an appropriate Agrément certificate.

Instant hot water heater conserves energy

The WaterMatic is an in-line water heater developed by the CSIR and manufactured and marketed by Rural Maintenance (Pty) Limited (an SMME). Using double elements, the geyser heats water instantly to the desired temperature and delivers a continuous flow of hot water. It is easily fitted to an existing water supply network, and can be installed by the DIY enthusiast. It is designed to be simply plugged into a "ready board". When the water supply is opened, a flow sensor activates the elements, and when the water is turned off no electricity is consumed.



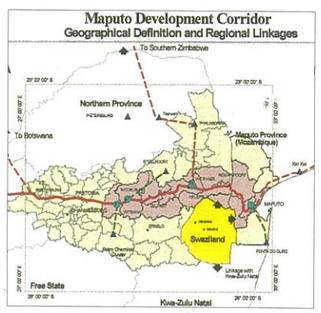
In-line water heater conserves power

Maputo corridor

The South African and Mozambican Governments have been working closely to examine the possibility of maximising the mutual benefits of a development corridor between the two countries by linking Gauteng, the Witbank complex, the Tzaneen/Phalaborwa region, and the region around Nelspruit more closely with the port of Maputo and popular tourist destinations in its vicinity. The purpose of the Maputo Development Corridor would be to improve inter-regional accessibility and associated development potential.

The CSIR, as a member of the Technical Committee for the Maputo Development Corridor, is responsible for setting up and maintaining a Geographic Information System (GIS) to facilitate the appraisal of the existing socio-economic conditions and development potentials along the corridor. It has already been shown that the re-establishment of the axis will significantly enhance the underlying conditions for economic growth and development along its entire length, presenting a range of new opportunities for investment by the public and private sectors, individually or jointly, in all dimensions of development and key sectors.

This project also involves technology transfer to Mozambique, in the form of training in GIS techniques.



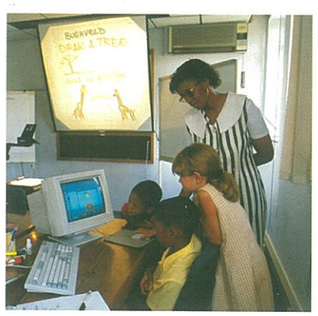
Appraisal of potentials along the Maputo development corridor

Improving the quality of education through technology

Providing education over a distance is a way of reaching people more cost-effectively, and overcomes the restriction of a relatively small number of high-quality teachers who have to train a large number of people.

The CSIR is a founder member of a distance education consortium consisting of major players in telematics and distance education, and include government departments, NGOs and private sector companies.

The CSIR is approaching distance education as a specialised information service which involves content creation, publishing and brokerage content, and presentation and usage of content. Underlying this is the supporting role of technology, in this case networking. The CSIR is enabling and supporting other members of the consortium through the appropriate implementation of various technologies.



Technology supports education

Towards connectivity in Africa

Globalisation and the advantages of the information age have sparked much interest in the establishment of connectivity on the African continent. This is evident from the ground-breaking events held in South Africa during the first half of 1996.

The CSIR was involved in presenting two coinciding events focusing on related issues, which were attended by international speakers and audiences. These were a conference entitled "Towards a southern African Information Network: North/South cooperation in scientific and technical information" and a workshop entitled "Empowering Communities in the Information Society".

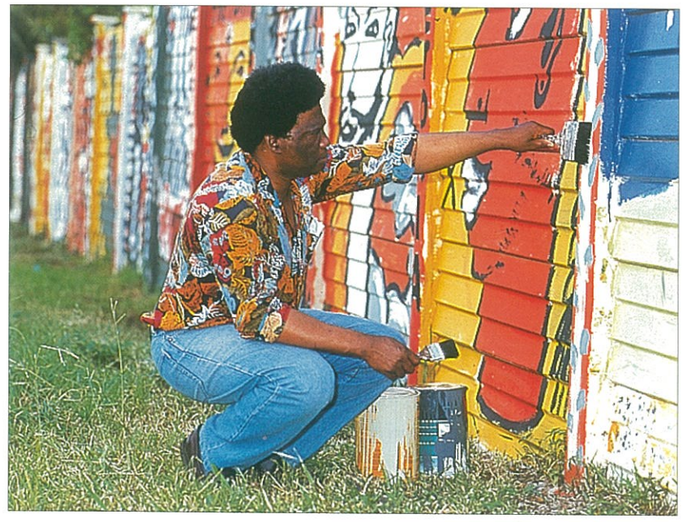
A major outcome of the first G7 Information Society and Development Conference (ISAD) was the signing of a memorandum of understanding between the CSIR, the Egyptian Cabinet Information Decision Support Centre and the Regional Information Technology Software Engineering Centre, with the aim of establishing a basis for cooperation with regard to network developments in Africa.

Job creation through SMMEs

The goal of the CSIR's Small, Micro and Medium Enterprise (SMME) initiative is ultimately to contribute to the economy of South Africa through job creation resulting from the establishment of SMMEs.

One particular set of activities has been centred primarily around chemicals formulation technology ranging from household, personal care, hair care to paint formulation. Appropriate business models have been developed during the past year according to a phased approach whereby the entrepreneur, in Phase 1, can secure his market with products formulated by the CSIR. Limited production encompasses Phase 2 and, in Phase 3, a complete technology transfer of what is essentially a turnkey business takes place. Prospective entrepreneurs can join any of the Phases.

During the past year the CSIR has



Products formulated by the CSIR are supplied to entrepreneurs

Development (continued)

been involved primarily on a Phase 1 and a Phase 2 level with various entrepreneurs. Paint has been supplied to an entrepreneur who, in turn, is supplying a provincial government department. Two entrepreneurs have been supplied with hair care products and one client has been supplied with household products.
The project has now advanced to the point whereby complete technology transfer is under negotiation with various entrepreneurs.

Low-cost road roughness indicator
The CSIR has developed a portable prototype instrument called LORRI (Low-cost Road Roughness Indicator) for use in areas where it is not feasible or cost-effective to use an LDI (Linear Displacement Indicator) or other similar road-roughness measuring device. The LORRI is extremely useful for the quality control of labour-intensive and community-based construction and maintenance, the measurement of short experimental sections and the calibration of LDI equipment.

Quality control of road maintenance and construction

It has been used in calcium chloride experiments as well as gravel road maintenance studies in Botswana and Qwa Qwa in South Africa.

Shelter for the people, by the people
Through research and the exploration of ideas, as well as direct involvement, the CSIR's Shelter Group is striving to make a meaningful contribution to the process of improving the level and quality of shelter in the country. Support is provided to central, provincial and local government departments, NGOs, community groups, people's organisations and individuals in their attempts to create viable and sustainable communities.
The Shelter Group strongly encourages development through what is referred to as "the people's housing process", in which individuals, families or community groups take charge of the planning, design and building of their own houses. Particular emphasis is therefore placed on capacity building through the transfer of technological know-how to the poorest of the poor in order to support community-driven decision-making.
The Group is also closely involved in the housing support initiative and is represented on the National Housing Support Task Team. The Group's services include facilitating the identification of housing support needs at both regional and project levels, assisting with the setting up of housing support centres, and developing criteria for evaluating and monitoring support initiatives.

Improving the quality of shelter through transfer of technological know-how

Community participation in road traffic safety
Community involvement and participation in all transport and traffic matters are inherent to the Reconstruction and Development Programme and the Green Paper on National Transport Policy. The need to improve road user knowledge, skills and attitudes through comprehensive educational programmes aiming at promoting voluntary compliance with traffic laws, has been identified as a priority.
Training programmes, aimed at all categories of road users, are developed at national level and implemented at provincial and local levels, in co-operation with community structures.
The CSIR formulated guidelines on the establishment of community-based traffic safety forums based on the experience gained from the constitution of a number of forums in Pretoria, Soweto, Mpumalanga and Knysna. Technical assistance is provided to these forums until they are fully operational.
Guidelines for the nationwide establishment of community road safety centres are being developed. These centres will be instrumental in implementing educational and other traffic safety programmes and projects. Traffic safety officials will be trained to establish community-based forums and safety centres to ensure sustainability of efforts to improve traffic safety within communities.

Major brick project at Tyumbu
Transkei builders will soon be able to source their bricks from Umtata as a result of a project at Tyumbu Bricks, situated about 10 km from Umtata. Until now, the brickyard has only been able to produce a low-quality brick because of lack of proper equipment and technology. Consequently, the bricks were only used by a small number of builders in rural areas.
Now with the aid of a TDC (Transkei Development Corporation) loan and with the assistance of the CSIR, Tyumbu bricks will soon be able to manufacture the type and quality of brick that is generally used. At present the CSIR is testing clay from Tyumbu and making bricks with it to set correct quality limits for the brickyard in terms of mixing, forming and firing techniques.
The present staff complement of the brickyard is 54, and the expectation is that further jobs will become available once the new equipment is in place. Members of the Transkei Building Association have pledged their full support for the project.

Equipment and technology upgrades for a Transkei brickmaker

Developing specialty or customised fabrics
The CSIR, with its capability to develop customised, specialty or unique fabrics over a wide range, was approached by Thread Bears, a KwaZulu/Natal-based client, to develop fabrics for covering teddy bears. The brief was that the fabric should be unique to South Africa, and as a result Cape mohair and mopani silk fabrics were developed.
The fact that almost 50% of mohair produced internationally is from South Africa was a deciding factor in the choice of this fibre. In this case the mohair fabric is constructed of woven loop yarn and then brushed.
Mopani silk was selected as the fibre type for the second fabric range. This form of wild silk is derived from the cocoon of an indigenous moth found only in southern Africa. The CSIR is the first organisation to convert silk from the *Gonometa* worm into spun

Specialty fabrics developed by the CSIR

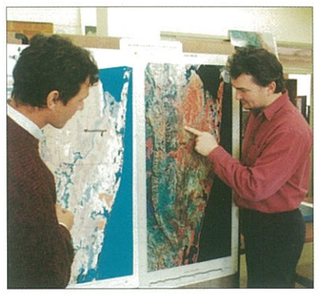
Development (continued)

yarn and other high-value-added spun products, ranging from teddy bear fabrics to high-fashion garments.

SpaceMap production in full swing

The production of SpaceMaps at the Satellite Applications Centre of the CSIR is well under way. At present the focus is on 1:250 000 map sheets in support of the National Land Cover Project, and the initial production of SpaceMaps has been tailored to assist in the interpretation of the required land cover classes.

The SpaceMaps are mosaicked from carefully selected, multiple Landsat Thematic Mapper satellite images and are output in the Gauss Conformal Projection using the Clarke 1880 (modified) ellipsoid and Cape Arc datum. Although the satellite maps cover the same two-degree area as the National Topo and Topo-cadastral sheets, an extra five-minute margin has been added all round to aid in the classification of boundary areas. The SAC's SpaceMaps are not limited to Landsat TM data – data from SPOT, ERS SAR and other sensors can be used or combined at appropriate scales to provide information for input into Geographic and Land Information Systems.



SpaceMaps produced in support of the National Land Cover project

COMSEC accreditation achieved during 1995

In May 1995 a Community Self-employment Centre (COMSEC) was opened in Port Elizabeth, the first of its kind in South Africa. It was the result of a joint effort between community leaders, the CSIR's Division of Textile Technology, the Chamber of Industries, several large industries and training institutions.

Business Development Services (BuDS) of the Department of Trade & Industry granted COMSEC full accreditation as a local business service centre as it met all ten criteria for accreditation satisfactorily. Criteria include aspects such as core services, financial solvency and business plans.

Community self-employment centre teaches a variety of skills

The CSIR played a pioneering role in the COMSEC initiative of the Regional Economic Development Forum (REDF) for job creation by providing not only a project model for this thrust to be based upon, but also by launching the job creation project with a training programme in knitting for budding entrepreneurs. The CSIR Knitting Academy, which is in essence a one-stop technological aid centre which assists potential entrepreneurs with technical, marketing, and business management skills, training and support, has been established to give momentum to job creation in the region.

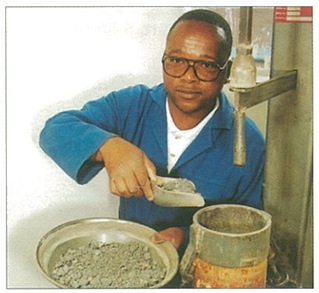
Ash as a road construction aggregate

The ash produced as a waste product by the Sasol plant in Sasolburg was identified by Sasol as a possible major environmental and land-use problem. The CSIR was commissioned to undertake a study on the viability of using ash from the Sasol plant in road construction.

Benefits of using ash for road construction include reduced environmental pressure (lower demand for natural materials and reduced pressure on dumping sites) and lower road construction costs (for haulage distances of up to 300 km from the plant).

In addition, ash pavement layers constructed using labour-based techniques were also found to be competitively priced compared with those constructed using conventional materials and techniques, mainly due to the ash being significantly lighter, and therefore easier to handle. This could have enormous implications in terms of job creation and the use of labour-based techniques in road construction.

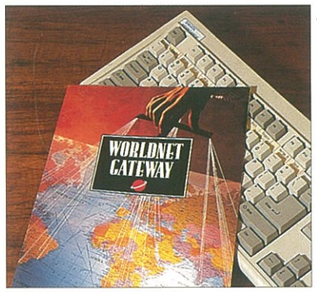
Further research into the long-term performance and environmental impacts of using Sasol ash in road pavement layers is planned.



Research into ash as a road construction material

Access to on-line services in African countries

On a practical level, the CSIR has been actively involved in establishing on-line information services in African countries. Access to CompuServe, the US-based on-line service, and the CSIR's own Worldnet Gateway database service, has formed the backbone of connectivity in several countries in southern Africa. The addition in 1995 of the CSIR's Worldnet Africa Internet service and the Africa Hub, an e-mail exchange service, has provided further impetus to the development of information infrastructure in the region.



Worldnet Gateway – backbone of connectivity in southern African countries

Major connectivity points, or "hubs", have been installed in Pretoria, Port Louis (Mauritius), Nairobi (Kenya) and Paris. There are plans to include Gabon, Cairo, Bahrain and India. Countries around these hubs are able to access the information services through a node. Nodes have been installed in Zimbabwe, Swaziland and Botswana, and plans are in place to install nodes in all the Southern African Development Community (SADC) countries shortly. The CSIR is involved in negotiations aimed at continuing this initiative in partnership with the SADC countries and other role players on the continent.

Lubisi Dam community upliftment project

When the Lubisi Dam was constructed in the Eastern Cape in the 1960s, the consequences for the local residents were severe: the dam displaced them from their homes, covered sacred burial grounds and deprived the farmers of fertile flood plains. A downstream irrigation scheme was directly beneficial only to one landowner, who happened to have been the ruling chief of the region at the time. Local residents around the dam site have never been permitted to draw water from it.

The primary and long-term objective of the CSIR's involvement in the Lubisi Dam project is to help improve, in a sustainable manner, the quality of life and standard of living of the people in the 23 villages in the vicinity of the dam (some 80 000 people).

Since full community involvement in this project is essential, the Lubisi Dam Development Forum (LDDF) has been established. Workshops with the communities and extensive needs surveys have been conducted in order to formulate the project in close collaboration with the people.

CSIR project planning is being done in close collaboration with the LDDF and the Eastern Cape provincial government. Priority areas identified by the LDDF are water supply, energy provision, agriculture, roads and transport and the creation of Small, Medium and Micro Enterprises (SMMEs). Feasibility studies in these areas are under way and some have been completed. A major emphasis of the project is capacity building, training and creating an awareness of the benefits of technology in the region.

This integrated development project will be assessed for replication in other communities.

Lubisi Dam, site of an integrated development project

Decision-making

Audit of national health facilities

With the advent of a new political dispensation in South Africa, there is a new vision for better and more accessible health services for all South Africans. Although there is an urgent need for major capital spending, the point of departure in the restructuring process is the existing health care facilities estate. It is essential first to know what this estate consists of, as well as its suitability, condition and the likely cost of sustaining and redeveloping it.

To facilitate the planning process at national and provincial levels, the Department of Health appointed the CSIR to undertake a comprehensive audit of the capacity, condition and suitability of hospitals and health centres in all the provinces. A wide range of consultants were used to undertake the audits at facilities level. The National Health Facilities Audit will give health planners a clear picture of the current status of the full health estate and empower them to make more effective decisions on where to add capacity, which facilities need to be maintained, upgraded or replaced and how best to redress current inequalities in provision. In the survey assessments were made both at site and building levels of aspects such as water supply, fire services, sewage, stormwater, electrical supply, piped gases, ventilation, design suitability, and physical and operating environments.

The Department of Health is the first department to have such a comprehensive view of all its facilities across the country.

Other African countries have already shown an interest in the health facilities audit, which could lead to an improvement of the health facilities status of the whole continent.

Breakthrough in sludge disposal

The annual output of sludge from municipal and industrial waste water treatment plants is enormous. Because of the moisture content, which can be as high as 98%, it is voluminous and very costly to handle and transport. It is therefore imperative that as much water as possible should be removed from the sludge to obtain a product whose higher solids content is suitable for energy recovery and the production of compost.

The CSIR has designed and patented an electro-osmotic belt filter method of sludge disposal. The technique involves electrical currents that separate the liquid from the bio-solids. After the liquid has been removed, the volume of the sludge is dramatically reduced and is ready for recycling. The technology has been acquired by an international company which is developing a pilot plant in Klerksdorp.

Electro-osmotic belt filter method of sludge disposal

SeamCam improves quality control

The CSIR has developed an award-winning machine vision inspection system, known as SeamCam.

It is one of three CSIR products that won "best in category" awards in the 1996 Engineering Week/Engineering Council of SA Top Products Competition. SeamCam improves quality control in the manufacture of metal cans and canned products. The PC-based system provides an automatic means of measuring the seams of cans of all shapes and sizes.

Automatic measurement of can seams

If the seams of cans are not correctly formed, leaks and degradation of the contents of the can may occur. This can lead to the rejection of both the can and its contents by wholesalers, purchasers or exporters, with adverse financial consequences for producers. SeamCam dramatically improves the productivity of quality control staff: manual testing of one can with three seam cuttings can take up to 15 minutes, whereas Seamcam takes three minutes. There is the added disadvantage of the risk of human error.

The SeamCam system consists of a specially designed measuring station containing a measurement pedestal, a high-quality CCD camera, optics and lighting, interfaced with a PC. Software developed by the CSIR allows easy, operator-assisted calibration and measurement of the common seam parameters, such as length, thickness, gaps, body, cover hook, overlap and free space. It also provides statistical information, such as averages and deviations from test samples, which can be saved, printed, or imported into other quality assurance packages at a later date. The data are available in hard copy for management reports in both tabular and graphical form.

Transport policy review

Early in 1995 the Department of Transport embarked on a process to review and revisit transport policy and formulate new policy where it has become necessary to adjust to the changed environment in South Africa. This policy-making process has involved all role players and the public at large in determining issues, generating policy options and discussing and accepting policy proposals.

A steering committee, sectoral working groups, and plenary meetings identified policy issues, and debated policy options relating to overarching transport principles, transport infrastructure, land passenger transport, land freight transport, civil aviation, maritime transport, and road traffic.

The policy proposals to address the issues perceived as being problematic were summarised into a Green Paper on National Transport Policy, which was released by the Minister of Transport during March 1996. The comments on the Green Paper were analysed, and the Department is now drafting a White Paper on National Transport Policy, which it will submit to the Minister and then the Cabinet for approval in July 1996. The implementation of the new policies will follow, and hopefully the key policies requiring legislation will be considered by Parliament during the current year.

The CSIR actively participated in the process, which included the activities of the Steering Committee, the Working Groups, Plenaries, Seminars and the production of the Green Paper which was completed in February 1996. The White Paper is now in production and the CSIR continues to be involved in this important policy document that will impact on decision-making in South Africa.

Potable water pipeline services

Pipelines are a significant capital investment and safe, reliable operation is essential to pipeline owners. As it is generally expensive to replace corroded pipelines, the CSIR has in recent years developed a variety of technologies to assist pipeline operators to extend the useful life of pipelines under their control.

The CSIR's comprehensive assessment and management services of ageing pipelines include a database built up through internal and external pipeline inspections, pipeline refurbishment and the maintenance and proactive asset management of pipelines through on-line monitoring. These services offer clients cost-effective solutions to their pipeline problems.

Assessment and management of pipelines

Decision-making (continued)

Mr David Bath, Director of the CSIR's Division of Building Technology, presented the first copy of the Red Book Management Companion to the Minister of Housing, Ms Sankie Mthembi-Nkondo. With them is Mr Aussie Austin, project leader for the Red Book and its Management Companion.

Assisting non-technical managers and decision-makers

The CSIR recently published a Management Companion to the Red Book ("Guidelines for the provision of engineering services and amenities in residential township development") written in easily-understood layman's language. The Management Companion describes the key issues and concepts for each chapter of the Red Book and gives a glossary of technical terms used. Cross-references are also provided where appropriate.

This comprehensive guide will prove invaluable to all users of the Red Book, as well as to decision-makers in government departments, local authorities, housing boards, RDP offices, NGOs, financial institutions, development corporations and funding agencies. Town planners, consulting engineers, urban developers, educational institutions, human resources managers, farmers, suppliers of materials and various other professionals will also benefit from the Management Companion, while persons conducting community liaison will find it a useful tool.

The Red Book is the result of many years of research and experience in the field of residential engineering services and amenities. The guidelines in the book offer a range of choices on the levels of service that can be provided, while a summary of the costs involved is also provided in the Levels of Service (LOS) Matrix.

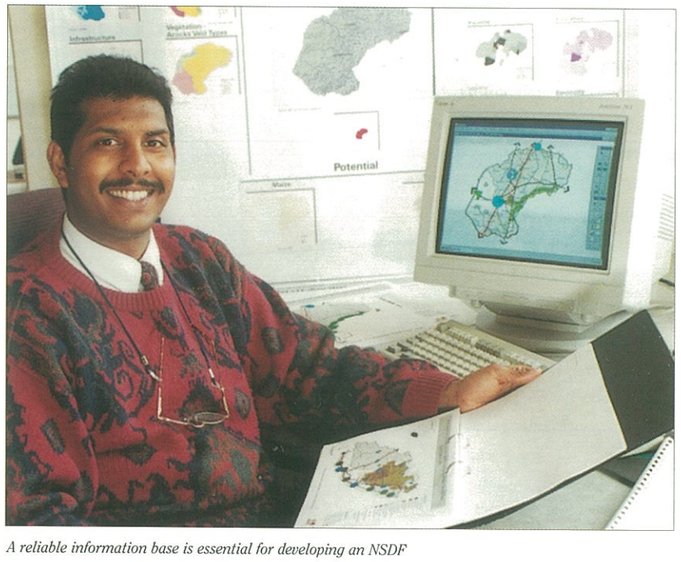
A decision about which levels of service are to be chosen depends, among other things, on the priorities of the community being served, the funds that are available, the importance placed on job creation and employment-intensive construction methods, the nature of the area where the services are to be provided, the implications for later upgrading of the services, and the initial capital costs as well as the costs of operating and maintaining the services.

The chapters in the Red Book and its Management Companion include principles of layout planning, stormwater management, road design and maintenance, water supply, sanitation, solid waste management and electricity.

National Spatial Development Framework

A National Spatial Development Framework (NSDF) is a key part of ensuring sustainable economic growth. An NSDF provides a consistent framework for public sector intervention in the development of the country, as well as a clear plan for guiding private sector involvement.

An NSDF requires input from a multi-disciplinary team of professionals and considerable interaction with interested and affected parties. The CSIR has extensive experience in the management of projects of such an integrative nature. Apart from its in-house capacity, the CSIR also has the methodology and systems to support the contracting of a multitude of smaller organisations, who within their specialised fields of operation, can be of significant value in assisting the project team with the compilation of an NSDF.



A reliable information base is essential for developing an NSDF

The CSIR was contracted by the development planning branch in the office of the Vice President (formerly RDP office) to assist them with the first phase of the NSDF, which involved populating a Geographic Information System with currently available data within a very short time frame of six weeks.

When complete, the NSDF will guide the development of urban economic nodes, integrated rural clusters, manufacturing and industrial clusters, and the supporting infrastructure networks. In addition, it will play a guiding and integrating role in identifying areas of economic development across all sectors, within corridors of optimum development potential.

At the core of developing an NSDF is a reliable and consistent information base reflecting the current status of development. Underpinning this information is a standardised coding scheme to allow for unambiguous referencing of data and for efficient integration of information across the various role players in government and the private sector.

Stope support design methodology enhances safety in mines

In South African mines with tabular ore bodies, the design of stope support systems has in most cases been based on experience, past practices and cost considerations. Approximately 130 support systems are in current use in the mining industry, which include various types of support units with variations in spacing and support dimensions.

The CSIR has developed a design and evaluation methodology to determine how stope support systems would behave under rockfall or rockburst conditions. The methodology required reef-specific rockburst and rockfall criteria to be established, against which any stope support system can be tested for different stope closure rates and mining cycles.

A large fatal accident database of 1 200 fatalities made it possible to determine these reef-specific criteria for the first time. This technology will eventually lead to a computer program enabling mines to design the optimum support system for a particular stope.

Lucas technology and plant transfer

The CSIR and Lucas UK have entered into an agreement whereby the CSIR purchased the technology license and associated machinery and tools for the manufacture of the Lucas 28RA automotive relay, and subsequently transferred it to COMAC (Pty) Limited.

The Lucas 28RA is a one-inch relay which is used in automotive applications for load-switching such as hooters, electric windows and rear screen heaters. It is still used extensively in new and used vehicles.

The CSIR has refurbished all the machines and installed them at a site in Paardeneiland in Cape Town. The manufacturing tools have been sent to a plastics and metal pressing company where the plastic components will be produced. Sub-assembly, final assembly and testing of the components will be done by COMAC.

The project will provide about 25 job opportunities in a developing company; it will save foreign exchange owing to import substitution; and it will generate foreign exchange through exports. The acquisition of this plant will enable COMAC to enter the existing markets of local and international vehicle manufacturers, as well as the associated service and after-markets. The CSIR has ensured that the project has a guaranteed R3,2 million export order at inception.

Design and evaluation methodology for stope support systems

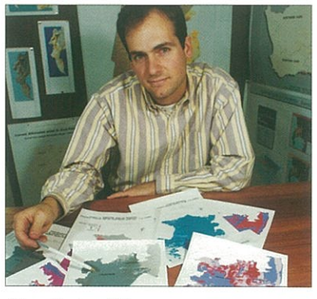
Decision-making (continued)

Atmospheric pollution maps aid policy-making

The CSIR has devised a scheme for an Atmospheric Deposition Risk Advisory System (ADRAS). The scheme aims to incorporate all aspects of air pollution, such as the assessment of air quality, the consideration of environmental impacts, and the control and management of air quality.

ADRAS is aimed at involving all parties interested in air quality. The system provides a framework by which information gathered by means of nationwide research efforts and monitoring can be integrated and presented to policy-makers in a form that is concise and easy to interpret.

As a test case, maps of actual sulphate deposition for the coal-rich province of Mpumalanga have been produced. These maps can be compared with maps of the potential sensitivity of soils and surface waters, allowing sensitive areas which receive high levels of pollution to be monitored. Researchers will be able to determine tentative critical loads for the region and compare them with the actual deposition loads of pollutants. This, in turn, will enable them to pinpoint areas where critical loads are being exceeded and the environment damaged, so that action can be taken. ADRAS provides a means of focusing on air pollution and its associated effects in an integrated manner, thereby allowing policies and strategies for further industrial development to be continuously improved.



Atmospheric pollution maps

GLAXO-WELLCOME throughput improvement project

The merger between GLAXO and WELLCOME, the pharmaceutical giants, resulted in increased volumes of their products that had to be packed in the single packing hall. The need was to improve their throughput in the packing hall from the previous levels of 900 000 units per month to 1 500 000 per month.

The CSIR undertook a 'Business Process Analysis' to identify and quantify opportunities for improvement. Based on the findings of the analysis, a twenty-four-week "Business Performance Improvement Programme" was developed. A three-member CSIR team, and a three-member task force team seconded to the Programme by the client, developed significant planning, controlling and reporting systems based on meaningful operating standards to monitor productivity continuously.

To date the productivity evaluation is showing an improvement of greater than 45%, which was achieved without any reduction in staff numbers. The system has highlighted maintenance as the main contributor towards performance, and the information has been used to appoint maintenance personnel.

Risk assessment services are provided by MineRisk Africa

MineRisk Africa

The CSIR's Division of Mining Technology has introduced risk assessment services which are available through its specialised unit, MineRisk Africa. The new service was introduced in response to the identification by the South African mining industry and the Leon Commission for the urgent need for the application of risk assessment processes with regard to safety and health, and financial risk and productivity.

The formation of the MineRisk Africa unit follows an agreement signed with an Australian-based company which developed risk assessment techniques based on classic risk assessment processes that have been successfully applied for a number of years in the Australian mining industry.

Identifying development priorities

Help is on the way for decision-makers involved in determining country-wide development priorities. The CSIR and the Human Sciences Research Council have collaborated in devising a system that provides an overall and comparative picture of the level of assistance required by the country's communities. This system can ensure that development funds reach those communities that need them most, as its application will include those communities which may not even have the means or knowledge to submit applications for development funding.

World first design of airline operations control system

The CSIR, jointly with the prime contractor ICL, developed an airline operations control system for South African Airlines (SAA). The Genesis system distinguishes itself from systems used by other airlines through its level of integration of daily operations planning and management and provides SAA with a tailor-made suite of applications which merges flight, aircraft and crew planning into one graphically driven environment.

The Genesis system also addresses crew issues such as duty schedules, training and leave periods and provides electronic touch-screen access to records. The system's support of current and foreseeable business practices will enable SAA to react creatively to changes in their market place and will contribute to decision-making and maintaining the company's competitive position.

An operations control system designed for SAA

Optimising railway station design

In response to a request from the South African Rail Commuter Corporation (SARCC), the CSIR is calibrating the British Pedroute Station Congestion Programme for local use and is assessing various design proposals to facilitate optimal railway station design. The CSIR was also asked to look at access route signage on the surrounding road network, to make the station more visible to feeder transport and to facilitate orderly movement to and from the station.

As a result, guidelines were developed to aid future station design in South Africa, taking both pedestrian and vehicular requirements into account. These will be incorporated into the Norms, Guidelines and Standards for Metro Stations being developed by the SARCC. The Pedroute model has been applied to the Dube station in Soweto and the Park station in Johannesburg. The CSIR is currently investigating the expansion of Pedroute to other facilities frequented by pedestrians such as shopping centres, taxi and bus terminals and airports.

Ship Operational Decision Support

The CSIR developed a customised PC-based system for operational use at harbours to monitor the environmental conditions as well as offer guidance to the operator on safe operation of ships.

This development was done in response to the needs at Portnet harbours for round-the-clock wave,

PC-based system for operational use at harbours

Decision-making (continued)

weather, tide and/or current data for port operational purposes, and computerised guidance on safe and optimum operation of ships.

The CSIR's Integrated Environmental Monitoring and Ship Operational Decision Support System is designed to collect, analyse and store all environmental data, to provide the operator with a continuous report on wave, weather and tide conditions at a glance, and to offer optional guidance on the safe operation of ships in terms of safe keel clearance and safe mooring.

The system accommodates all CSIR-developed data recording equipment, but can be made compatible with most commercially available data recording systems. An optional modem or network link allows remote system performance monitoring, as well as data recovery and storage. The system also supports Meteosat weather images using software supplied from Timestep.

Railbus feasibility study

At the request of the South African Rail Commuter Corporation (SARCC), the CSIR has been investigating the feasibility and economics of replacing the motive power and rolling stock used on some of SARCC's lines with more cost-effective equipment, such as diesel railbuses. A number of these lines are either not electrified, or are otherwise unsuitable for SARCC's electric multiple-units, and hence locomotive-hauled trains (with high operating costs) are used instead to provide a minimal level of service during peak hours.

A case study of one such commuter line was carried out in the Western Cape and concluded that conversion to railbus (DMUs) operation is a more cost-effective long-term option than either continued operation of the existing locomotive-hauled service, or a substitute bus or minibus-taxi service.

DMU or railbus operation offers the possibility of introducing cost-effective new rail passenger services, especially where goods lines already exist, without the need for electrification. Developing urban areas in particular could benefit from their introduction.

Railbus operation offers cost-effective services

Radar countermeasure technology for aircraft protection

The threat posed by radar-guided weapons to transport and fighter aircraft was adequately demonstrated during recent conflicts around the world. The Digital Radio Frequency Memory (DRFM) technology developed at the CSIR has the capability to replicate received radar signals and therefore provides a modern radar jammer with the ability to protect aircraft and personnel by deceiving radar-guided weapon systems. This technology has been utilised by the local defence industry and is at present being used at the CSIR in the development of advanced radar countermeasures. The technology compares well with similar technologies in Europe and the USA.

Rope and mine hoisting technology

The CSIR has a sound record of research and testing in the fields of mine rope hoisting systems and shaft measurements. Central to the viability of the deep mining industry, rope and hoisting technology is a major thrust at the CSIR's Cottesloe laboratories. The laboratories are equipped to handle major research and testing projects and offer a wide variety of engineering and testing services to the mining industry. Some 3 000 destructive rope tests are performed annually.

The rope database and archives date back to the advent of rope testing and projects range from minor failure analyses to major studies such as the Vaal Reefs technical investigation.

Rope and mine hoisting technology serves the mining industry

New guide for institutional laundry services

The CSIR has published a planning, design and operation guide on the laundry and linen services for institutional laundries. The guide covers services for hospitals, but is applicable to any institutional laundry. It provides guidance on a vast spectrum of topics of importance, including sizing, equipment, reception, storage, classification and marking of linen, washing requirements and costs.

In addition, the chapters on linen handling and the avoidance of infection at hospitals provide invaluable information not only for the launderers, but also for nurses and infection-control officers concerned with nursing the sick and aged. The guide has been produced by the CSIR in association with the Fabric Care Research Association (FCRA) in the UK, one of the most prestigious laundry and dry-cleaning research organisations in the world.

Guide on laundry and linen services for institutional laundries

Seismic monitoring

Three major organisations, the CSIR, Gencor and M&M Systems, collaborated to develop Prism, a state-of-the-art digital seismic-monitoring system. At present, seismic-monitoring systems are the most powerful tools available to mining engineers to assess risk associated with possible rockbursts underground and thus avoid tragic loss of life.

The Prism system can be installed in less than a week and can be operated by mine personnel. Consequently, mines need not employ full-time seismologists but now have the option of using the expertise of consultants to assist with the seismic analysis they require for mine planning.

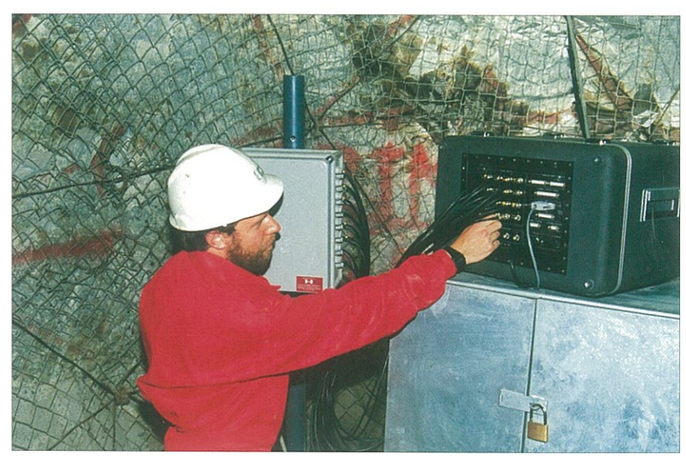
Decision support system developed for marine water quality

The Department of Water Affairs and Forestry (DWA&F) commissioned the CSIR and WAMTechnology to develop a user-friendly, menu-driven management information system to assist in marine water quality management in South Africa. The system will give the DWA&F all the relevant information it requires, including relevant acts, regulations and policies; the location and details of waste discharges to the marine environment; details on all interested and affected parties; and relevant information on basic physical processes, water quality and ecology for selected coastal regions.

The system will be used for practical day-to-day management, e.g. for compliance testing of waste discharges.

Quality assurance for Central Statistical Services

The CSIR was responsible for a quality assurance project for Central Statistical Services (CSS) on the enumerator areas used in the 1991 population census. This was achieved by using the functionality



Prism, a seismic-monitoring system

Decision-making (continued)

available in a GIS (Geographical Information System) in conjunction with statistically valid sampling methods.

Digital data checked by the CSIR included both the geo-referenced graphical representations of the boundaries and the attribute data linked to it. These data sets play an important part in mechanising the census process by generating urban and non-urban maps for use by enumerators. In the past, these Enumerator Areas (EAs) were traced manually onto the paper maps obtained from the Government Printer and other sources, and then supplied to the enumerators.

Capturing the enumerator area boundaries into a Geographical Information System provides a cost-effective means by which the boundaries can be supplied for purposes of a census or local authority elections. The boundaries can also be used to generate and map comprehensive socio-economic data such as the total population of communities, population density or population composition.

Environmental Impact Assessments

In recent years the CSIR has been involved in preparing Environmental Impact Assessment (EIA) studies for a series of major industrial projects intended to transform the South African economy. These projects, such as the building of a new steel mill at Saldanha Bay in the Western Cape, have focused the public's mind as never before on the issues of economic development versus preservation of the environment, with the CSIR playing a pivotal role as the scientific "honest broker" in specific EIA studies.

The CSIR plays a pivotal role in EIA studies

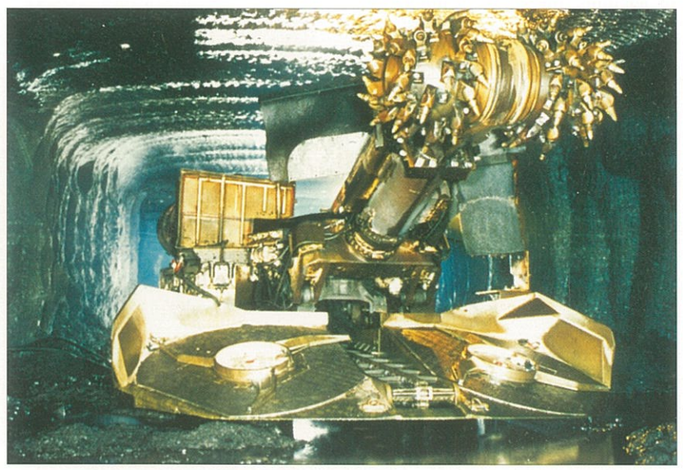
Projecting trends in anti-aircraft sensor technologies

Armscor contracted the CSIR to project technology trends in anti-aircraft tracking sensors for the period 2000 to 2030. With inputs from the South African National Defence Force (SANDF), local industry and its overseas networks, the CSIR produced a report that has been highly regarded by the anti-aircraft community. After investigating further issues identified by the group of reviewers, the updated report is now used as a point of departure in the SANDF and Armscor's thinking about possible future technology acquisitions.

Containing methane ignitions in coal mines

Active suppression systems play a vital role in containing methane ignitions at the face of coal mines. A square tunnel for testing active suppression systems has been built at the CSIR's Kloppersbos facility outside Pretoria. With its dimensions of 2,5 m in length, 7 m in width and 6 m in height, conditions for all mining heights in South Africa can be simulated.

The tunnel is being used as part of the SIMRAC project which is concerned with the testing of existing active suppression systems, as well as to assist manufacturers to develop new systems suitable for South African conditions. Highly sophisticated testing equipment is used by the research personnel to assist the South African mining industry in their quest for greater mining safety.



Containing methane ignitions is vital for mining safety

Coordination: CSIR Corporate Communication
Designed and produced by Adcorp Graphics 2033


CSIR