



C S I R

**TECHNOLOGY
IMPACT 1990**

scientiae

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SPECIAL ISSUE

CSIR Annual Report 1990

The Annual Report reviews the activities and contains the financial statements of the CSIR for 1989/90.

Scientiae: Technology Impact

A selection of reports on successful co-operation between the CSIR and South African industry in 1989/90.

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SOME TECHNOLOGY HIGHLIGHTS

- Superfledermaus *synchro interface*
- Boucell: *a new foundation design*
- *Innovative distribution network model*
- *Abalone industry established*
- *Aerial bundle conductors*
- *Sorghum grain enriched with fungi*
- *Sawmill management support systems*
- *Technology audit service*
- *Advanced non-destructive evaluation*
- *Multichip technology*
- *Unique optical systems*
- *Data base of vehicle overloading*
- *Fire survival blanket*
- *Expertise in water biology acknowledged*

IF ONLY . . .

How often do we hear the comment: "I never knew that the CSIR was working on that! If only our Joe/Fred/Pete had known – we might have saved ourselves a good deal of time/money/aggravation . . ."

As we go about rousing the slumbering giant of South African technological capability, we regularly experience a tension between our marketing and our commercialisation drives. On the one hand we would like to shout from the rooftops about the great things we have done for, and with, our clients, establishing our track record as a truly market-driven technology partner of industry, and building our credibility as a quality research and development agency committed to the implementation of our services and products in the marketplace. In direct conflict with this yearning need is our equal commitment, firstly, to rigorous confidentiality, which precludes any bragging about (or indeed mention of) our achievements without the specific consent of our private or public sector partners; and, secondly, to preserving the competitive advantage that we provide, which can properly be exploited only within an exclusive framework. Often there is no prize for arriving second in the marketplace!

It is in this context that this fourth edition of *Technology Impact* aims to provide a tempting glimpse inside the "new" CSIR. The case studies summarised here – representing a section across our many, multi-disciplinary activity areas – come with our thanks to those of our clients who have allowed us to discuss openly our joint efforts, while also fully respecting those to whom confidentiality is currently of paramount importance.

The title of this publication is deliberate. As we drive the ongoing process of change in our organisation, where we measure success by our outputs, *impact* – the ability to make a difference – must surely be a key feature of the role of technology in the new South Africa.

Indeed, as we stand on the threshold of a new and most challenging era for our country, with long-established ideologies and policies daily placed under the microscope of change, we must never for a moment – within the turmoil of political and constitutional redevelopment – lose sight of our vision of a globally competitive South Africa.

*Drs Geoff Garrett and
Daan Toerien, Deputy Group
Executives for Research,
Development and
Implementation.*



While the urgent problems of poverty, housing and education require imaginative and courageous attention, we eschew at our peril the nurturing and growth of our technology base for the economic drive that must take us, one way or the other, into the 21st Century. As State President F W de Klerk has said (22/4/90): "We should concentrate our efforts on generating our own applicable technology through innovation. Although foreign technology is often effective and relatively cheap, the importance of such technology also restricts our export capability. There is still considerable scope for industrial development in respect of projects and unique products where South Africa enjoys a competitive advantage."

None of us, in twenty years' time, would want to look back and say "if only . . .". Now is the time for us, together – and for economic and competitive advantage – to support and to build on the scientific and technological capability that is the CSIR. This document aims to open the door a little on that capability: we hope that you will take up our invitation to "come on in".

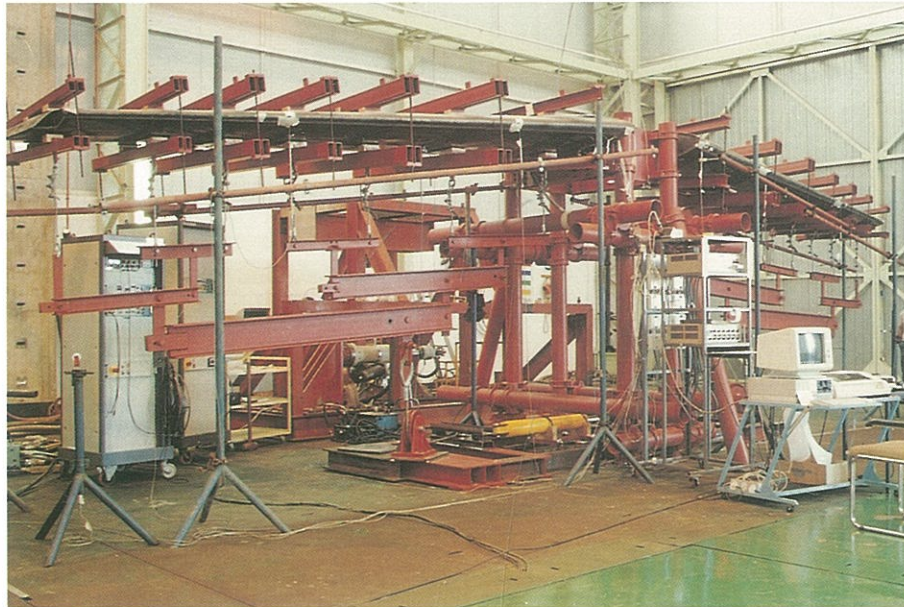
G G GARRETT
*Deputy Group Executive:
Research, Development
and Implementation*

D F TOERIEN
*Deputy Group Executive:
Research, Development
and Implementation*

September 1990

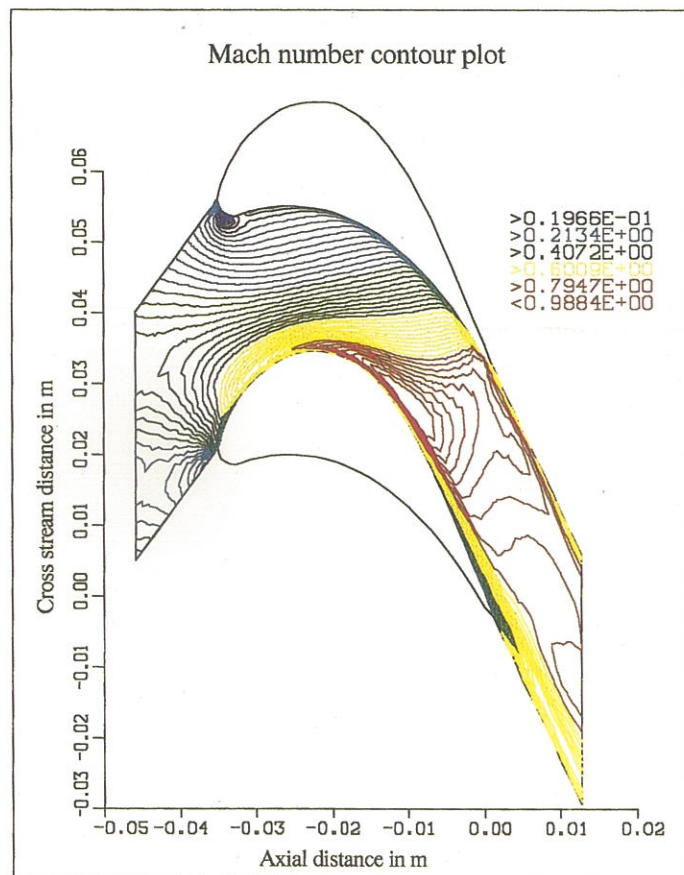
SPECIALISED WING TESTING:

The first carbon fibre aircraft wing built in South Africa has been successfully tested, demonstrating its structural integrity. The wing was designed and built by the Division's engineers and technicians and the tests were conducted by staff of Atlas Aircraft Corporation. The wing skins are mainly of a sandwich construction consisting of facings of carbon fibre reinforced epoxy resin, with a Nomex honeycomb core. The span of the wing is approximately 11 metres and the mass 280 kg, excluding the undercarriage. A whiffle tree arrangement was used to load the wing. With the aid of this relatively simple system of levers, aerodynamic loads can be simulated and applied using a single hydraulic jack.



COMPUTATIONAL FLUID DYNAMICS:

Gas turbine engine design has two major components. The one is experimental, making use of wind tunnels and cascade test facilities, for example. The other is numeric, and focuses on the simulation of physical phenomena by computer programs. This picture was produced when the flow between two turbine blades was solved using a bulk flow simulation program. The Mach number distribution was calculated and is depicted by the contour plot.



Division of Aeronautical Systems Technology

INCODE SPEEDS UP FLUTTER ANALYSIS

INCODE, a new computer program for flutter analysis of, amongst other things, new aircraft designs, should result in considerable time savings.

Although the theory of and programs for flutter analysis have been in use for a considerable time, INCODE in most cases produces better results than could hitherto be obtained.

The primary purpose of the new program is to prepare data for aerodynamic analyses. By making use of a database which holds descriptions of various types of aircraft and external cargos, it is possible in some cases to define a new configuration solely from existing data. In most instances new data have to be keyed in for only a few elements of a particular configuration.

Any configuration can be displayed at any time on the computer screen in its entirety, or partially, with true perspective, or as a top, side or rear view.

The program can also be used to insert mode shapes (characteristic vibration patterns). The data required for the insertion are also stored in the data base, and after insertion the mode shapes can also be displayed on the screen. Any changes can then easily be made and the insertion repeated.

SUPERFLEDERMAUS INTERFACE

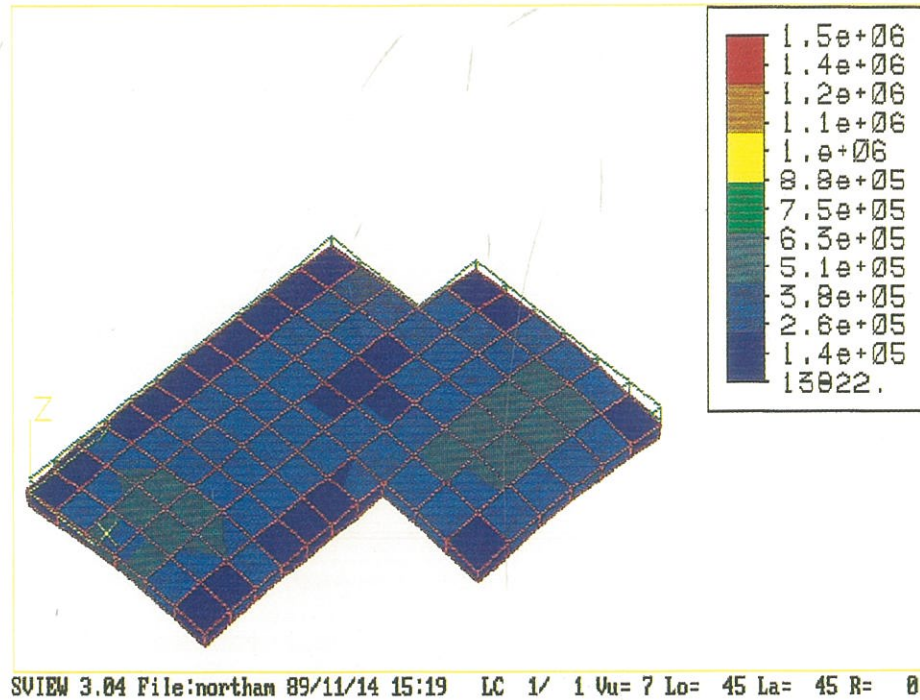
The Division has developed a multi-channel synchro data capture unit, named the Superfledermaus Interface, for the interfacing of so-called "synchro" signals to modern digital systems.

Until the late 1960s angular displacement of sights, turrets and trackers was measured by means of a rotary transformer or "synchro", in which relative phase corresponded to angle. This signal is difficult to interface to digital systems.

The new multi-channel synchro data capture unit can be applied to any synchro technology system for evaluation or testing. The unit can monitor eight dual (coarse/fine) synchro channels with any binary gear ratio, or sixteen single channels. The system caters for 90 V line-to-line voltages and a frequency of 400 Hz.

It converts each synchro channel into a 10-bit digital word, sampled every 40 ms. Each coarse/fine pair in the application yields an overall 14-bit resolution for each of the eight channels. These data are then serially sent to and stored by a PC. The data are time stamped with a video code and can therefore be synchronised with any video data that could have been recorded simultaneously.

The Division of Building Technology's latest solution to problems experienced when building on unstable soils consists of a rigid cellular raft foundation known as Boucell, which offers many advantages over other systems. The picture shows a graphic representation of stresses developed in the raft foundation due to soil movement.



"PLUG-IN" BATHROOM:

This complete bathroom, 1,6 m² in area, has been developed by the Division of Building Technology. It is ergonomically designed, self-contained, barrier-free and easy to transport. "Plug-in" water, sewerage and electrical connections allow it to be set up almost anywhere. As the need arises, the basic, inexpensive unit can be upgraded by means of optional extras.



Division of Building Technology

FOUNDATION DESIGN

Cracks in structures built on problem soils can be avoided by using a stiffened raft foundation. Through a lecture course on raft design, the Division of Building Technology has trained more than 150 consulting engineers working in this field.

The main theme of the course is that, by building structures on a reinforced concrete raft foundation, the amount by which walls are allowed to deflect on unstable soils can be controlled. A test facility consisting of a large, flexible steel beam on which test walls are built has proved invaluable in this research.

AID FOR MANAGERS OF LARGE ESTATES

The Division of Building Technology has developed a computerised management information system, PREMIS, that is specifically aimed at the management of large estates of buildings, including the associated land, road and services infrastructure and equipment.

The system will provide estate managers with the information they need, and provides it in the right format to facilitate investment decisions. It will provide the up-to-date position relating to space occupancy, future space availability, rental income and administration, the condition of constructional and service elements and reported defects. The system handles forward maintenance budgeting and tracks both routine and non-routine inspections and maintenance schedules.

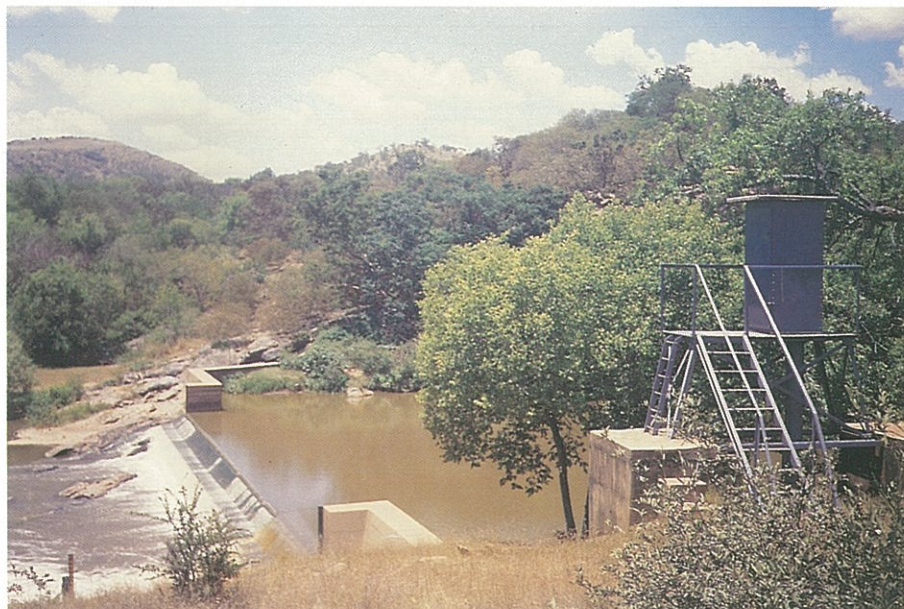
PREMIS integrates a number of pedigree software packages. It links graphic and non-graphic data, thereby enabling information to be mapped or highlighted on town, site or building plans.

The first phase of PREMIS is already being used for the management of the CSIR's own R300-million estate and is proving highly successful.

A SYNTHETIC RAY-TRACED IMAGE, showing shadows and reflections, generated by software developed by the Centre.



WATER QUALITY MONITORING: The Centre is helping to design a statistical analysis protocol for analysing data from the national water quality monitoring system.



Centre for Advanced Computing and Decision Support

BACKBONE LAN FOR CSIR CAMPUS

The largest local area network (LAN) in South Africa went into operation on the CSIR's Scientia campus in July 1990. The network was commissioned by the Centre for Advanced Computing and Decision Support, which provides infrastructural computing and telecommunication services to the CSIR.

Most of the computers, including PCs, minicomputers and mainframes on the Scientia campus, will be able to communicate with each other via the network's 12 km of 12-core optical fibre and the smaller, linked LANs within the various divisions. Electronic mail, file transfer capabilities, and access to mainframes are some of the features the network offers users. In addition, it allows access to external networks, through CSIRNET (connecting the CSIR's remote sites to the main campus), UNINET (the university network), and X-25.

Electronic mail permits faster and more effective communication. Messages can be sent immediately to individuals or to a selected group of people, locally or overseas, and the recipients also do not have to be in their office when the message is sent. Both short messages and long documents can be transferred.

DISTRIBUTION NETWORK MODEL

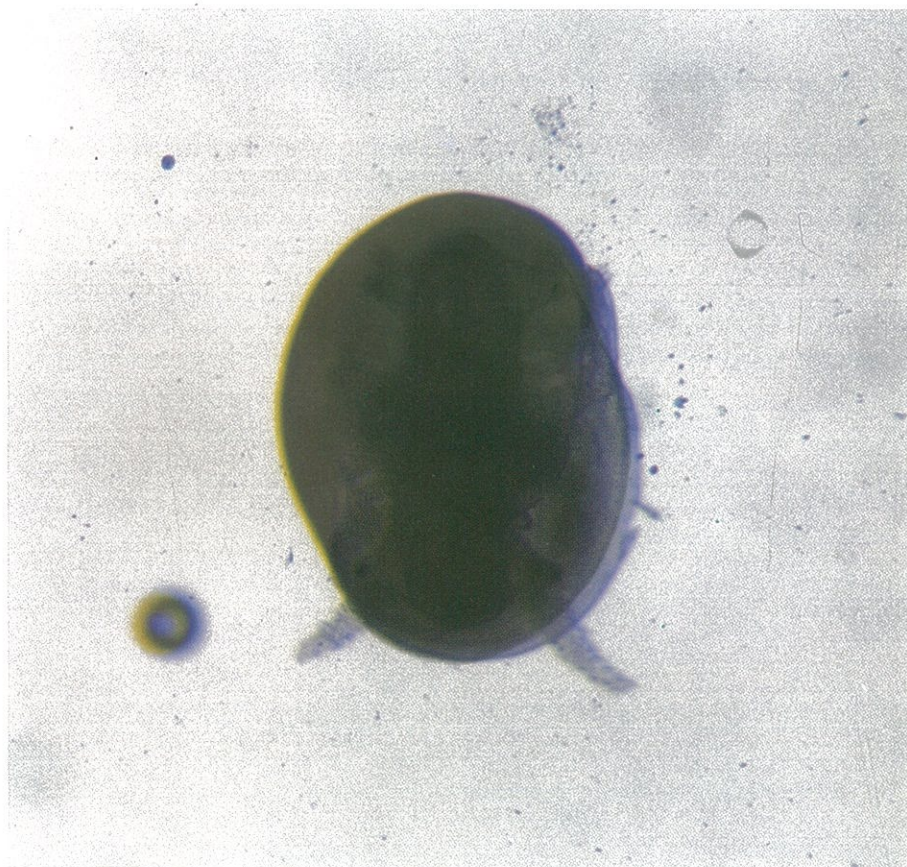
The Computing Services Programme, assisted by members of the Software Technology Programme, has developed a distribution network model which will be used as a management and planning tool by one of the largest oil companies in South Africa.

The model enables the oil company to determine the most cost-effective methods of, and routes for, transporting products from the sources or terminals to the supply points or depots. An interesting feature of the model is the incorporation of the legal constraints pertaining to maximum road delivery radii. The model can also be used to list depots that could be closed if all customers allocated to them were reallocated to other depots.

Electromagnetic sounding techniques have proved successful for probing the Namib sand dunes in the Walvis Bay area to detect and delineate underlying aquifers.



NEW INDUSTRY: *A forty-day-old (1 mm) juvenile abalone (perlemoen: Haliotis midae) reared in the Division's recirculating seawater aquarium at Stellenbosch. Abalone hatched and reared to a size of 10 mm in this facility will be supplied as seed to abalone farms. The seed will be grown to a size of 50-80 mm and sold for export and on local markets.*



Division of Earth, Marine and Atmospheric Science and Technology

EXPLORATION AND MANAGEMENT OF GROUND WATER

Geophysical theory, techniques and instrumentation developed by this Division have found wide application in the exploration of an increasingly valuable resource: ground water.

For example, electromagnetic and electrical profiling has enabled researchers to detect and trace ground water contamination originating from landfill sites and mine dumps. Geophysics provides a three-dimensional image of the contaminated part of the aquifer and ensures the optimum placement of boreholes for monitoring changes in ground water quality.

The potential of combining geophysical and geohydrological methods to extend the current database of aquifer properties has also been demonstrated. Aquifer parameters from a few pump-tested boreholes are interpolated and extrapolated using geophysical techniques. This very cost-effective approach may prove valuable in developing future ground water management strategies.

FIRST RECORDING OF A PHOTOCHEMICAL SMOG EPISODE IN CAPE TOWN

Motor vehicles and industries emit unburnt fuel and nitrogen oxides. In South Africa's sunny climate, these pollutants are readily converted to the photochemical smog for which Los Angeles is notorious.

The best indicator of photochemical smog is peroxyacetal nitrate (PAN). The Division recently succeeded in developing a new technique for measuring this very volatile substance: PAN molecules are trapped in hexane cooled with dry ice. Subsequent analysis using gas chromatography allows detection of the trapped pollutant in concentrations of sub-parts per billion.

The main advantage of this procedure is that sampling is simple and easily automated. Samples are reasonably stable at low temperatures and analysis can therefore be done in the laboratory. Thus only one costly instrument is required, instead of one at each measuring site, as recommended in the literature.

On 7 April 1989, PAN concentrations reaching levels of half of those known to cause damage to green vegetation were recorded in Cape Town.

ENGINEERING AWARD:

The Division received an award for the successful design, installation and commissioning of a commercial fluidised-bed hot gas generator for Slagment (Pty) Ltd in Vanderbijlpark. It was one of four awards made annually by the South African Institution of Mechanical Engineers. Photographed at the presentation ceremony were Mr Peter Graham, Managing Director of Slagment; Mr Dieter Krueger, Director of the Division (holding the trophy); Dr Chris Garbers, President of the CSIR; and Dr Christos Eleftheriades, the former Programme Manager for Coal Utilisation of the Division, who received the award on behalf of the design team.



Herman Louwrens, Senior Researcher of the Division's Coal Oxidation Project Team, assisted during the commissioning phase of the first process development unit.



Division of Energy Technology

NEW COAL CONVERSION TECHNOLOGY

A new process development unit is currently being commissioned by the CSIR's Division of Energy Technology for further process development, process demonstration and the generation of sufficient product volumes for large-scale evaluation in different applications.

The objective of this multifaceted coal research and development project, which is sponsored by the National Energy Council, is to develop new technologies to convert coal into value-added products by means of a process of controlled oxidation.

Preliminary technical and economic evaluations have indicated that, in addition to applications in the energy sector, various products with promising application potential could be synthesised directly from coal. These include petrochemicals, agricultural products such as soil ameliorants and growth stimulants, and products for general industry, used in water treatment and heavy-metal recovery.

AERIAL BUNDLE CONDUCTORS

In another research project sponsored by the National Energy Council the Division is investigating the possible effects of the country's high lightning flash density and high soil resistivity on aerial bundle conductors (ABCs).

Intense lightning activity and reduced air density in areas where South Africa's major industries are concentrated adversely affect the reliability of the electricity supply. Because it is crucial to understand the effects of lightning on rural power distribution networks in order to reduce the number of power failures, the Division, in collaboration with Eskom and consulting engineers, committed itself to extensive research in this field more than ten years ago. This study culminated in an authoritative guide, *Insulation co-ordination of unshielded distribution lines from 1 kV to 36 kV*, which was presented to the power engineering fraternity in August last year.

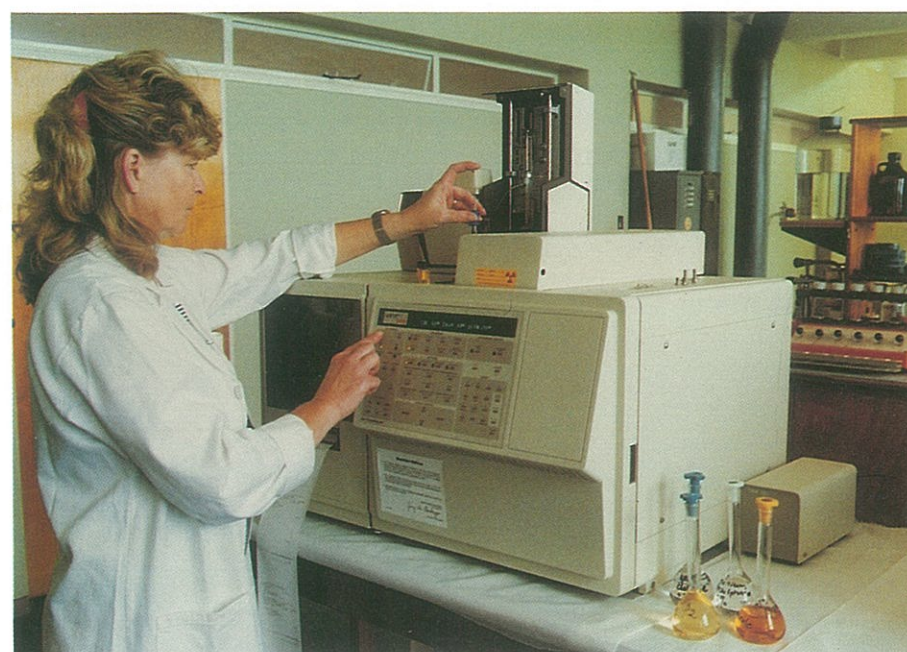
As Eskom strives to implement its vision of "electricity for all", more and more ABCs are being installed. Their superior safety features and durability make them very suitable for use in high-density, low-income areas. ABCs also permit high-voltage power, low-voltage power and telecommunications to run on the same overhead structures.

It has, however, not yet been ascertained to what extent this technology will be able to withstand the country's high lightning flash density and high soil resistivity. Existing expertise must now be adapted and applied to ABCs, and the new research project is expected to provide industry with guidelines in this regard.

PROTEIN ENRICHMENT OF SORGHUM GRAIN: The Food and Industrial Microbiology Programme has developed a microbiological process for the improvement of the protein content of sorghum grain. Non-toxic, protein-rich fungi which grow rapidly were cultivated on a solid sorghum substrate to which an inorganic nitrate source had been added. This solid-substrate fermentation process increased the protein content of sorghum grain from 10 to 23 per cent, the lysine content from 0,22 to 0,71 per cent, and the methionine content from 0,18 to 0,26 per cent. This protein-rich product can therefore be used to replace other, expensive sources of protein, such as soya or oil cake, in the diet of ruminants.



PESTICIDE RESIDUES IN FOOD ANALYSED: The Food Quality Programme can now offer organised agriculture and the food industry a comprehensive service for the analysis of pesticide residues in food, fruit, vegetables, soil and water. The high-performance liquid chromatography method developed by the team can detect diclorophen at levels as low as 0,01 mg/kg. The gas chromatograph shown here is one of the instruments used to develop sophisticated analytical methods.



Division of Food Science and Technology

SPOILAGE IN FRUIT JUICES

During the past year the fruit juices project has contributed to the Division's knowledge and expertise surrounding the use of the processing aid dimethyldicarbonate (DMDC) in controlling spoilage in fruit juices. Papers on this subject have already been published in international journals.

So far, the studies have focused on control of spoilage caused by the heat-resistant mould *Byssochlamys fulva*. It was found possible to apply DMDC in such a way that the organism could be eliminated. Additional studies with *Talaromyces flavus* and *Neosartorya fischeri*, two moulds also occurring in fruit juices, have yielded a similar result. DMDC was also successfully applied to fruit juices to eliminate a variety of yeasts, both in the unsporulated and the sporulated form.

Additional work concerning the elimination of fruit juice spoilage concentrated on filtration. A sophisticated modern filtration system was used to study the removal of microorganisms from clear apple juice concentrate, and excellent results were achieved, using various combinations of cartridge filters.

BREWING SCIENCE AND TECHNOLOGY COURSES

The first brewing science and technology course presented by the Division, which ended in May 1990, is a fine example of the CSIR's partnership philosophy in action.

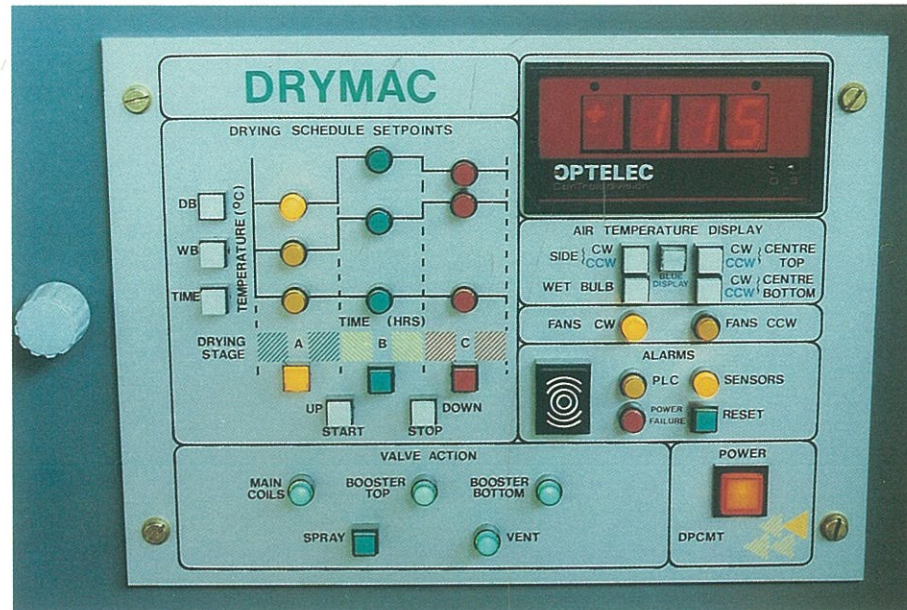
During the Government's moves to privatise its sorghum beer interests over the last few years, a serious skills shortage developed at the approximately twenty breweries concerned. The Technikon Brewing Technology course required students to be away from work for about three years. During the crucial period of restructuring, National Sorghum Breweries (Pty) Ltd, the company which by this time controlled the breweries, could not afford their absence for such a long period.

At the same time, it was recognised that it was essential to upgrade the skills and knowledge of staff. Faced with this dilemma, the company looked to the Division for help and an appropriate solution.

An educational scheme was developed and accepted as a contract by National Sorghum Breweries. In terms of this contract specialised staff of the Division would present a short course in brewing science and technology, consisting of four modules of one week each, to candidates selected by the breweries. The subjects covered were: brewing biochemistry, brewing microbiology, process brewing and plant technology.

The first course was held in 1989/90 and ended in May 1990, with the 12 students writing an examination. Two further courses have been scheduled for 1990/91.

TIMBER DRYING: The Timber Processing Programme of the Division has developed new instrumentation to monitor and control timber drying at sawmills. The instrumentation consists of a kiln control station and moisture measuring equipment. Because the instruments were developed to suit the needs of the South African sawmilling industry and are simple to operate, unskilled labour can easily be trained in their use.



ENERGY AND RESIDUE MANAGEMENT: The CSIR is currently developing modern multi-fuel, high-efficiency combustion equipment which meets stringent pollution standards. Associated products, developed in collaboration with industry, range from clean-burning industrial burners to domestic stove improvements. A team at the Division is involved in the assessment and development of new sources and forms of wood fuels. It is evaluating the potential of woodlots, invader plants, blended fuels and fuel densification. Development work is also being conducted on heating and lighting equipment for low-income housing.



Division of Forest Science and Technology

NEW SOLVENT PENETRATION ASSESSMENT TECHNIQUE FOR WOOD

A new technique for determining the pathways which liquid solvents take when penetrating wood has been developed by the Wood Protection and Improvement Programme of the new Division of Forest Science and Technology, in conjunction with the Electron Microscope Unit of the University of Pretoria.

Solvent and hence solute penetration during any wood preservation treatment cycle and the flow pathways taken by the solvent in the wood are crucial elements in determining the efficacy of the treatment. This is because inadequate penetration or an inappropriate tissue throughflow pattern during impregnation markedly affects the distribution pattern achieved by many non-diffusible preservation systems.

The new technique is based on cryogenic electron microscopy. It relies on the fact that solvent (in the trials water) penetration throughout a sample of timber involves progressive solution inflow through the different tissue elements in wood. The instant freezing of water-infiltrated specimens in liquid nitrogen (at -186°C) ensures that the water penetration achieved is retained and is visible as a solid ice deposit within the cellular matrix of fractured frozen specimens.

SAWMILL MANAGEMENT SUPPORT SYSTEMS

Life for sawmill managers has become much easier with the development of a number of computer programs and a machine monitor by the Timber Processing Programme of the Division.

- The program MONITOR is used to monitor log intake and to plan sawmill production. It provides a fast and accurate analysis of logyard intake, which simplifies effective resource planning and makes it easier to maintain production standards.
- The Production Planning System (PPS) program allows interruptions in routine sawing to be handled in the most effective way, saving time and money.
- The sawmill machine monitor developed by the Programme makes it possible to monitor and record power consumption of machines while they are working. With the monitoring apparatus coupled to the various machines in the sawmill and connected to his PC, the sawmill manager can monitor the power consumption of each machine from his office. Because the power consumption graphs indicate which machines are over- or underutilised, he can identify bottlenecks in the production process.

WORLD TECHNOLOGY

ALERT: This service has been launched to keep South African industrialists and businessmen informed about the latest international technological developments and trends. World Technology Alert forms part of a comprehensive international scanning service provided to local industry by the CSIR through the South African Science and Technology Offices (SASTOs) in London, Paris, Bonn and Washington.



ADVANCED COMPUTERISED RETRIEVAL FACILITIES have been developed and are being used to provide customers with a range of new and sophisticated information services. They can now have direct, user-friendly access to the Division's specialised subject data bases through specially developed retrieval and communications systems and interfaces. This enables them to conduct their own information searches and to transfer relevant information to their microcomputer workstations for further processing.



Division of Information Services

TECHNOLOGY AUDIT

Technology Audit is a new service offered by the CSIR to local industry. It aims to assess the relative technological capabilities of industrial firms and to recommend appropriate, commercially viable product and process innovation strategies.

Many businesses underestimate the pace, force and direction of technological change and do not take cognisance of the inevitable movement along the product, technology and corporate life cycles. If adequately prepared, business could take advantage of these dynamics by converting them into a product development strategy.

A Technology Audit formally recognises and evaluates technological threats, opportunities, strengths and weaknesses of individual companies. An appropriate strategy is formulated in conjunction with the company's management and, if necessary, with the assistance of other technology partners.

THE ENVIRONMENT, WATER AND WASTE MANAGEMENT

As we move into the last decade of this century, people all over the world are becoming increasingly concerned about pollution and environmental protection. Information on these issues has therefore become vitally important to policy makers and companies in South Africa.

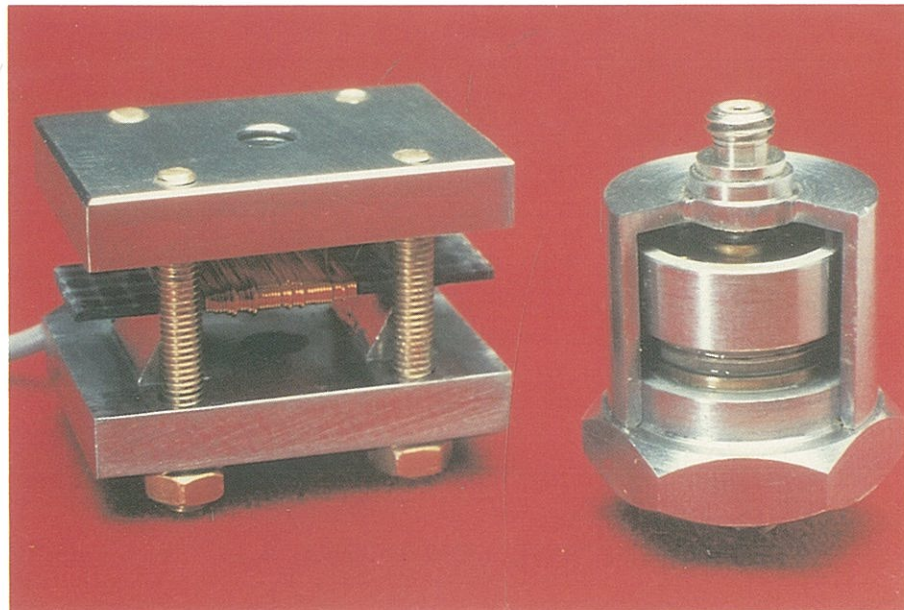
The Division of Information Services is well equipped to provide information on matters such as water and air quality criteria, pollution prevention and control, legislation, the treatment of industrial wastes, pollution detection, the greenhouse effect and sanitation.

Environmental information can be accessed from various types of sources both locally and internationally. These sources include data bases such as the locally produced WATERLIT, a comprehensive collection of environmental publications, and computerised searches on overseas data bases. The publication, *Selected Bibliography on Wastes 1986 - 1989*, was recently released by the Division and covers many topics relevant to waste management.

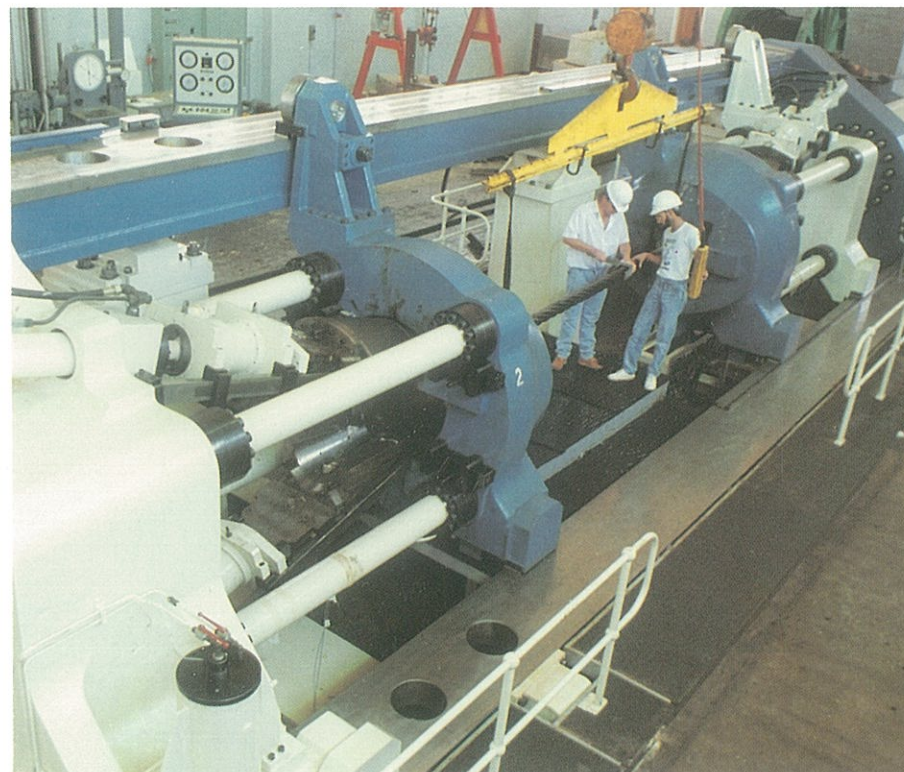
A wide range of expertise concerning environmental issues exists not only within the Division, but also in the rest of the CSIR. This expertise has resulted in involvement in a major CSIR project on waste management and pollution control.

VIBRATION SENSORS:

Two vibration sensors undergoing development in the Sensor Systems Programme. The sensor on the right utilises piezoelectric ceramics developed in-house and the one on the left shows the Division's first implementation of an exciting new magnetoelastic sensing technology. Similar sensors are used to measure acceleration, velocity, mechanical strain and stress.



ROPE TESTING: Final measurements being taken before a statutory test is performed on a mine winder rope on the new 15 MN tensile test machine of the Mine Hoisting, Metallurgical and Corrosion Services Programme at Cottesloe, Johannesburg.



Division of Materials Science and Technology

ADVANCED NON-DESTRUCTIVE EVALUATION

The Non-destructive Evaluation (NDE) Section of the Division's Specialty Metals Programme has in the past year established a niche as an authoritative group in the field of advanced non-destructive evaluation. The inauguration of the Shaft Test Service, in particular hollow bore shaft evaluation, means that the services provided by the Section will rival work done by overseas specialists and prove a more cost-effective service in this complex test area.

In line with the Section's policy of providing both industry and the NDE fraternity with specialised support services, the NDE team is at present commissioning the country's first industrial CAT scanner primarily for the assessment of composite materials and ceramics; establishing a Non-destructive Testing Database, containing more than 40 000 entries; and assisting in developing remote pipe condition monitoring and non-destructive testing of wire ropes.

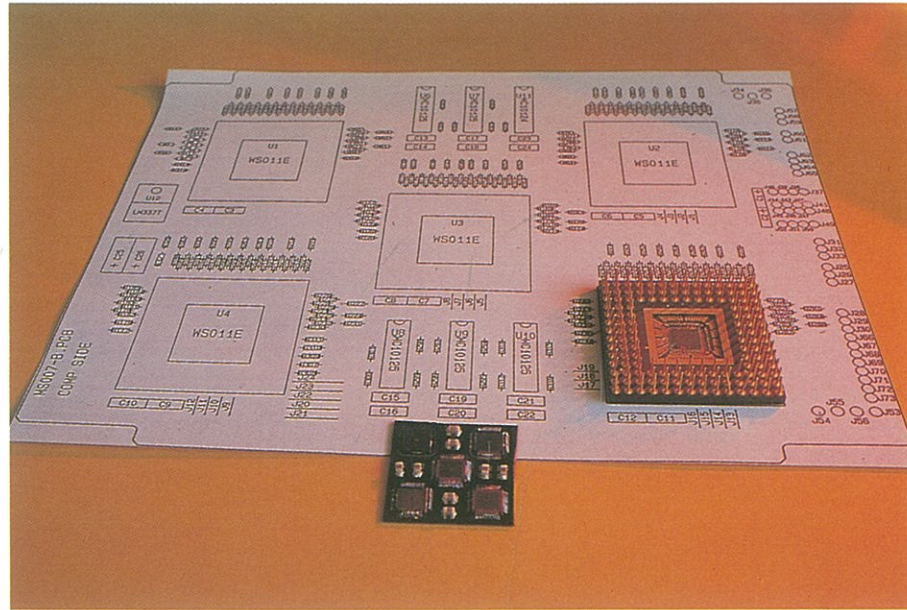
LONG-TERM ATMOSPHERIC CORROSION TESTS

The results of a 20-year study on metal corrosion are soon to be published in a book which is expected to become an invaluable aid to architects, engineers and long-term planners.

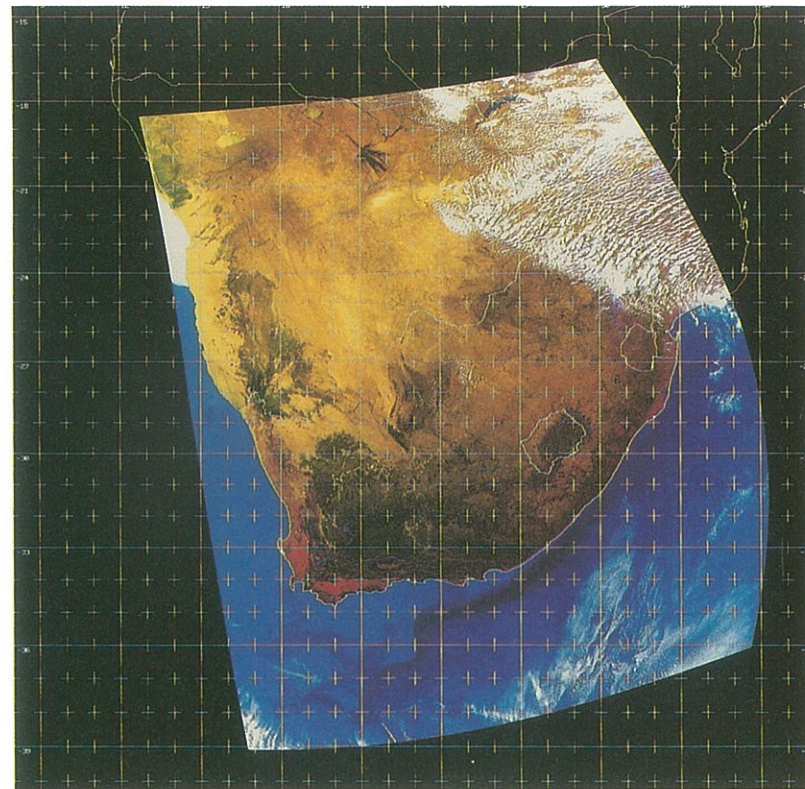
This guide to the expected life, maintenance requirements and aesthetic aspects of metal structures is the culmination of the long-term atmospheric corrosion exposure programme of the CSIR. The programme was initiated for the building and construction industries in 1969, when various metals were exposed to the environment at a variety of selected sites. These exposure sites constituted a representative selection of the country's climatic areas.

After 20 years, the metals were removed to allow the effects of corrosion to be evaluated. Detailed photographic records of the appearance and corrosion characteristics of the metals are now being used to compile the book. Newer alloys such as 3CR12 were also included in the programme, and more recent exposure sites used included the much publicised industrial areas of the Eastern Transvaal Highveld.

MULTICHIP: The Division has developed a so-called multichip technology which allows the combination of a number of ICs on a unique silicon printed circuit board. The multichip shown above (foreground) was produced by taking a complex very-high-speed digital circuit that was previously laid out on three A4-size printed circuit boards, putting it onto five ECL (emitter-coupled logic) chips, and then reducing all five chips with their support circuitry onto a 244 mm square multichip supercomponent module – the size of a single packaged ECL chip, shown just above and to the right of the multichip.



SATELLITE DATA: The Satellite Applications Centre provides satellite data products to users in fields such as geophysics, cartography, hydrology and agriculture. This false-colour image was received from the American NOAA-9 polar orbiting meteorological satellite by the Satellite Applications Centre. The warmer the water, the darker blue it appears; vegetation appears as various shades of red and pink; bare soil and sand are yellow and the clouds white.



Division of Microelectronics and Communications Technology

SOLID-STATE LASER

The Division achieved another first with the development of the first local semiconductor diode laser. This type of laser is used in consumer products such as cordless remote controls for video recorders and hi-fi sets. Much of telephone communications technology is also based on semiconductor laser systems.

Industry represents a significant market for custom laser devices. Using the demonstrator laser as a starting point, the Division will focus on high-efficiency, high-power diode lasers – so-called Grinsch lasers – to support industrial applications.

RADVOORT

Radio engineers at the Division have developed a computer aided design system which can be used to rapidly determine the broadcast qualities of any particular transmitter site.

The system, RAP (Radio Propagation), uses the most recent propagation models. The software allows the communications engineer to begin the design of a radio system by selecting potential transmitter sites, using tinted maps or contour elevation maps of the area. The maps can be displayed at any user-specified scale. Once sites have been chosen, the user may interactively modify fundamental design parameters such as transmitter and receiver antenna mast heights and positions, signal frequencies, and the effective earth radius.

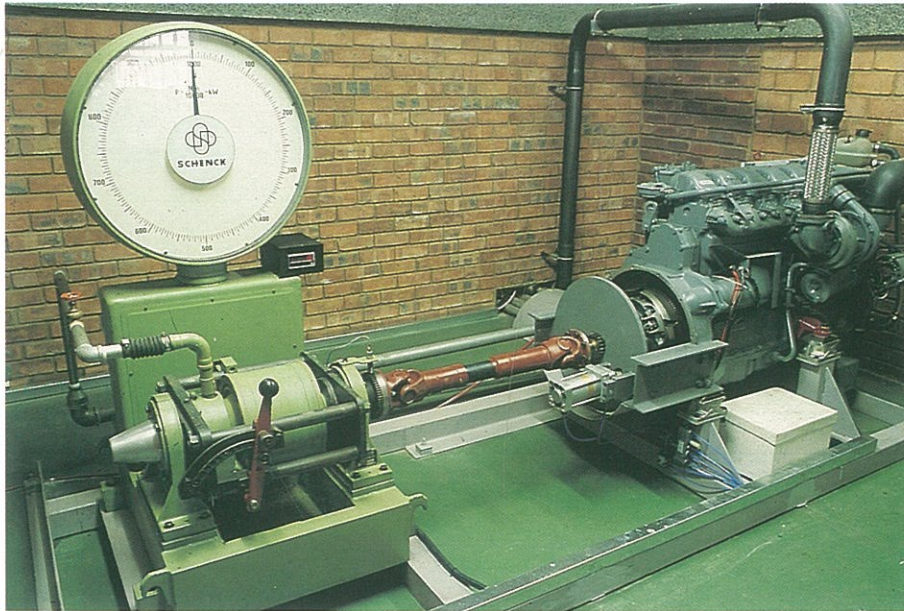
SAPHIRE – SMALL OUTLINE INTEGRATED CIRCUIT HANDLER

When the Division needed to test very large quantities of 14-lead, 3,7 mm wide small outline integrated circuits (SOICs), it decided to develop an SOIC component handler locally, rather than import expensive overseas equipment.

Electronics and mechanics engineers within the CSIR were contracted to develop and produce a prototype SOIC component handler, interfaced to an automatic IC tester. Since the commissioning of the package handler in the third quarter of 1988, more than one million SOICs have been tested.

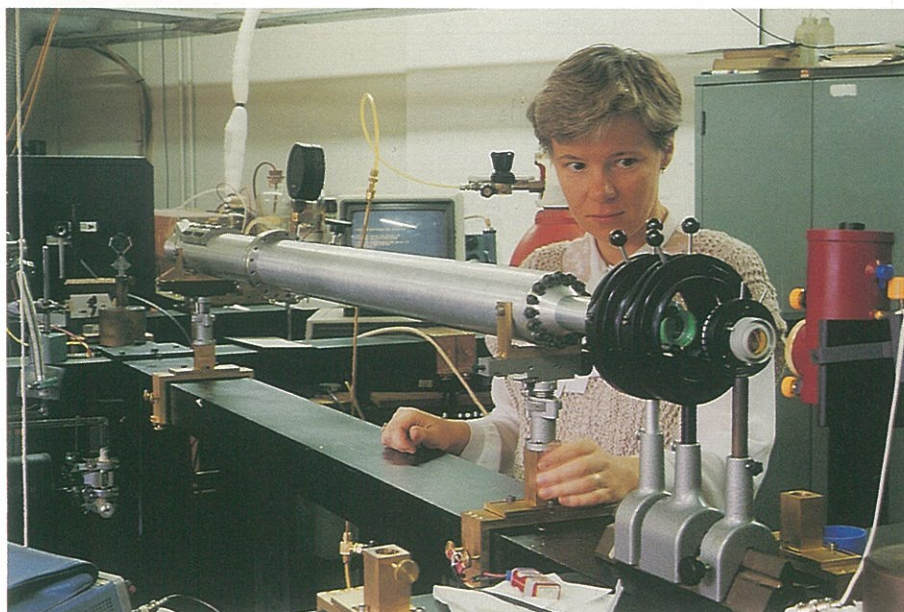
CLUTCH PLATE TESTING MACHINE:

The Division designed, manufactured and successfully commissioned this clutch plate testing machine for Pretoria Clutch and Brake. The client's main requirement was for a machine that would test a statistical sample of clutch plates against the test specifications of the various vehicle manufacturers. The machine consists of a diesel engine sized to deliver the power requirements of the largest of the clutch plates to be tested; a universal bell housing into which the various flywheel, clutch plate and pressure plate assemblies are installed; a coupling; and a dynamometer for measuring the power used.



HELIUM-NEON (He-Ne)

LASERS: These lasers are widely used in applications such as laser printers and barcode scanners and for the detection of dangerous gases, such as methane, in mines. Prototypes are being manufactured and evaluated by the Laser Technology Programme of the Division, since soaring import costs have made local manufacture of these lasers very desirable.



Division of Production Technology

MEASURING STANDARD AGREEMENT SIGNED WITH CHINA

Efforts by the metrology programmes of the Division have led to the signing of an agreement of intent for the mutual recognition of the national measuring standards of the Republic of China and South Africa. The countries will work towards acceptance of each other's national measuring standards and national calibration services. This implies that calibration certificates issued in Taiwan will be accepted in South Africa as being traceable to national standards, and *vice versa*.

In a world of ever-finer production tolerances, the agreement will make an important contribution to successful quality assurance. It will also help ensure that production measurements are consistent in both countries. This is particularly important where the final product is assembled from components that have been manufactured in different countries.

UNIQUE OPTICAL SYSTEMS

Several new optical products and systems have been developed by the Optical Engineering Programme.

One example is an electronic zoom lens system, which is unique because it permits the user to compensate for manufacturing errors, has internal focus and boresight retention, and embodies highly complex movements of the zooming groups. The prototype lens operates at a constant relative aperture of 1:5,6 regardless of the focal length, which ranges from 50 to 277 mm. The demonstrator unit has performed entirely to satisfaction.

A mechanically compensated zoom lens was also designed and manufactured in record time for a client. Although it has a wide zoom range of 50 to 300 mm, it is only 165 mm in length.

Other optical systems developed recently by this Programme are a telemacro lens and a remote-controlled tripod head.

CORRUFIX: Badly rutted and corrugated gravel roads abound in southern Africa. Maintenance of unpaved roads has, however, always been expensive and time-consuming. In a major breakthrough, the Division, together with Matador Industries, has developed this extremely effective, easy-to-use, yet comparatively inexpensive maintenance tool, the Corrufix mat. This drag, which can be towed behind any vehicle, will maintain the shape and riding quality of a gravel road if used regularly. It is ideally suited for use on corrugated roads by farmers, foresters, game reserves and country hotels.



ROADFIX: In the continuous quest for efficient and cost-effective methods of maintaining the road network, the Division, together with Roadfix (Transvaal) (Pty) Ltd, has developed a new pothole filling material, aptly named Roadfix. Thorough laboratory and field tests, as shown in these "before" and "after" photographs, have demonstrated that this material is capable of withstanding both heavy traffic and very wet conditions. Roadfix has the further advantage of needing very little pre-treatment: only the loose debris must be removed from the pothole. It is simple to apply and is compacted by the traffic.



Division of Roads and Transport Technology

CONCRETE CUBE COMPRESSION TESTING MACHINE

A concrete cube compression testing machine – standard laboratory equipment for testing concrete and the strength of some aggregates – has been built at the Division of Roads and Transport Technology under licence from Leonard Farnell & Co Ltd of Hatfield, England.

It is the first machine of its kind that fully complies with the Committee for State Road Authorities (CSRA) standard specifications in terms of both calibration and load frame stability.

Tests undertaken in accordance with British Standards 1610 and 1881 to determine the stability of the load frame and upper load platen assembly proved that a product of superior quality had indeed been built.

The current model can exert a force of up to 2 000 kN.

VEHICLE OVERLOADING

Overloaded vehicles, which continue to increase in number, inflict severe damage on our roads. These vehicles have posed a problem for the road authorities for many years.

The Division of Roads and Transport Technology has, in conjunction with the Natal Roads Department, developed a database program for the analysis of the static weigh data from the province's weighbridges. Weigh data and vehicle details, including ownership, are recorded, and companies consistently overloading their vehicles can thus be identified.

The information gathered will be of great importance in any further investigations regarding revised permissible axle loads.

FIRE SURVIVAL BLANKET:

A stuntman demonstrates the effectiveness of the fire survival blanket which has been developed with the technical assistance of the Division and the Wool Board. This specially woven pure new wool blanket is impregnated with an antiseptic water gel derived from a natural biological source and it offers the following features:

- it smothers flames and fires instantly;
- it can withstand high temperatures, for example providing heat shielding protection to people trying to escape from burning buildings;
- it gives relief to burn victims by dissipating heat, moisturising burn wounds and reducing pain; and
- it minimises bacterial infection of burn wounds.



This instrument was designed by the Division to provide objective measurements of wool staple length and strength.



Division of Textile Technology

NEW TYPE OF BACKFILL BAG MATERIAL

The CSIR's new Division of Textile Technology in Port Elizabeth, which functioned as the Textile Programme of the erstwhile Division of Processing and Chemical Manufacturing Technology during the year under review, has been instrumental in developing a new type of backfill bag for use in gold mines.

These lightweight, seamless tubular bags are very strong, and the fabric used allows the rapid percolation of water while retaining particles greater than 45 μm .

This new product can be processed for direct delivery from the weaving machine to the stope, in any size up to 10 m in circumference, without any sewing. Strategically placed handles allow for easy handling and placing under extremely difficult conditions.

Mine trials have proved successful, and negotiations have started aimed at setting up a joint venture company to produce these backfill bags, which will enable the gold mining industry to improve productivity and efficiency.

WOOL STAPLE LENGTH AND STRENGTH TESTER

As part of its drive to develop suitable techniques for the objective measurement of textile properties, the Division of Textile Technology has developed an instrument for measuring the length and strength characteristics of wool staple.

Staple strength and fibre breakage during processing are interrelated. The more fibres that break during processing, the poorer the quality of the final product. Wool buyers therefore pay less for tender wools, the fibres of which break more easily.

By helping to maintain the quality profile associated with the South African wool clip, which has an annual export value of some R980 million, the instrument will contribute to South Africa maintaining its position in the world market and assuring its reputation as a country that produces some of the best wools in the world.

In addition to a number of testing houses, some local and foreign processing mills have displayed interest in the instrument.

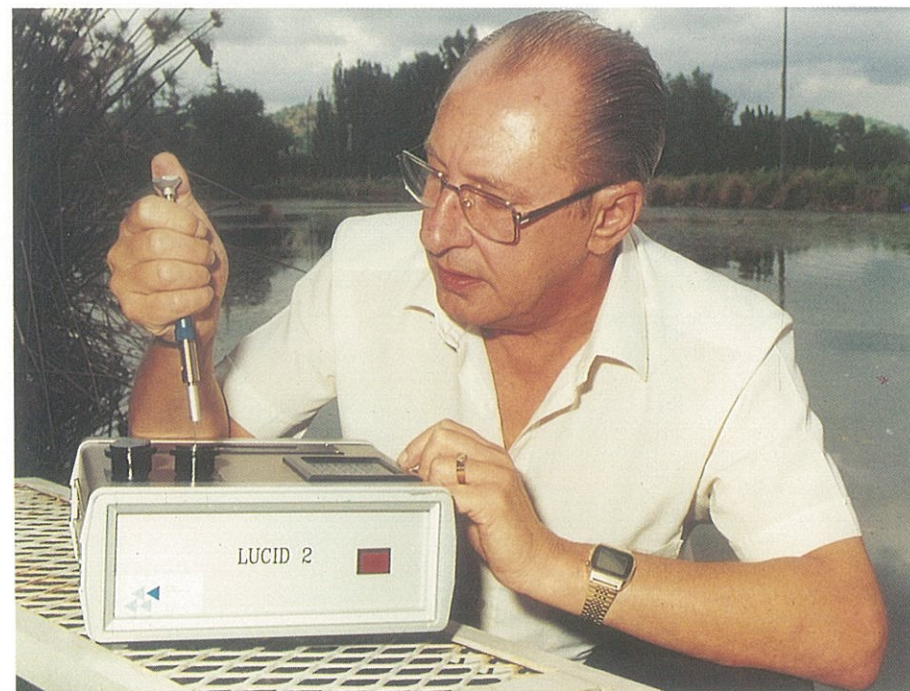
PERISTALTIC PUMP:

This revolutionary peristaltic dosing pump, developed at the Division of Water Technology, won the 1989 Technology Award of the South African Institute of Inventors and Innovators. Its inventor, Dr R A van Steenderen, also won the industrial award in 1988 for his AQUADOC Analyser, which automatically measures the dissolved organic carbon content of water.



LUCID INSTRUMENT:

This low-cost, portable and robust instrument accurately measures the extremely faint light emitted by certain bioluminescent compounds. The amount of light emitted by some aquatic organisms can indicate the presence of toxic or hazardous materials in water which inhibit the biochemical reaction controlling their luminescence. The photograph shows Dr W S G Morgan injecting bioluminescent bacteria into the test vials of the instrument.



Division of Water Technology

EVALUATING NEW TECHNOLOGY

The Division of Water Technology has been contracted by South African licensee Bruberg Industries to assist in evaluating the imported Evans-Stog Aqua-Life wastewater treatment technology in South Africa.

The system is based on the successful introduction into, and retention of oxygen in, a treatment plant to stimulate biological degradation of pollutants. It has numerous potential applications, for example in the treatment of domestic sewage or industrial effluents.

The first local unit was installed at Citrusdal in February and negotiations for the purchase of several more units are far advanced. The Division will evaluate the performance of the system in each particular application.

EXPERTISE IN WATER BIOLOGY ACKNOWLEDGED

Proof that the Division's expertise in water biology is gaining international recognition is afforded by the fact that no fewer than six papers written by researchers from the Division were accepted by the International Conference on Health-related Water Biology, held in Germany in April.

Two of the papers related to the Division's research work and analytical service aimed at detecting the presence in water of *Legionella pneumophila*, the bacterium which causes Legionnaires' Disease.

The bacteria gain entry into water systems, where they proliferate if conditions are favourable. Since they are spread mainly in relatively humid aerosols, the water used in air conditioning cooling towers poses a particular risk as a source of infection.

Einführung - "Hätten wir nur"

In ihrer Einführung bemerken Herr Dr. Geoff Garrett und Herr Dr. Daan Toerien, Vizedirektoren der Abteilung für Forschung, Entwicklung und Anwendung, einen gewisser Zwiespalt zwischen den Marketing- und Verkaufsbemühungen des CSIRs. Einerseits möchte der CSIR seine hervorragenden Produkte und Dienstleistungen so weit wie möglich der Öffentlichkeit bekanntmachen; andererseits ist er jedoch seinen Kunden gegenüber zu völliger Verschwiegenheit verpflichtet und muß sich einen gewissen Vorsprung gegenüber der Konkurrenz sichern. Daher kann der CSIR viele seiner Errungenschaften nicht ohne die ausdrückliche Erlaubnis seiner Kunden und Partner erwähnen. Die Beispiele aus der Praxis, die in der vorliegenden vierten Ausgabe von "Impact" mit der freundlichen Genehmigung von CSIR-Kunden aufgeführt werden können, die eingewilligt haben, gemeinsame Vorhaben öffentlich zu besprechen, gewähren deshalb nur einen Einblick in den gesamten Tätigkeitsbereich des neugestalteten CSIRs.

Im Englischen bedeutet "Impact" Wirkung und Herr Dr. Garret und Toerien erklären, daß "Impact" als Name für dieses Dokument gewählt wurde, der auf die Fähigkeit, etwas zu verändern und die Rolle, die die Technologie im zukünftigen Südafrika spielen wird abzielt. Trotz der umwälzenden politischen und verfassungsmäßigen Änderungen, die zur Zeit in Südafrika stattfinden, muß das Land weiterhin auf den Weltmärkten konkurrenzfähig bleiben. Südafrika muß dringend seine schwerwiegenden Probleme, wie Armut, Wohnungsnot und Mangel an Ausbildungsmöglichkeiten, lösen, es muß aber gleichzeitig die technologische Grundlage für sein künftiges Wohlergehen erhalten und weiterentwickeln. Innovation wird in Zukunft eine ausschlaggebende Rolle spielen. Damit die Südafrikaner in zwanzig Jahren nicht rückblickend "hätten wir nur ..." sagen werden, müssen die wissenschaftlichen und technologischen Fähigkeiten dieses Landes, die weitgehend im CSIR vertreten sind, verstärkt gefördert werden.

Abteilung für Systeme der Luftfahrttechnik

INCODE ist ein neues Computerprogramm, mit dem Ingenieure aerodynamische Flatteranalysen – zum Beispiel für neue Flugzeugentwicklungen – durchführen können. Die Abteilung hat eine Mehrkanal-Synchrondatenerfassungseinheit (die sogenannte **Superfledermaus**) entwickelt, die als Schnittstelle eingesetzt werden kann, um Synchronisiermeldungen für moderne Digitalsysteme umzusetzen. Der erste **Flugzeugflügel aus Kohlenfasern**, der in Südafrika gebaut wurde, ist mit Erfolg geprüft worden. Er wurde von den Ingenieuren und Technikern dieser Abteilung entwickelt und hat eine Spannweite von 11 Metern und eine Masse von 280 kg [siehe Bild]. Die Abteilung hat ebenfalls ihre Versuche und Berechnungen auf dem Gebiete von **Turbotriebwerken** weitergeführt.

Abteilung für Bautechnologie

Mehr als 150 Ingenieure nahmen an einem Lehrgang teil, den diese Abteilung über die Verwendung von **versteiften Plattenfundamenten** zur Verhinderung von Rißbildungen in Bauwerken auf schwierigen Böden anbot. PREMIS ist ein neues **Informationssystem für die Immobilienverwaltung**, das als Planungshilfe für die Zuordnung, Umgestaltung und den Unterhalt von Grundstücken, Versorgungselementen, Gebäuden und Einrichtungen verwendet werden kann. **Boucell**, ein starres, zellenförmiges Plattenfundament, welches von dieser Abteilung entwickelt wurde, kann sehr hohe Spannungen aufnehmen [Bild]. Ein vollständiges **Fertigbau-Badezimmer** von nur 1,6 m², das leicht transportiert und praktisch überall direkt installiert werden kann, wurde ebenfalls von dieser Abteilung entwickelt [Bild].

Zentrum für fortschrittliches Rechnerwesen und Hilfe bei der Entscheidungsfindung

Dieses Zentrum nimmt zur Zeit das größte **Computer-Netzwerkssystem (LAN)** in Südafrika in Betrieb; dieses Netzwerk wird alle Abteilungen des CSIRs miteinander verbinden und an die nationalen und internationalen Rechnernetze angeschlossen werden. Im Service-Rechenzentrum dieser Abteilung wurde ein **rechnergesteuertes Verteilungsprogramm** entwickelt, das es einer großen südafrikanischen Ölgesellschaft ermöglichen wird, für ihre Produkte die kostengünstigsten Verteilungsmethoden und Transportrouten zu den Auslieferungs- und Lagerstellen zu bestimmen. Modernste **Tracing-Techniken** werden angewandt, um komplexe Computerbilder aufzubauen [Bild]. Das Zentrum wirkt ebenfalls an der Ausarbeitung eines statistischen Auswertungsprotokolls für die Analyse von Daten des nationalen Wasserqualitätsüberwachungssystems mit [Bild].

Abteilung für Geo-, Meeres- und atmosphärische Wissenschaften und Technologie

Diese Abteilung entwickelt **geophysikalische Theorien, Techniken und Meßmethoden** zum Nachweis und zur Bestimmung des Verursachers der Grundwasserverschmutzung, zur Erweiterung der bestehenden Datenbank für die Eigenschaften wasserführender Schichten, sowie zur Entwicklung von Strategien für die Grundwasserbewirtschaftung. Die Abteilung hat eine Methode für die Bestimmung von Peroxyacetylnitrat (PAN) entwickelt, das als guter Indikator für **photochemischen Smog** gilt, wie er im sonnigen Klima Südafrikas durch eine Kombination von nicht verbrannten Brennstoffen und anderen Schmutzstoffen gebildet wird. Man war damit in der Lage, den photochemischen Smog, der am 7. April 1989 in Kapstadt auftrat, zu registrieren. **Elektromagnetische Tiefenlottechniken** werden von dieser Abteilung eingesetzt, um in Namibia Wasseradern unter der Sanddünen der Namib-Wüste zu entdecken [Bild]. Im **Meerwasser-Umlaufaquarium** der Abteilung in Stellenbosch werden Seeohren für den Binnen- und den Exportmarkt gezüchtet [Bild].

Abteilung für Energietechnologie

Eine neue **Verfahrensentwicklungsgruppe** wird zur Zeit aufgebaut, um Verfahrenstechniken zu entwickeln und zu demonstrieren, sowie ausreichende Mengen von Produkten zu erzeugen, um es zu ermöglichen, die Ergebnisse der Kohlenumwandlungstechnologie für verschiedene Anwendungsbereiche in großem Maßstab auszuwerten. Die Wirkung hoher Blitzdichten und hoher spezifischer Bodenwiderstände auf **oberirdische Bündelleiter** (die vor allem für dichtbesiedelte Wohngebiete in ärmeren Gegenden geeignet sind), wird ebenfalls untersucht. Letztes Jahr vergab der südafrikanische Verband der Maschinenbau-Ingenieure einen seiner vier Preise für hervorragende Leistungen im Maschinenbau an dieses Institut für die erfolgreiche Entwicklung, Installation und Inbetriebnahme eines im Handel verkäuflichen **Wirbelschicht-Heißgaserzeugers**. Das von dieser Abteilung verwendete Raster-Elektronenmikroskop trug wesentlich zum Erfolg der mineralogischen Untersuchungen bei, die hier durchgeführt wurden [Bild].

Abteilung für Lebensmittelwissenschaft und -technologie

Im Rahmen des Fruchtsaftprogramms wurde ein wesentlicher Beitrag dazu geleistet, den **Verderb von Säften** zu verhindern. Man entdeckte zum Beispiel, daß Dimethylbikarbonat verwendet werden kann, um den hitzebeständigen Schimmelpilz *Byssochlamys fulva* aus zu scheiden. Der erste **Lehrgang in Brauwissenschaft und -technik**, den die Abteilung bestimmten Mitarbeitern einer großen Firma anbot, war außerordentlich erfolgreich. Ein **Feststoffgärverfahren**, das im Rahmen des Programms für industrielle Mikrobiologie entwickelt wurde, ermöglichte es, den Proteingehalt von Sorghumkörnern von 10 auf 23 Prozent zu erhöhen [Bild]. Die Abteilung kann jetzt ein vollständiges Untersuchungsprogramm für die **Bestimmung von Schädlingsbekämpfungsmitteln in Nahrungsmitteln** anbieten. Sie entwickelte außerdem eine neue Methode, die es ermöglicht, Dichlorophen mit einer Konzentration von nur 0,01 mg/kg in Pilzen mit Hilfe der Hochleistungs-Flüssigkeitschromatographie zu bestimmen [Bild].

Abteilung für Informationsdienste

"**Technology Audit**" ist eine neue Dienstleistung, die von dieser Abteilung angeboten wird, um die relative technologische Kapazität einer Firma zu bestimmen und produkt- und prozeßorientierte Strategien zu empfehlen. Ein kürzlich veröffentlichtes Verzeichnis von **Abfallstoffen** ("*Selected Bibliography on Wastes 1986-1989*") behandelt wichtige Aspekte der **Umweltverschmutzung und des Umweltschutzes**, z. Bsp. Festermüll, Abfallrecycling, Giftmüll und Sondermüll. "**World Technology Alert**" ist ebenfalls eine neue Dienstleistung, die es der südafrikanischen Industrie erlaubt, sich über internationale Entwicklungen auf dem Gebiete der Technologie zu informieren und die südafrikanischen Organisationen hilft, Auslandsbeziehungen anzuknüpfen [Bild]. Zukunftsweisende **computergestützte Retrievalmöglichkeiten** ermöglichen dem Kunden direkten und anwenderfreundlichen Zugang spezialisierten Datenbanken dieser Abteilung [Bild].

Abteilung für Materialwissenschaft und -technologie

Mit der Einführung von Hohlwellenprüfungen kann die Gruppe für **zerstörungsfreie Prüfverfahren** dieselben Dienstleistungen wie die ausländischen Spezialisten auf dem Gebiete moderner, zerstörungsfreier Prüfungen anbieten. Die Ergebnisse einer zwanzigjährigen **Metallkorrosionsstudie** werden demnächst in einem Buch veröffentlicht, das wohl bald ein unentbehrliches Nachschlagewerk für Architekten und Ingenieure sein wird. Im Rahmen des Programms für Sensorsysteme werden **Vibrationsmeßfühler** entwickelt, von denen einer mit piezoelektrischer Keramik und der andere mit magnetoelastischer Sensortechnologie arbeitet [Bild]. Im Bereich der Bergwerkfördertechnologie wird die neue 15 MN **Zugfestigkeitsprüfmaschine** für die gesetzlich vorgeschriebenen Schachtseilprüfungen voll genutzt [Bild].

Abteilung für Mikroelektronik und Nachrichtentechnologie

Südafrikas erster **Halbleiterdiodenlaser** wurde von dieser Abteilung entwickelt. RAP ist ein **rechnergestütztes Entwurfssystem**, das von den Rundfunktechnikern dieser Abteilung entwickelt wurde und von Nachrichtentechnikern eingesetzt werden kann, um die Ausstrahlungsqualität an einem beliebigen Senderstandort zu bestimmen. SAPHIRE, ein **kompakter Leiter von integrierten Schaltungen**, der an ein automatisches Prüfgerät für integrierte Schaltungen angeschlossen wird, wurde entwickelt und gebaut um große Mengen kompakter integrierter Schaltungen (SOICs) zu prüfen. Fünf emittiergekoppelte Logikbausteine wurden auf einem **aus mehreren Chips bestehenden Bauteilmodul** integriert, wobei die fünf Einzelchips mit ihrer Schaltungsanordnung durch einen Chip ersetzt wurden, der so groß wie das Gehäuse eines einzigen emittiergekoppelten Logikbausteins ist [Bild]. Das Satellitenanwendungszentrum liefert **Satellitendatenprodukte** für Kunden im Gebiet der Geophysik, Kartographie, Hydrologie, Landwirtschaft usw. [Bild].

Abteilung Produktionstechnologie

Ein Grundsatzabkommen über die gegenseitige Anerkennung der **nationalen Meßnormen** wurde zwischen der Republik China und Südafrika im Rahmen des Meßtechnikprogramms dieser Abteilung unterzeichnet. Es wurden mehrere neue **optische Produkte und Systeme** entwickelt, einschließlich eines elektronischen Objektivs mit veränderlicher Brennweite zwischen 50 und 300 mm, das nur 165 mm lang ist. Diese Abteilung hat ebenfalls mit Erfolg eine **Kupplungsplattenprüfmaschine** entworfen und hergestellt [Bild]. Im Rahmen des Lasertechnologieprogramms werden Prototypen von **Helium-Neon-Lasern** hergestellt und bewertet [Bild].

Abteilung für Straßen- und Verkehrstechnologie

Eine **Betonwürfelprüfpresse** wurde mit Genehmigung des englischen Lizenzgebers gebaut. Eine von dieser Abteilung zusammengestellte Datenbank, die es ermöglicht, **statische Gewichtsinformationen** von den Brückenwaagen der gesamten Provinz zu analysieren, wird es den Verkehrsbehörden der Provinz Natal in Zukunft erleichtern, Firmen zu identifizieren, die ihre Fahrzeuge regelmäßig überladen. Die **Corufix-Matte** ist eine einfach einzusetzende Schrappmatte; wenn sie regelmäßig verwendet wird, kann damit die Form und die Fahreigenschaften von Kiesstraßen unverändert beibehalten werden [Bild]. Roadfix, ein neues von der Abteilung entwickeltes **Material, um Schlaglöcher aufzufüllen**, kann fast ohne Vorbehandlung eingesetzt werden und widersteht starkem Verkehr sowie besonders feuchten Bedingungen [Bild].

Abteilung für Wassertechnologie

Im Rahmen eines Vertrages wurde diese Abteilung damit beauftragt, bei der Bewertung der aus dem Ausland eingeführten **Evans-Stogg Aqua-Life Abwasserbehandlungstechnologie** mitzuwirken, die auf dem Prinzip des biologischen Schmutzstoffabbaus begründet ist. Sechs Forschungsberichte, die von Wissenschaftlern dieser Abteilung über die Möglichkeit vorgelegt wurden, die Bakterien, welche die **Legionärseuche** verursachen, im Wasser zu bestimmen, wurden von der internationalen Konferenz über das Verhältnis zwischen Gesundheit und Wasserbiologie angenommen. Die von Herrn Dr. R.A. van Steenderen erfundene **peristaltische Zuteilpumpe** erhielt im Jahre 1989 den technischen Preis der südafrikanischen Erfindervereinigung [Bild]. **LUCID** ist ein preiswertes, tragbares und solides Instrument, mit dem man das **äußerst schwache Licht** messen kann, das von gewissen biolumineszierenden Verbindungen ausgestrahlt wird. Man kann damit die Anwesenheit giftiger oder schädlicher Abfallstoffe im Wasser feststellen [Bild].

Abteilung für Textiltechnologie

Eine neue Art von **Säcken zum Hinterfüllen** in Goldbergwerken wurde von dieser Abteilung entwickelt. Sie hat auch ein neues Instrument eingeführt, um die **Länge und Stärke von Wollstapeln** zu messen. In Zusammenarbeit mit dem Wool Board wurde eine speziell gewebte Feuerschutz-Decke aus reiner Schurwolle entwickelt, die mit einem antiseptische Wassegel imprägniert wurde.

Abteilung für Forstwissenschaft und -technologie

Es wurde ein neues Verfahren entwickelt, mit dem es möglich ist, den **Flüssigkeitsverlauf in Hölzern** mit Hilfe von Tiefsttemperatur-Elektronenmikrotechnik zu bestimmen. Die Abteilung entwickelte ebenfalls mehrere Computerprogramme für die **Produktionsüberwachung in Sägewerken**, sowie ein **Überwachungssystem für Sägewerkmaschinen**, welche die Arbeit der Leiter von Sägewerken wesentlich erleichtern. Im Rahmen des Holzverarbeitungsprogramms wurden neue Meßmethoden zur Überwachung und Kontrolle des **Holztrocknungsvorganges** entwickelt [Bild]. **Vielstoff-Hochleistungsverbrennungsanlagen**, die den strengsten Luftverunreinigungsvorschriften genügen, werden ebenfalls von dieser Abteilung entwickelt [Bild].

F R E N C H S U M M A R I E S

Introduction - si seulement

Dans l'introduction qu'ils ont écrite pour *Impact*, le Dr. Geoff Garret et le Dr. Daan Toerien, Vice-présidents adjoints du Groupe Recherche, Développement et Exécution (RDI) constatent qu'il existe un manque d'harmonie assez frappant dans les efforts de commercialisation du CSIR. En effet, le CSIR voudrait accorder autant de publicité que possible aux produits et services de qualité qu'il fournit. Toutefois, en raison du secret professionnel et de la nécessité de rester compétitif sur le marché, le CSIR n'est pas en mesure de mentionner de nombreux travaux qu'il a accomplis avec succès, a moins d'avoir l'autorisation de ses clients et partenaires. Les exemples concrets résumés dans cette quatrième édition d'*Impact* permettent de présenter les activités du "nouveau" CSIR, ceci grâce aux clients qui ont donné leur accord pour que soient abordés en public certains efforts communs.

Selon le Dr. Garret et le Dr. Toerien, ce document a été nommé *Impact* pour montrer qu'il est possible de changer l'état des choses, ce mot-clé ayant été choisi pour décrire le rôle de la technologie dans la nouvelle Afrique du Sud. Au milieu des changements politiques et constitutionnels, l'Afrique du Sud doit continuer à faire face à la concurrence sur les marchés mondiaux. Elle doit s'efforcer de résoudre ses problèmes immédiats (pauvreté, manque de logement, manque d'éducation) tout en développant la base technologique nécessaire pour faire prospérer son économie. L'innovation jouera un rôle décisif dans ce contexte. Si les Sud-Africains veulent éviter de se dire dans une vingtaine d'années "si seulement on avait ...", ils doivent continuer à développer les capacités scientifiques et techniques de leur pays, celles-ci étant représentées par le CSIR.

Division technologie des systèmes aéronautiques

INCODE est un nouveau programme d'ordinateur qui permet aux ingénieurs de faire des calculs de flottement aérodynamique, comme ceux qui sont requis pour la conception de nouveaux avions. La Division a mis au point un appareil de collecte de données synchrones, appelé "Superfledermaus Interface", qui permet d'adapter des signaux de synchronisation aux systèmes digitaux modernes. Les essais de la première aile d'avion en fibre de carbone fabriquée en Afrique du Sud ont été concluants. Il s'agit d'une aile avec une envergure de 11 mètres et pesant 280 kg (voir photo) qui a été conçue et réalisée par les techniciens et les ingénieurs de cette Division. La Division a également poursuivi ses travaux expérimentaux et ses calculs numériques de moteur turbos (voir photo).

Division technologie du bâtiment

Un cours sur l'utilisation de radiers de fondation renforcés permettant d'éviter les fissures dans les ouvrages construits sur des sols difficiles a été donné par cette Division et plus de cent cinquante ingénieurs y ont participé. PREMIS est un nouveau système informatique de gestion immobilière par ordinateur qui permettra aux régisseurs de grandes propriétés de planifier plus facilement la répartition, l'aménagement et l'entretien des terrains et des bâtiments. BOUCELL, un radier de fondation cellulaire rigide a été mis au point par cette division. Il est capable de résister à des contraintes extrêmement fortes (voir photo). Cette division a également créé une salle de bain prête à l'emploi d'une superficie de 1,6 m² seulement, facilement transporter et pouvant être installée presque partout [photo].

Centre de calcul de pointe et d'aide aux décisions

Ce Centre est en train d'installer le plus grand réseau local (LAN) d'Afrique du Sud. Ce réseau reliera toutes les divisions du CSIR et sera rattaché aux réseaux nationaux et internationaux. Dans le cadre de son programme de services par ordinateurs, la division a conçu un logiciel pour réseaux de distribution qui permettra à une grande société pétrolière du pays de déterminer la les méthodes et les routes les plus rentables pour acheminer ses produits vers les points de distribution et les dépôts. Des techniques avancées de dépistage sont utilisées pour créer des visualisations informatisées très complexes (voir photo). Le Centre aide à la conception d'un protocole de mesures statistiques pour le dépouillement des données du système national de contrôle de la qualité des eaux [photo].

Division science et technologie de la terre, la mer et l'atmosphère

Cette division étudie les techniques et les méthodes de mesure géophysiques pour détecter la contamination des eaux souterraines et pour compléter la banque de données sur les caractéristiques des zones aquifères et pour développer des stratégies de gestion des eaux souterraines. La Division a élaboré une méthode de détection de nitrate de peroxyacétyle (PAN), un bon indicateur du smog photochimique causé par une combinaison de combustibles imbrûlés et autres produits polluants et du climat ensoleillé d'Afrique du Sud. Cette méthode a permis d'enregistrer par exemple une épisode de smog photochimique à Cape Town le 7 avril 1989. La Division utilise des techniques de sondage électromagnétique afin de déceler les zones aquifères sous les dunes de sable du désert Namib en Namibie [photo]. L'aquarium d'eau de mer recyclée à Stellenbosch est utilisé pour l'incubation et l'élevage d'abalones, grands mollusques comestibles, destinés au marché intérieur et à l'exportation [photo].

Division technologie de l'énergie

Une nouvelle unité a été créée pour la mise en place et l'analyse de processus industriels permettant d'analyser sur une grande échelle les applications liées à la transformation du charbon. Une étude a été effectuée pour déterminer les effets des éclairs grande intensité d'éclairs et les effets de la haute résistivité du sol sur les câbles multiconducteurs aériens qui sont particulièrement adaptés aux zones d'habitation de forte densité et de prix modéré). L'un des quatre prix décernés chaque année par l'Institut Sud-Africain des Ingénieurs Mécaniciens pour récompenser les réalisations techniques exceptionnelles à cette Division pour un gazogène à lit fluidisé qu'elle avait conçu, installé, mis en service et commercialisé avec beaucoup de succès. Le microscope à balayage électronique qui est utilisé par cette Division a permis de faire une contribution importante à études minéralogiques [photo].

Division technologie de l'alimentation

Un projet entrepris sur les jus de fruits a permis de réduire considérablement les déchets. On a découvert par exemple qu'il était possible d'utiliser du bicarbonate de diméthyle pour éliminer *Byssoschlamys fulva*, une moisissure résistant à la chaleur. Le premier cours sur les techniques de brassage donné aux employés d'une grande société a connu beaucoup de succès. Un procédé de fermentation à l'état solide mis au point dans le cadre du programme de microbiologie industrielle a permis d'améliorer de 10 à 23 pour cent la teneur en protéines des graines de sorgho [photo]. La Division présente un service complet d'analyse des résidus de pesticides dans les aliments. Une méthode de chromatographie liquide de haut rendement a été mise en place pour détecter la présence de dichlorophène dans les champignons, et ce à des niveaux aussi faibles que 0,01 mg/kg [photo].

Division technologie et science sylvicole

Une nouvelle technique basée sur la microscopie électronique cryogénique a été mise au point pour déterminer les voies de passage des liquides dans le bois. Cette Division a également conçu des programmes d'ordinateur afin de contrôler la production des scieries. Elle a aussi installé un système de contrôle des machines qui facilitera considérablement le travail des gérants de scieries. De nouvelles méthodes pour surveiller et contrôler le séchage du bois ont été établies dans le cadre du programme de traitement du bois [photo]. La Division a aussi mise au point des appareils efficaces de combustion à plusieurs carburants répondant à des normes de contrôle d'émission très rigoureuses [photo].

Division services d'information

Cette division offre un nouveau service d'évaluation technologique visant à déterminer les capacités technologiques relatives d'une société et à lui recommander des actions stratégiques pour ses produits et ses méthodes de fabrication. Une bibliographie sélective sur les déchets (Selected Bibliography on Wastes 1986-1989), qui a été publiée récemment, traite des problèmes importants concernant la pollution et la protection de l'environnement, tels que les déchets solides, le recyclage, les déchets dangereux et toxiques. Un nouveau service, "World Technology Alert", a été lancé pour informer les industriels sud-africains sur les développements technologiques internationaux et les aider à établir des contacts à l'étranger [photo]. Des systèmes de recherche documentaire par ordinateur de haute technicité permettent à nos clients d'accéder facilement et directement aux banques de données spécialisées de cette division [photo].

Division science et technologie des matériaux

L'instauration d'une station d'essai pour arbres tubulaires a permis à la section d'évaluation non-destructive d'offrir des services comparables à ceux offerts par les spécialistes à l'étranger. Les résultats d'une étude sur la corrosion des métaux entreprise depuis vingt ans seront bientôt publiés dans un livre qui devrait constituer un ouvrage de référence de grande valeur pour les architectes et ingénieurs. Dans le cadre de son programme de systèmes de détection, la Division a fabriqué des détecteurs de vibrations dont un détecteur utilisant des céramiques piézoélectriques et un détecteur basé sur la technique de détection magnéto-élastique [photo]. Dans le domaine des techniques d'extraction minière, une nouvelle machine de traction de 15 MN est utilisée pour tester les câbles de treuil [photo].

Division technologie de la microélectronique et des télécommunications

Le premier **laser semi-conducteur à diode** développé en Afrique du Sud a été mis au point par cette Division. RAP est un **système d'étude automatisé de propagation radio** qui a été produit par les radiotechniciens de cette Division. Il permet aux ingénieurs spécialisés en télécommunications de déterminer la qualité de transmissions faites à partir d'un point donné. SAPHIRE, un **manipulateur de circuits intégrés de petite dimension** connecté à un testeur automatique de circuits intégrés, a été réalisé pour contrôler un grand nombre de circuits intégrés de petite dimension. Cinq couples d'émetteurs logiques (ECL) ont été intégrés à un **module à paillettes** remplaçant les cinq puces individuelles et les supports de montage par une puce à peine plus grande qu'un seul boîtier de puce ECL [photo]. Le Centre d'Applications de Satellites fournit des **produits de données obtenues par satellite** à des utilisateurs en géophysique, cartographie, hydrologie et agriculture [photo].

Division technologie de la fabrication

Un accord de principe sur la reconnaissance réciproque des **étalons de mesures nationaux** a été signé entre la République Populaire de Chine et l'Afrique du Sud dans le cadre des programmes métrologiques de cette Division. De nouveaux **produits et systèmes optiques** ont été créés, notamment un objectif électronique 50300 mm d'une longueur de 165 mm seulement. La Division a mis au point et fabriqué avec succès une **machine d'essais de disques d'embrayages** [photo]. Des prototypes de **lasers à hélium et néon** ont été fabriqués et évalués par le programme technologie des lasers [photo].

Division technologie des routes et transports

Un **banc d'essais de compression de blocs de béton** a été construit sous licence d'une société anglaise. Une banque de données pour **l'analyse d'éléments de poids statiques** a été créée par la Division; elle permettra à l'administration routière de la région du Natal d'identifier plus aisément les entreprises ayant l'habitude de surcharger leurs véhicules. CORRUFIX est un **tapis de freinage** facile d'emploi qui permet de maintenir l'état et la qualité de circulation sur les pistes, quand il est utilisé régulièrement [photo]. ROADFIX, un nouveau **matériau pour combler les nids de poule**, a été inventé par cette Division. Il nécessite peu de préparation et résiste à une circulation importante et à des conditions très pluvieuses [photo].

Division technologie des textiles

Un nouveau type de **sac de remblai** utilisé dans les mines d'or a été créé par cette division. Elle a également mis au point un nouvel instrument pour mesurer **la longueur et la résistance des fibres de laine**. La Division a développé pour le Wool Board une **couverture de protection contre le feu**; cette couverture en pure laine vierge est imprégné d'une gélatine antiseptique.

Division technologie des eaux

Dans le cadre d'un contrat, on a fait appel à l'aide de cette division pour évaluer la **technologie Evans-Stog Aqua-Life pour le traitement des eaux de décharge**, une technologie importée qui est basée sur la décomposition biologique de matières polluantes. Six rapports d'études effectués par des scientifiques de cette Division ont été acceptés pour la Conférence Internationale sur la Biologie de l'Eau et la Santé. Ces rapports traitent de la détection des bactéries à l'origine de **la maladie du légionnaire**. L'Institut Sud-Africain des Inventeurs et Innovateurs a récompensé le Dr. R.A. van Steenderen pour la **pompe à dosage péristaltique** qu'il a inventé [photo]. LUCID est un instrument bon marché, portable et solide qui mesure la lumière extrêmement faible émise par certains composés bioluminescents et qui peut servir à détecter la présence de matières dangereuses ou toxiques dans l'eau [photo].