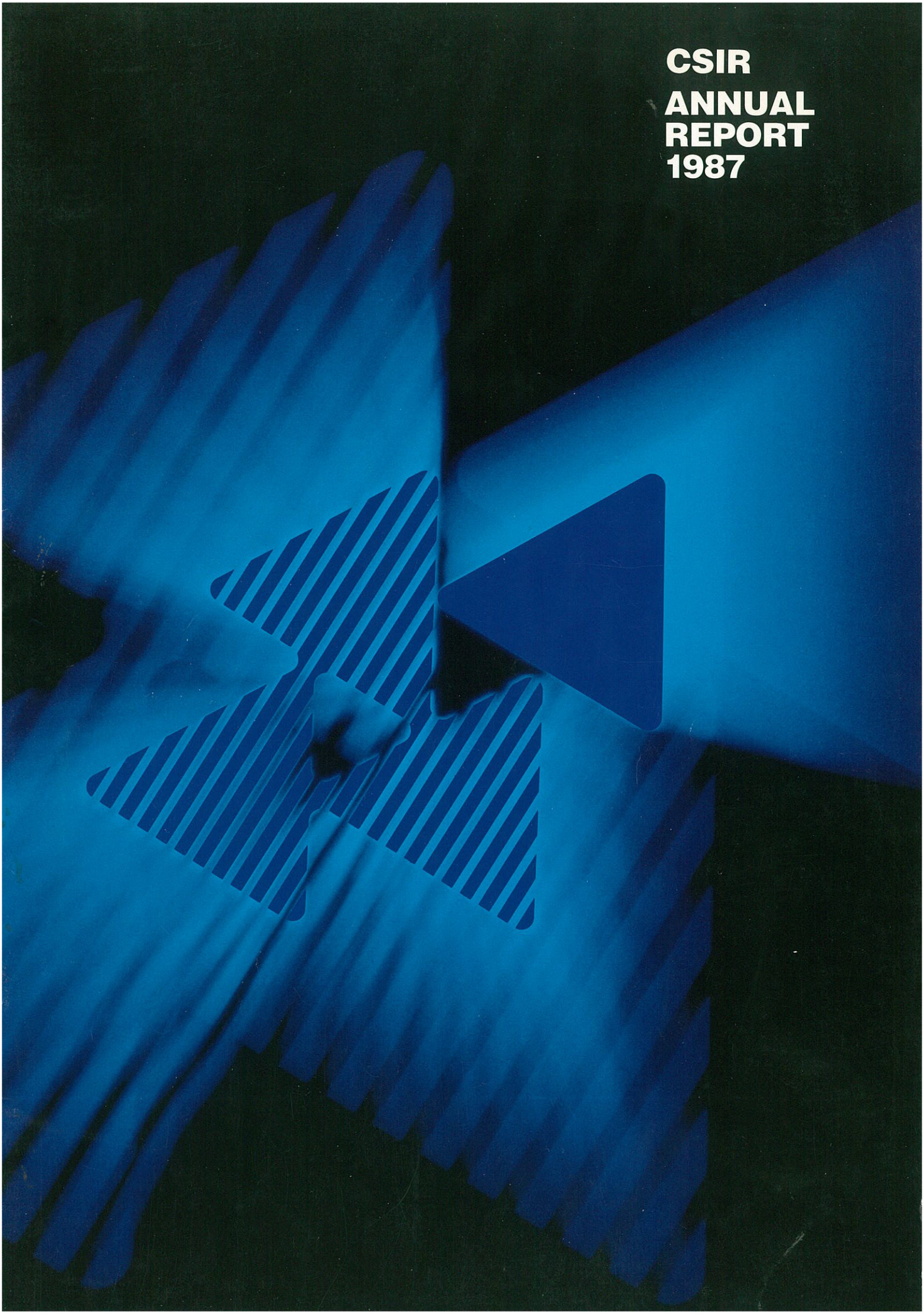
CSIR ANNUAL REPORT 1987



THE MISSION OF THE CSIR

The CSIR undertakes, fosters and manages broadly based scientific research, development and technology transfer in support of and to meet the needs of South African industry, community interests and quality of life in a cost-effective and ethical manner. It strives for excellence.

As a national research and development organisation, we aim to promote national prosperity and the quality of life of all South Africans through the power of a broadly based capacity in science and technology

Empowered by our founding statute, we have as our main goals to:

- interactively develop, transfer and apply new, improved or adapted scientific and technological expertise to strengthen local industry, commerce and supportive infrastructure, as well as to protect the environment
- initiate and undertake directed fundamental scientific research to develop innovative technologies of high potential market value
- provide extensive and purposeful national scientific and technical information services
- support and complement the advanced training as well as the research and investigations of scientists and engineers
- establish, operate and manage special multi-user national scientific and technological research facilities on a contractual basis

Contents

Our Symbol

The basic element of the new symbol is the equi-lateral triangle (top right), which represents the three basic sciences – mathematics, physics and chemistry – and their contribution to the activities of the CSIR.

The three repeated triangles symbolise the interaction of the three basic sciences, while the two enclosed smaller triangles represent the public and private sectors as the focus of scientific research and the transfer of technology from the CSIR.

Copies of this report (in English or Afrikaans) can be obtained from Communication Services:
CSIR, PO Box 395, PRETORIA, 0001

Strategic approach

Markets

We aim to:

- be a market-orientated organisation
- help South African industry to earn its optimum share of world trade
- provide decision-makers with appropriate scientific and technological input
- demand scientific and professional trust and integrity in all our dealings
- ensure implementation of the products of our expertise in our markets
- continuously maintain and update our resources to meet market needs
- make our facilities and people available to those who need them

Management

We recognise the need to:

- constantly improve our performance and be a dynamic and flexible organisation
- keep South Africa at the forefront of technology in selected fields
- function through individual action, teamwork and corporate effort
- have all our leaders manage professionally, their performance being assessed on relevant value-based output criteria
- value and reward individual excellence in all staff categories
- maintain effective communication internally
- be appropriately pro-active and reactive
- demand that resources be applied optimally and prudently
- conduct our affairs in a manner which will satisfy external scrutiny

Resources

We:

- are an equal-opportunity employer
- recruit, promote and reward on the basis of merit to foster outstanding performance
- aim to provide the scientific and technical leadership South Africa needs
- develop in our staff skills for enhanced achievement, and in turn expect dedication and commitment
- compete aggressively for the resources necessary to fulfil our mission

PRESIDENT'S REVIEW

INTRODUCTION

The CSIR, emerging from a year in which it totally restructured itself in order to remain a powerful force in shaping South Africa's future, faces 1988 with new confidence and energy.

Many changes have been brought about, many more are to come as the CSIR drives through its commitment to become a market-orientated organisation. Long ago the CSIR realised that, technology-wise, it was imperative for South Africa to build on its strength and to take realistic steps to eliminate weaknesses if it was to remain a competitive part of the developing world and not degenerate into an impoverished society.

Likewise, the CSIR has had to analyse its strengths and weaknesses realistically. This it has tried to do honestly, with the appreciated assistance of its stakeholders. Now it is putting in place the structures that will capitalise on its strengths and eliminate its weaknesses.

One of the key strengths of the CSIR – as acknowledged by the marketplace – is its depth of experience in technology research and development (R&D) and the equipment required for that R&D. Our commitment now is to build our strength in the implementation of technology.

By April 1988 the restructuring will be complete and the CSIR, through its broadly-based expertise in science and technology, will be firmly positioned to play a major role in strengthening both the public and private sectors in their thrusts to meet the development challenges of the sub-continent.

The CSIR believes that the future of South Africa is largely dependent on developing a sound technology base. It is an international experience that successful entrepreneurs have achieved their success by effectively applying the results of scientific R&D to their businesses.

THE SOUTH AFRICAN CHALLENGE

Renowned historian Arnold Toynbee once described the rise and fall of nations in terms of challenge and response. A young nation is confronted with a challenge for which it finds a successful response. It then grows and prospers. But as time passes the nature of the challenge changes. If a nation continues to make the same, once successful response to the new challenge it inevitably suffers a decline and eventual failure.

There is a clear lesson here: new challenges demand new responses.

What is the nature of the challenge South Africa faces? The negative factors have been listed often:

- exponential population growth, which puts increasing pressure on the tiny band of entrepreneurial talent stimulating development
- political uncertainty which increases the brain drain and strains both economic and social systems
- heightened global isolation which shrinks markets and dries up needed technology transfer
- clashing development priorities which strain South Africa's very finite resources and environment
- mass demands for a new political dispensation and a radical redistribution of national wealth
- a rapid decline in fixed investment and a sharp drop in job creation. In 1985, according to a National Productivity Institute analysis, there were actually fewer black people in formal employment than in 1970.

However, if South Africa is to plan constructively for the future it is necessary to balance all factors, positive and negative. Opportunities that the current South Africa presents include:

- enormous growth potential in numerous areas of national life, stimulated by the accelerating tempo of black urbanisation
- a very well-developed infrastructure in energy, transport, education, health, agriculture and industry
- the ability to handle internally major and complex development projects
- the most sophisticated research and technology-based institutions in Africa
- a potentially huge African market on our doorstep
- an abundance of raw materials
- the capacity to compete successfully in specific international market niches.

Balancing these factors in the South African scenario adds a sense of urgency to the CSIR's commitment to mobilise all its scientific and technological capabilities to boost industrial growth in the sub-continent.

THE MISSION

As a national research and development organisation, the CSIR must aim to promote national prosperity and to improve the quality of life of all South Africans through the power of a broadly-based capacity in science and technology.

This is a high-sounding ideal but the CSIR is committed to its fulfilment through the goals it has set for itself. These are to:

- foster research development and the training of high-level manpower to meet national needs
- develop new scientific and technological expertise which can be transferred to strengthen local industry and commerce
- develop innovative technologies and adapt existing technologies with high potential market value
- provide comprehensive scientific and technical information services nationally
- establish and manage multi-user national scientific and technological research facilities on a contractual basis.

1987 REVIEWED

As the CSIR reached a watershed in 1986, so can 1987 be regarded as a year of upheaval. Throughout the past year we have – from a position of strength – assessed ourselves, evaluated our structures, reorientated our thrust and prepared ourselves in every way possible for a rollercoaster of change.

Members of the CSIR's Executive are (from left to right): Dr R.R. Arndt (FRD), Dr C.F. Garbers (President), Dr J.B. Clark (RDI) Dr E.N. van Deventer (CSS). The head of the Corporate Financial Management group (CFM) is still to be appointed.

Change brings with it a turbulence which is at once unsettling but also exciting in that it throws up new opportunities.

One such opportunity is presented by our depth of talent in research resources, human and material. The problems needing urgent solutions if South Africa is to grow and prosper, require a multi-disciplinary approach and the CSIR has the largest pool of multi-disciplinary expertise on the African continent. In addition, we have had 42 years of experience in collaborating in R&D with universities and other research bodies. In 1987 the CSIR considerably increased its research development support to universities, museums and technikons and its graduate bursaries to talented students. This activity, together with the CSIR's understanding of the South African dynamic which requires appropriate solutions, gives the organisation a leading edge as it pushes out the frontiers of technological innovation.

This year we continued our extensive collaboration with the private sector and concluded more than 2 500 contracts for industry. Through the SA Inventions Development Corporation (Saidcor), a CSIR subsidiary, extensive knowledge of licensing, patent agreements and joint ventures has been applied in the exploitation of R&D findings.

At the strategic level the CSIR expanded its partnership with commerce, industry and the public sector. In effect this partnership, based on joint agreements as to research priorities, consists of putting together the right scientific and technological support to meet research goals and then working with the partners to implement research findings until satisfactory results are obtained.

Its contract work in this sphere brought in R108-million during the past financial year.

But the key development that stirred up the CSIR in 1987 was undoubtedly the restructuring that took place.

It took place after many months of work by the CSIR management and outside consultants. Inevitably it caused upheaval and insecurity, but every effort was made to involve all CSIR personnel at every stage of the changes.

THE NEW STRUCTURE

The restructuring was done on a group and on a divisional basis with an emphasis on a matrix management system to support the new independence and autonomy that has been devolved downwards.

At a macro-level the CSIR now consists of four groups:

- Research, Development and Implementation group (RDI), headed by Dr J.B. Clark
- The Foundation for Research Development (FRD), headed by Dr R.R. Arndt
- The Corporate Financial Management group (CFM), headed by an executive still to be appointed
- The Corporate Support Services group (CSS), headed by Dr E.N. van Deventer.

Part of the reorganisation has resulted in the 21 institutes which now make up the RDI group, being restructured into 11 divisions, so as to meet the research, development and implementation needs of identified priority markets more effectively.

This new macro structure alters the previous role of the CSIR Executive, since each group has a degree of autonomy that establishes its manage-

ment as largely independent. At the same time final authority remains vested in the Chief Executive of the CSIR with the Executive Management as an advisory, coordinating and policy-implementing body.

In line with Executive-approved budgets, financial management is to devolve much further to the divisions. The corporate financial management will, however, co-ordinate salary and other payments, insurance and the support of overseas offices.

In putting this new structure – and its leaders – into place the following were deciding factors:

- the CSIR remains a research organisation, involved in activities ranging from fundamental research to the transfer of technology to the marketplace
- a heavier emphasis in future is to be on servicing the market
- the strategic direction of the change necessitates a structure clearly different from the old one
- the leader corps of the new organisation had to be selected on the basis of their strong commitment to change alongside the personal and intellectual characteristics required by an R&D organisation
- the scientist, engineer and specialist occupy central positions in the search for solutions to South Africa's problems – they must be provided with the support systems they need to meet those challenges
- further training in effective leadership and staff skills will be needed for key newly-appointed leaders so that they will be effective managers in the technological marketplace of the future.

ROLE OF THE CSIR COUNCIL

The CSIR can be proud of its forceful Council. Its collective wisdom, the high quality of leadership of individual members, and their extensive contacts and experience in all spheres of life and business, both at home and abroad, have been crucial to the CSIR's well-being.

The Council's input on strategic issues such as planning, management and technology development has helped firm and shape our new direction .

In addition, the Council helped the CSIR to protect its autonomy and the individuality of research councils generally, and to avoid efforts towards prescriptiveness and microcontrol.

All this was a logical preparation for turning the CSIR towards greater market-orientation and client participation.

CSIR & GOVERNMENT

The new market-orientated approach has required a penetrating look at the provisions of the Scientific Research Council Act (Act 82 of 1984) to ensure that the CSIR enjoys the greatest degree of freedom and independence concomitant with the necessary parliamentary control of any public funds directed to it.

Changes to the legislation, which will be put before Parliament in the 1988 session, include:

- a clearer distinction between the CSIR Council/ Board, a policy-making body, and the CSIR, an operational organisation
- separation of the offices of Chairman of the CSIR Council and President of CSIR – presently vested in one person – in order to underline the CSIR's greater autonomy
- much greater autonomy in operational matters. For instance, the CSIR Board will in future decide on issues such as relationships with educational organisations, employee training and remuneration, purchase of property, borrowing and investing of funds, exploitation of technological innovations. The Minister may, however, require certain aspects to be cleared with him as determined from time to time in consultation with the chairman
- authority for the CSIR to obtain shares in private companies involved in developing or utilising technology

These changes are expected to be approved by Parliament early in the 1988 session, enabling the CSIR to re-examine its conditions of service, including the remuneration of employees.

Naturally, as with other major changes which may evolve, there will be full discussions with the Employees' Association in order to get its input in shaping new directions resulting from changes in legislation.

SCIENCE POLICY

The publication of the White Paper on Industrial Development Strategy in May 1985 and others on Mineral Policy, Energy, Privatisation, and Deregulation prompted far-reaching changes in national policy on science and technology.

At the beginning of 1987 the Minister of National Education listed adjustments to the national science policy which have particular impact on the CSIR:

- "deregulation" of statutory science councils with devolution of decision-taking. Funding of the CSIR for which the State will accept responsibility will be calculated according to the base-line approach. This aims at placing greater emphasis on the earning power of the CSIR and reducing its dependence on direct State support while ensuring greater market-relatedness through provision of services on a contract basis to both private and public sectors
- scrapping of the Scientific Priorities Committee, which previously advised on the allocation of the State's research budget. In future, State departments will each decide on what portion of their budgets should be expended on research, and where these services should be obtained. A request has been put forward to the Cabinet for a ruling that the percentage of State departments' budgets currently spent on research be entrenched for the next five years. In future the CSIR will have to compete for the available research funds in the public sector. In the 1987/88 financial year the CSIR's contract income, most of which is derived from the public sector, amounted to R108-million
- restructuring of the Scientific Advisory Council, to which Professors D.S. Henderson and O.W. Prozesky have been appointed. This necessitated their having to resign from the CSIR Council.

These changes all reinforce the CSIR's repositioning as a market-driven organisation.

CSIR

PERSONNEL & REMUNERATION

If the CSIR is to be competitive in the South African marketplace, which has an undersupply of high-level manpower, then it must be an attractive employer.

A task group formulated an overall policy, approved by Council in March 1987. It is based on attracting leaders in science, engineering and technology who show a talent for innovation and entrepreneurship in research development and implementation as well as the necessary management and business skills. A tall order? Yes – but one we are committed to meeting.

Just a word about the salary structure as applied in the past. From 1983 it was ruled that the CSIR should employ what were known as Personnel Administration Standards (PAS). This meant, in effect, that remuneration in the CSIR was prescribed according to instructions for every occupational group. Deviations required ministerial approval.

This forced, rigorous application of this PAS system led to an intolerable situation. After a Cabinet-ordered investigation a system of framework autonomy was developed and introduced in April 1987. This system allows the CSIR to determine its own remuneration packages subject to a fixed maximum yearly average expenditure for each fulltime staff unit. Hence, for the first time in the CSIR's existence, achievement can be appropriately rewarded. As a further incentive, increased contract earnings mean the maximum average is increased.

ACKNOWLEDGEMENTS

Over the past 42 years, South Africa – through Parliament – has invested large sums of money in the CSIR. Over the years, its growth was prompted by demand for its services and it developed into an important national asset.

Obviously, Council's decision to effect the major restructuring of this asset during 1987 required a number of policy decisions at the highest level. I wish to record the CSIR's sincere thanks to Ministers D.W. Steyn and T.G. Alant for their much appreciated support and encouragement and particularly for their wise counsel in finalising legislation for submission to Parliament.

Mr S.J.P. du Plessis, Director-General of the Department of Trade and Industry, retires soon after an illustrious career. To him the CSIR is greatly indebted for his guidance and assistance at all times.

As already mentioned, Professors D.H. Henderson and O.W. Prozesky were appointed to the reconstituted Scientific Advisory Council and

Prof. D.H. Henderson

Prof. O.W. Prozesky

Mr M.T. de Waal

resigned from the CSIR's Council. Mr M.T. de Waal was appointed chairman of Iscor and, in view of his many heavy commitments, relinquished his membership of the Council. We thank these men for their manifold contributions and wish them well in their new tasks.

The members of the CSIR Executive and I are extremely grateful for the time and trouble Council members devote to CSIR affairs as well as for their commitment to the CSIR in many areas of its day-to-day activities.

During 1987, two of the CSIR's chief directors retired. Dr M.S. Hunt (National Mechanical Engineering Research Institute) and Mr V.A. Shaw (National Institute for Informatics) both left lasting impressions in their fields of endeavour.

CONCLUSION:

The history of the CSIR is characterised by noteworthy successes. Those achieved in 1987 are featured in the reports of the divisions of RDI, the centres of CSS and the programmes of FRD in this annual report.

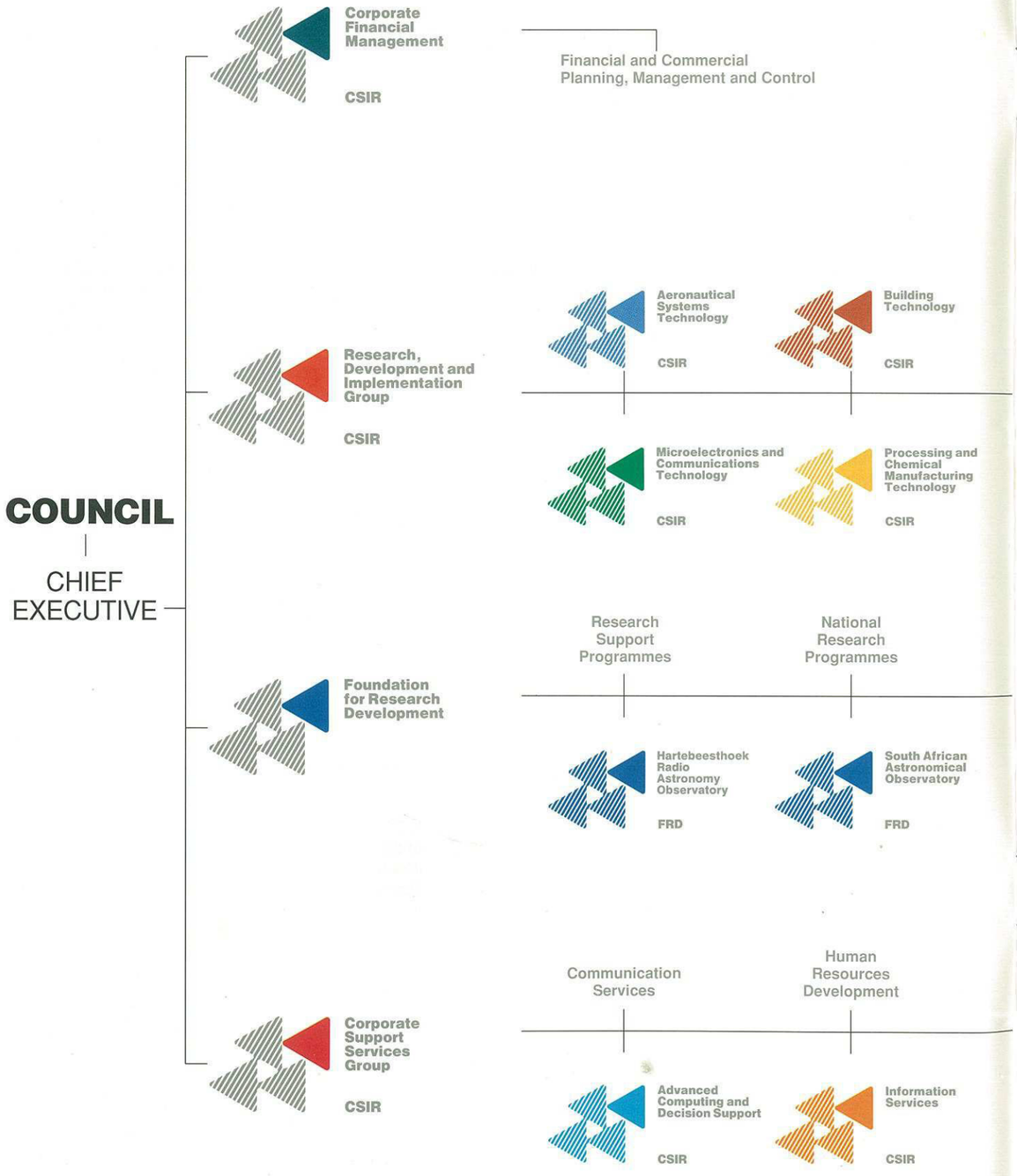
However, there never could be any question of our relying on past achievements to carry us into the future.

We grasped the nettle of change in 1987 and it required major readjustments by many individuals. I would like to pay tribute to all those colleagues of mine, at all levels of the organisation, who have risen to the challenge of change, often at personal cost.

We all realise that the CSIR is destined to play a crucial role in the future of our country. We realise, too, that our role must be played in the wider context of the African continent to which we belong and with which our destiny is bound. The size of the task is illustrated by the fact that the 0,32 percent contribution by South Africa to the world R&D effort represents 60 percent of all R&D on the African continent!

The CSIR is changing from a hierarchically structured, regulated institution into an innovative, dynamic one in which entrepreneurial and creative people will thrive. We have put together a young, enthusiastic management corps, which is fully committed to its task. We also have a select staff with exceptional capabilities. We have put a challenge to our scientists and engineers and look forward to the future with excitement.

Structure

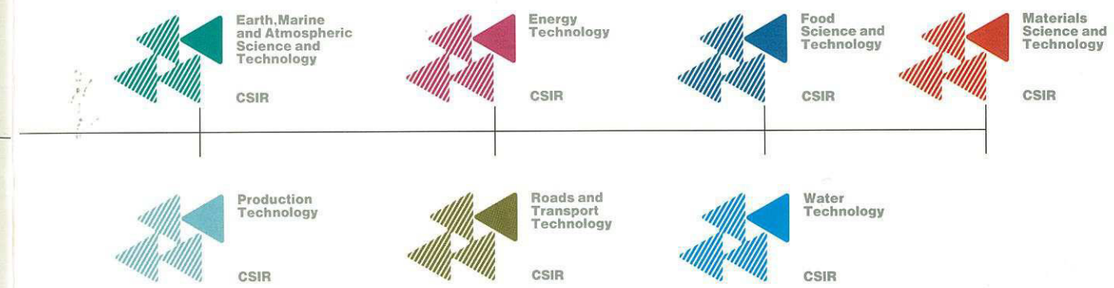


Within the new structure four groups have been created, each with a high level of autonomy which will establish its management as a largely independent authority.

Operational management issues, currently dealt with by the CSIR Executive will devolve to the managements of these groups.

The four groups are:

- Corporate Financial Management (CFM)
- Research, Development and Implementation (RDI)
- Foundation for Research Development (FRD)
- Corporate Support Services (CSS)



CSIR

THE CSIR COUNCIL

Apart from its chairman, members of the CSIR's distinguished Council are executives or retired executives of some of the country's largest business concerns. In addition to holding many directorships, all serve or have served on a wide range of South African national bodies in business, culture and education. Biographies below necessarily carry only brief details of the career and other activities of each member.

C.F. Garbers, PhD
(Chairman)
Christoph Friedrich Garbers (58), who studied at Pretoria University before obtaining his PhD at the University of Zurich, has held the offices of chairman of the Council and president of the CSIR, which are to be separated, since 1980. He had a distinguished career in chemical research, having been awarded the Havenga Chemistry Prize of the SA Akademie vir Wetenskap en Kuns in 1977 and the SA Chemical Institute's Gold Medal in 1980.

H.B. Dyer, PhD
Henry Brooke Dyer (60) has been managing director of De Beers Industrial Diamond Division (Pty) Ltd since 1971 and is also a director of De Beers Consolidated Mines Ltd and numerous other companies. His PhD was awarded by the University of Cambridge for research into solid-state physics. His early career was spent in De Beers Diamond Research Laboratory, of which he became head in 1961.

L.B. Knoll, DPhil
Leon Brink Knoll (64) is a director of numerous companies after having been managing director of Massey-Fergussson SA Ltd from 1961 to 1980 and group managing director and deputy chairman of Fedmech Holdings Ltd from 1980 to 1984. He obtained his DPhil from Oxford University for work on the behaviour of steel at ultra-high rates of strain.

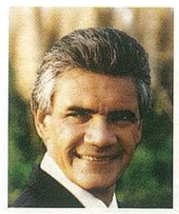
R.A. Plumbridge, MA
Robin Allan Plumbridge (52) joined Gold Fields of South Africa in 1957 after studying at Oxford University. He was appointed an executive director in 1969, a deputy chairman in 1974 and chairman in 1980. He is also chairman of Driefontein Consolidated Ltd, the largest group gold mine. He received the Decoration for Meritorious Service in 1982.

J.A. Stegmann, BSc, MCom, DSc (hc), DCom (hc)
Johannes Augustus Stegmann (61) was last year appointed chairman of Sasol Limited, of which he became chief executive in 1976. Also chairman of various group companies, he joined Sasol in 1952. He was elected one of the Business Times' Top Five Businessmen of 1979 and nominated Business Statesman of the Year by the Harvard Business School Club of SA in 1982.

E. van As
Eugene van As (49) is group managing director and chief executive of Sappi Ltd, which he joined as a divisional managing director in 1976 after having been managing director of Henkel SA (Pty) Ltd from 1970. He is an executive director of General Mining Union Corporation Ltd and also serves on the boards of Malcor Ltd and Olivetti Africa.

C. van der Pol, PhD
Cornelis van der Pol (62) is a director of Tongaat-Hulett Group Ltd and Tongaat-Hulett Sugar Ltd, having joined the group in 1964 as managing director of the sugar division. After coming to South Africa with his Dutch parents in 1937 (he took SA citizenship in 1947), he graduated at Wits and then studied sugar technology at the University of Queensland.

P.J. van Rooy, MSc
Petrus Jacobus van Rooy (61) is managing director and chief executive of the Industrial Development Corporation and chairman of, among other companies, Alusaf and Saiccor. He has worked for the IDC since 1963, after previously working for the Veterinary Research Institute at Onderstepoort, the SABS and Messina (Tvl) Development Company.



W.P. Venter, DCom (hc)
William Peter Venter (53) founded the Altron/Altech group of high-technology companies, of which nine are now listed on the Johannesburg Stock Exchange, and is executive chairman of all the major ones. He has been the Institute of Marketing Management's Marketing Man of the Year (1977) and Business Times' Top Businessman (1978).

Research Development and Implementation Group

CSIR

RESEARCH, DEVELOPMENT AND IMPLEMENTATION

Over the past year the CSIR's operational line function of 21 national research institutes was prepared for re-organisation into 11 divisions, which came into being on January 1 1988. The divisions constitute the RDI group.

Each division focuses on a priority market area and has its own strategic plan and budget. Its director has considerable autonomy in directing its activities, particularly in interacting with marketplaces and in general operating it as a strategic business unit.

The mission of the RDI group is to serve customers in the private and public sectors as an interactive partner, both in identifying and responding to scientific and technological market needs and in anticipating opportunities.

It is also to provide timely and cost effective solutions by innovative research and development, and actively participate in the implementation of research findings and in technology transfer.

In its 42 years of existence the CSIR has a long history of working with industry to the benefit of both. In the past, however, it has responded to specific market niche requirements and has tended to concentrate on the research process rather than the implementation of findings.

Now the CSIR is to be "output-orientated" in responding to the needs of the marketplace rather than "input-orientated" as in the past. Performance will henceforth be measured in terms of outputs achieved and, among other criteria, their cost benefits.

The fundamental cultural and structural changes necessary to achieve these goals could not occur overnight. However, the need for change has been readily acknowledged by staff at all levels and the planning, communication and training to implement the changes is already far advanced.

To assess better the needs of the many different industries it serves, the RDI group has, in conjunction with international consultants, established the capability to conduct technology audits. This term describes a joint programme with the management of a client industrial company to determine its future technological requirements.

Subsequent to an audit the appropriate division, or divisions, of the RDI group will actively help to initiate technological improvements. The ultimate goal will be to make the company, and therefore also South Africa, more competitive in the international marketplace.

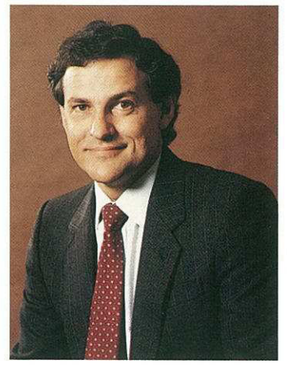
A further step towards providing a professional service to the CSIR's markets has been the establishment of a technology innovation fund. Funding will be used in specific instances to support research aimed at finding and implementing commercial solutions to South Africa's technological challenges.

A number of such joint ventures between the CSIR and business have already been developed. It is envisaged that the CSIR will recover its investment should these become commercially viable.

At the end of 1987, the RDI group stood ready to face the great challenge of effectively linking customer needs to the products and services which it can offer. Its confidence is based on past successes and full commitment of staff and the support of many customers.

On the following pages, the RDI group's 11 new divisions, in alphabetical order, report on their new structures and objectives, and achievements gained and expected. After each report is a short profile on the person appointed as director.

Full titles of the divisions are: Division of Aeronautical Systems Technology, Division of Building Technology, Division of Earth, Marine and Atmospheric Science and Technology, Division of Energy Technology, Division of Food Science and Technology, Division of Materials Science and Technology, Division of Microelectronics and Communications Technology, Division of Processing and Chemical Manufacturing Technology, Division of Roads and Transport Technology, Division of Water Technology



J.B. Clark, DSc
James Brian Clark (39) began working for the National Physical Research Laboratory straight after matriculating in 1965 and earned his DSc in physics from the University of Pretoria in 1973. His thesis covered phase studies of some simple inorganic substances at high pressure and temperatures.

Dr Clark has worked at the University of Munich as an Alexander von Humboldt Fellow, at the Technicon Israel as a Theodore-Krengel visiting scientist, and at the Pennsylvania State University. He has received the following awards: South African Institute of Physics' Silver Jubilee Medal; British Association Medal of the South African Association for the Advancement of Science; Meiring Naude Medal of the Royal Society of South Africa and the Jaycee FOYSA (Four Outstanding Young South Africans) Award.

A frequent representative of the CSIR overseas at conferences and on other occasions, he is author or co-author of 85 papers for scientific journals, co-editor of "Speciality Steel and Hard Metals" and co-holder of four patents. He serves on a number of committees and advisory boards outside the CSIR.

In the restructured CSIR he is group executive of Research, Development and Implementation and carries responsibility for the corporate management of RDI's 11 research divisions. The divisions service research, development and implementation demands of a wide range of identified market areas.

Dr Clark is married with two daughters and a son.

Reports from the Divisions

AERONAUTICAL SYSTEMS TECHNOLOGY

The sections of previous institutes consolidated into this division at the restructuring were already largely market-driven. Consequently the division, which serves high-technology customers on a contract basis, is expected to generate 95 percent of its own revenue.

The unique experience of the division's personnel built up over 20 years of experience with advanced systems, coupled with extensive overseas contact with leaders in the field, enables it to specialise in early identification of future technological needs. It has pro-actively adapted and expanded its multi-disciplinary expertise base to meet future needs in the fields of:

- experimental and theoretical aerodynamics
- aeroelasticity
- composite aircraft structures and materials
- turbo-machinery
- radar

It aims to reduce the lead time and risks associated with the industrialisation of new advanced technologies by proving the feasibility of local design and development of complex systems. In addition, specialist services for the measurement, analysis and evaluation of complex systems are provided.

Timely, cost-effective solutions using state-of-the-art, innovative technologies and participation in their transfer to industry are the aim. During the past year, the division was involved in the development of a dozen or so complex systems under some 230 government and other contracts. One such system includes a 10-metre approach radar "radome" – the largest of its type in the country..

The division has a staff complement of 300 – half of whom are graduates – and extensive experimental, design and development facilities. During November 1988, it will commission the latest addition to its half-dozen wind-tunnels – a medium-speed one costing R80-million and requiring 20MW of power. Special arrangements have had to be made for the supply of this power.

No other major additions to the facilities of the division itself are planned at this stage.

J.T.D. Fritz, D Eng, Pr Eng

Johann Thomas David Fritz (40) is widely known for his research in the field of strength mechanics, particularly the design, techniques for manufacture and in-service behaviour of mine hoist cables. While working in the National Mechanical Engineering Research Institute between 1969 and 1986, he completed more than 70 research contracts for clients.

He became director of the Institute in 1985, while heading the mine equipment research unit. Appointed chief director of the Institute for Aeronautics and Systems Technology on January 1 1987, he assumed his present post in August of the same year.

Married with two sons, he is a graduate of the University of Pretoria.

BUILDING TECHNOLOGY

This division confronts the challenge of man's need for shelter, both basic and sophisticated. Its mission is to develop and apply technological solutions to South Africa's housing and building needs in the most appropriate and cost-effective way.

The division's highest priorities are to:

- develop innovative solutions to the spectrum of accommodation needs of all South African communities
- research the interaction between communities and the buildings that house them
- continually research, develop and then implement – in cooperation with public and private sectors – appropriate methods for planning and designing the built environment of the future
- seek cost-effective innovations to the way existing building technology is used.

The main target market of this division is the building and construction industry and all its related services. The marketplace thus includes government and private sector policy-making bodies, financial institutions, planners, developers and builders and their suppliers.

During 1987 the division, through its 120 staff, generated just under one-third of its income through contract work done for this extensive market.

The restructuring during the year led to the appointment of a new director but left the staff of this division largely intact, except for the 13 staff members working in ceramics and polymers who shifted to Materials Science and Technology.

The year's achievements included:

- a technological breakthrough in solving concrete plague, a major problem in many of the country's concrete structures
- publication of the most comprehensive handbook ever on low-cost housing, covering every aspect in this field for the non-expert
- the application of multi-disciplinary expertise to the design and project management of public buildings. Massive savings on a new school in South West Africa/Namibia were achieved through this approach. An agreed budget of R7-million for the school was slashed to R3-million after the expert intervention of a team from the division
- application of the technique of photogrammetry to establish population densities in specific areas, developed in collaboration with the Housing Advisory Council.

Research Development and Implementation Group
CSIR

The rapid urbanisation of South Africa's rural population and the socio-economic issues surrounding this process present the division with its greatest challenge yet.

R.J. Page-Shipp, Sci Nat, MSc, Dip Occ Hyg

Roy John Page-Shipp (45) joined the CSIR in 1975, as head of the environmental engineering division of the National Building Research Institute, after working for Rand Mines, the Atomic Energy Board and Iscor in occupational hygiene. He was appointed a director of NBRI in 1981.

He is chairman of the National Safety Glazing Council and has twice been president of the Associated Societies for Occupational Safety and Health. He is also a member of the scientific advisory panel of the National Centre for Occupational Health.

Married with three daughters he is a graduate of the University of Natal.

EARTH, MARINE AND ATMOSPHERIC SCIENCE AND TECHNOLOGY

This division includes sections of the former National Physical Research Laboratory and National Mechanical Engineering Research Institute in Pretoria and National Institute of Telecommunications Research in Johannesburg and also the entire National Research Institute for Oceanology at Stellenbosch, and Magnetic Observatory at Hermanus.

During 1987 external contract income rose from 35 to 40 percent of total revenue. Customers include government departments, statutory bodies, second and third tier government agencies and private-sector users such as mining groups and exploration and engineering consultants.

Largest generator of income continues to be the programme for studying air pollution in industrial areas, cities and growth point areas, mostly on behalf of the Department of National Health and Population Development and the Department of Development Aid. It has become apparent that pollution may be concentrated a few hundred metres above the ground and further studies of this have to be undertaken.

A study of convection clouds is conducted from Nelspruit as part of the Programme for Atmospheric Water Supply of the Water Research Commission. This work is complemented by radar meteorological, cloud physics and lightning studies.

On behalf of the Department of Environment Affairs the division conducts studies of estuaries and other parts of South Africa's coastline to provide information for optimum management. It also investigates coastal structures, from harbours to pipelines, and undertakes studies on the marine discharge of effluent.

The unit, which was part of the NITR, specialises in radar meteorology and the study of lightning.

The Magnetic Observatory, which produces regional magnetic maps used locally for navigation and mineral exploration, has a high international reputation for the data it contributes to global magnetic field modelling and mapping projects. Although its work has previously been financed mainly by a parliamentary grant, the earning of more contract income is now being investigated.

The geotechnical engineering group of the division is involved in studies of the behaviour of rock and rock structures. Results of a study of the swelling characteristics of South African mud rocks are at present being used in the design of certain aspects of the Lesotho Highlands water project.

Other geoscientific expertise in the division provides advanced geophysical and isotope geochemical research services to satisfy the specialised needs of the exploration and mining industries.

The division, whose scientific personnel totals 310, anticipates that in the immediate future it will secure further contracts resulting from the Lesotho Highlands water and Mossel Bay gas projects. Another large developing market is for research on ground water resources, while Soekor is a potential customer for research into ocean currents, waves and coastal meteorology.

Ten research programmes identified by the division involve: air quality; atmospheric physics and cloud technology; geoexploration; geotechnical engineering; coastal processes; marine pollution; maritime structures; magnetic observatory activities; environmental information and remote sensing; and ocean processes.

The division aims to provide many of its own technical support services, including an electronics workshop.

J.S.V. van Zijl, PhD

Jan Stephanus Viljoen van Zijl (52) is one of South Africa's best-known and most experienced geophysicists. Among international users of his advice has been the Office of Naval Research in the US when it was investigating a possible telecommunication mechanism using the earth's crust as a waveguide.

While he was Union Corporation's group geophysicist in 1981 and 1982, his work included geo-

physical evaluation of the corporation's oil interests in the North Sea and Gulf of Mexico and gold interests in Brazil. He joined the CSIR in the National Physical Research Laboratory in 1962, and became head of the geophysics division when it was founded in 1969 and chief director of the laboratory in 1983.

He has been president of the South African Geophysical Association and is a Fellow of the Geological Society of South Africa and a member of numerous national and international professional bodies.

Married with two sons, he is a graduate of the Universities of Stellenbosch, Pretoria and the Witwatersrand.

ENERGY TECHNOLOGY

Energy is a critical component of development and this division is at the leading edge of research on the more efficient use of energy in three forms – coal, synfuels and electricity.

While research into uses of coal remains the major activity (six programmes), the division is also involved in four programmes in the fields of synfuels and electricity.

The restructuring has resulted in the former National Coal Research Institute and portions of two other research institutes (Chemical Engineering and Electrical Engineering) being absorbed into the new division, which has a staff of 333.

Its market covers a wide spectrum of energy users and producers – the mining industry, electrical power utilities, the synfuels and natural gas industry, the government and agencies or individuals requiring research, development or information on energy.

The division is strongly market-driven and is streamlining its operations to serve clients better. This includes a strengthening of ties with industry and actively communicating with all users of energy technology.

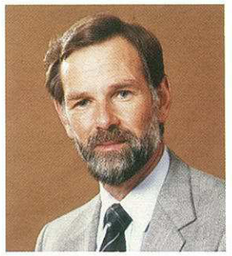
The division is also closely linked to the new Energy Council which is developing policy and research priorities in the field of energy utilisation in Southern Africa.

Funding for the division's research comes from contracts carried out for the public and private sectors and from the Central Energy Fund.

Its achievements during the past year included:

- demonstration at pilot plant level (10MWt) of the ability to combust inferior coals efficiently in an environmentally acceptable manner
- development of a rapid and precise method for determining the rank and maceral composition of coal by means of image analysis
- development of a new patented process of the oxidative conversion of coal to various useful products
- an early warning system for mines to prevent premature detonation of charges by natural occurences such as lightning.

The major challenge for the coming years is to find the balance between longer term fundamental research – necessary if the frontiers of energy technology are to be pushed outwards – and short term research findings whose implementation will give immediate benefits to the energy industry.



D.L.W. Krueger, MSc (Eng), Pr Eng

Dietrich Ludwig Wilfried Krueger (44) joined the CSIR in 1983 as co-ordinator of the National Programme for Energy Research.

Previously he had worked as a process engineer at Van Eck & Lurie from 1975 to 1978, where he was jointly responsible for the process design of the R20-million Ucar Minerals vanadium plant at Brits and several coal preparation plants. From 1978 to 1982 he held the position of project manager at E.L. Bateman, with turnkey responsibility for various mineral processing plants.

Earlier, as special assistant to the general manager of Palabora Mining Company (for which he worked between 1966 and 1975), he carried out the feasibility study for the mine's R80-million expansion programme. The author of a number of papers, he was co-author of a paper presented to the 13th Congress of the World Energy Conference in Cannes in 1986.

Married with two sons and a daughter, he obtained a BSc in chemical engineering at the University of Pretoria and MSc (Eng) at the University of Cape Town.

FOOD SCIENCE AND TECHNOLOGY

This division comprises sections of the former National Chemical Research Laboratory, Laboratory for Molecular and Cell Biology, National Institute for Chemical Engineering Research and the entire National Food Research Institute, Sugar Milling Research Institute and Fishing Industries Research Institute.

It employs about 250 people and focuses on seven key areas: food processing technology; food and beverage quality; bio-evaluation of foods and feeds; food chemicals; biotechnological products and processes; brewing and beverage technology and engineering; and food and industrial microbiology.

It promotes the effective utilisation of South African agricultural resources by the R20 000-million-a-year food and fermentation industries, through a leadership position in research, development and implementation activities. Its customers comprise major companies in these industries, the agriculture marketing boards as well as public sector agencies responsible for food supply and nutrition.

Research
Development and
Implementation
Group

CSIR

Recent achievements include:

- sophisticated technology for the bioproduction of essential amino-acids
- dehulling of sunflower seeds for the production of additional protein sources
- extrusion technology for the energy-efficient production of brewing adjunct from maize meal
- determination of radurisation condition for extending the storage period of fresh fish
- advice on mycotoxin contamination in imported grains
- international recognition for the analysis of mycotoxins and fibre in foodstuffs
- the award of a certificate of merit to the Sugar Milling Research Institute for its contribution to the increased industrial extraction of sucrose from sugar cane and for the optimisation of mud filtration in raw sugar factories.

The division continues to be the sole source of technology for the 800-million-litres a year sorghum beer industry. The expertise will be made available to the industry as it is privatised, and also to the barley beer industry.

Exciting prospects for the coming financial year include a substantial project involving technology for the production of single cell proteins from local carbohydrate sources.

P.S. Steyn, PhD

Pieter Streicher Steyn (48) began his career as a geologist but switched to research into the isolation, analysis, structure elucidation, synthesis and biosynthesis of mycotoxins, or toxins produced by fungi. Much of the research has been carried out in collaboration with fellow scientists across the world, and has formed the substance of 155 scientific papers and reviews.

Dr Steyn has served on the executive committee of the Council of the South African Chemical Institute and been president of the Joint Council of Scientific Societies. During 1987 he was awarded the Gold Medal of the South African Chemical Institute and the Merit Award of the CSIR. He serves on numerous national and international advisory bodies (particularly those related to the International Union of Pure and Applied Chemistry).

He joined the National Chemical Research Laboratory's division of organic chemistry in 1964 and became its head in 1983. He was appointed chief director of the National Food Research Institute in 1986.

Married with two sons and a daughter he is a graduate of the Universities of Stellenbosch and South Africa, and was awarded a post-doctoral fellowship by the University of Wisconsin USA.

MATERIALS SCIENCE AND TECHNOLOGY

This division serves the public and private sectors in the generation, application and commercialisation of materials technology. Its work involves the development and optimal use of engineering materials and products through a proper understanding of the relationships between structure, processing, property and – most importantly – service performance.

The focus areas for the new division's 240 people are its 11 programmes, which reflect the fact that the division is as much concerned with end-use knowledge as it is with specific materials knowledge. The programmes are: battery technology; composites, corrosion and corrosion control; failure analysis and materials selection; functional ceramics and refractories; mine hoist technology; polymers; speciality metals; structural ceramics; tribology and surface engineering; and ultrasonic and transducer systems.

The division's main markets are the manufacturing, mining and strategic industries. It also serves the communications, power generation, transportation, construction, agricultural, chemical, petrochemical and medical markets.

The core of the new division was formed from the National Institute for Materials Research, which during 1987 earned 52 percent of its revenue through more than 240 short- and long-term contract-directed Research, Development and Implementation projects in the public and private sectors. Information about many projects is of course limited by customer confidentiality agreements, but some of the Institute's successes in 1987 include:

- Import substitution. A partnership with Glamosa, a glass company in Escourt, Natal, led the company to marketing a range of glass products previously imported, including lamp covers
- Smallscale manufacturing. Specialised piezoelectric ceramic elements were sold to local industry for ultrasonic applications
- Material development. Provisional patents were taken out on novel tough zirconia ceramics which show high potential in wear-resistant applications
- Process development. Advanced investment casting technologies were developed in support of local industry
- International innovation. Significant support was given to the Zebra battery project.

In the restructuring of the CSIR, the rationalised new division has brought powerful consolidation in areas such as polymers, ceramics, composites and tribology. This consolidation has also taken place in materials applications in the mining sector, since the old Mine Equipment Research Unit based at Cottesloe in Johannesburg is included.

Today the technology market is global, and the process for generating new technology and getting it into use has become faster-paced and much more varied and competitive. The division is sensitive to and stimulated by this changing environment, seeing in it both opportunity and challenge.

G.G. Garrett,
PhD Pr Eng
Geoffrey Graham Garrett (40) became Professor of Physical and Fabrication Metallurgy in the Department of Metallurgy and Materials at the University of the Witwatersrand in 1980. Previously he had carried out research at universities in the US and Canada, and the year after obtaining his professorship was Visiting Professor at the University of Sheffield in the UK.

With numerous publications to his credit, primarily in the area of the fracture of materials, he has been a council member of the South African Institute of Mining and Metallurgy and South African Institute of Welding, and is a past chairman of the Institution of Metallurgists (South African region). He is honorary director of the Wits fracture research group and alloy development research programme.

Married with four sons, he obtained his first degree at Cambridge, where he was also a boxing Blue.

MICROELECTRONICS AND COMMUNICATIONS TECHNOLOGY

This division is composed of groups from a number of former CSIR institutes – merged in order to focus on electronic, communication and information technology. Products and services comprise electronic materials, components and systems and also revolve around the areas of design, information and specialist training.

Within this field, the division aims to concentrate on the development and implementation of technology on behalf of the private and public sectors. In providing the client with working solutions, it carries concepts through all the way to final implementation. Facilities for smallscale production runs are available, and the division has considerable expertise in this area – in particular, niche products are developed for import replacement and potential opportunities in world markets.

Technological developments during the past year included the successful design and testing of a revolutionary detonator integrated circuit. In this device, the detonation element and localised intelligence are integrated in a single chip, which dramatically improves accuracy, control and safety. Given that close on 1-million detonations occur daily in South Africa alone, the market potential for this technology is enormous. Patent rights have been secured in 13 countries jointly with a commercial company, which will also industrialise and market the technology.

Other highlights during 1987 included

- low-cost integrated circuits for surge protection of telephone systems during lightning strikes
- gallium arsenide (GaAs) single crystal material which is comparable to the best in the world
- mercury cadmium telluride single-crystal wafers of suitably high quality for infra-red sensing devices.

At present, the division is co-operating with a manufacturer in the marketing of a unique radio positioning system with an accuracy of a few hundred metres, which should be available to users at relatively low cost. The division is also entering the high-complexity, high-performance component field via both silicon and GaAs. The latter material will, furthermore, serve as a basis for entering the opto-electronic field.

As far as the immediate future is concerned, the division intends to build on its recognised strengths in the areas of vacuum tube, microwave and electro-optic components by extending its services to the private sector. The design, development and implementation of high-performance computer and data communications systems will be another priority area. Finally, the division will continue its well established services in the areas of specialised microwave systems for the private sector, as well as electromagnetic testing, the dissemination of satellite-derived environmental information, and high-technology prestudies.

Microelectronics is a highly capital-intensive field, but if markets are fully exploited the returns may be very high. Therefore, a particular objective is to significantly raise the division's contract income, which is already as high as 50 to 60 percent in certain areas.

J.R. Ahlers,
BSc (Eng), SMEE (MIT)
Johann Robert Ahlers (31) joined the CSIR in 1987 after working since 1980 for ESD (Pty) Ltd (formerly Marconi SA), a company in the Reunert group specialising in electronics. He spent the years 1984 and 1985 at the Massachussetts Institute of Technology, presenting a thesis on the design of nonlinear LOG/LTR controllers via inverse describing function techniques.

On his return to South Africa, he became senior specialist: control systems at ESD, and during the first half of 1987 was also guest lecturer to the University of Pretoria's post-graduate classes on stochastic control.

Married with one daughter, he obtained his first degree at the University of Pretoria.

PROCESSING AND CHEMICAL MANUFACTURING TECHNOLOGY

This division is made up of the National Timber Research Institute, the SA Wool and Textile Research Institute, the Laboratory for Molecular and Cell Biology (a CSIR laboratory at Wits University) and parts of the National Chemical Research Laboratory and the National Institute for Chemical Engineering Research.

Two different directions of its work can be clearly distinguished: processing of natural resources such as timber and wool, and chemical manufacturing technology for products such as pulp and paper, adhesives, speciality chemicals, etc.

The division has the scope to serve South African industries producing 37 percent of South Africa's gross national product.

During the past year the division received the National Productivity Institute Award for its development and implementation in industry of a two-component tannin adhesive for finger-joints.

Another achievement was the first heavy duty wood preservative developed worldwide since 1937 – a non-toxic derivative of DNBP.

A paper strengthener was developed from hemicellulose, a waste product from the chemical pulping of bagasse fibre.

The division's research and development programmes are: renewable resources chemicals; timber processing; speciality chemicals and chemical processes; organic materials protection, protective chemicals and biotechnological products and processes; adhesives, resins, natural polymers and custom synthesis; pulp, paper and cellulose; textile processing; and analytical services and industrial waste management.

A. Pizzi, PhD
Antonio Pizzi (41) is best-known for his work on the development and refinement of tannin-based adhesives for the particleboard, plywood, glulam and finger-jointing industries. He is a co-winner of two awards of the US Forest Products Research Society.

A member of the South African Chemical Institute, he is a Fellow of the International Academy of Wood Science. Author or co-author of more than 250 publications, he is a member of the advisory board of editors of the Journal of Wood Chemistry and Technology based in the US and of the International Journal of Adhesion and Adhesives based in the UK.

He joined the National Timber Research Institute in 1976 and the following year became head of its wood chemistry division. He was appointed chief director of the NTRI in 1984.

Married with four children, he is a graduate of the Universities of Rome, Orange Free State and Stellenbosch.

PRODUCTION TECHNOLOGY

This division is made up of staff from the National Physical Research Laboratory, the National Mechanical Engineering Research Institute and the National Electrical Engineering Research Institute.

It is at present one of the CSIR's smaller divisions but is seen as having enormous growth potential. Some of that growth will flow from a 2kW continuous wave CO_2 laser system already partially developed and from providing a metrology infrastructure for fibre optics in South Africa.

High power (multi-kilowatt) lasers are relatively new in South African industry, though now fairly widely used overseas for cutting, welding and surface treating. The laser developed by the division delivered outputs of 1,5 kW routinely during its first trial runs and final optimisation procedures were being carried out towards the end of the year.

Not only can the division now offer hands-on advice about laser applications, but local manufacture of the system is a possibility, as most of the technical stumbling blocks have been investigated and cleared. All components except the vacuum pumps, and all design work, were local.

As optical fibre is now being manufactured in South Africa and widely used in telecommunication, there is an urgent need for the appropriate metrological system to protect a huge investment in instrumentation. National measuring standards are also required to ensure compliance with specifications and reduce the possibility of expensive disputes between suppliers and customers.

Work is in progress on characterising a standard 40 km fibre, to allow calibration of the distance and attenuation scales of single-mode optical time domain reflectometers. Established standards are compared regularly with those in use in other countries.

A signal achievement during the year, by the old National Electrical Engineering Research Institute, was the development of the Otis Elevator Data Logger. This enables the company to evaluate the performance of multi-elevator systems in large buildings.

The logger – monitoring time taken to respond to calls, total calls and number of door operations among other things – is modular, portable and allows a certain amount of data processing to be done on site. Input voltages may vary.

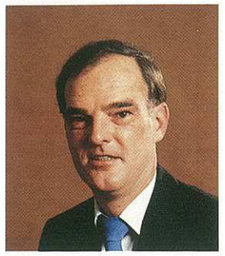
The Institute's Industrial Technology Group won the Design Institute/Shell Design Award for its basic data logger – of which the Otis Elevator Data Logger is a variant. Other uses are in water quality and hydrological monitoring, meteorological data capture, lightning and irrigation research, solar panel evaluation and an automatic electroplating line.

About 40 of the units have been produced.

The division has identified these 10 programme areas for its work: industrial instrumentation and control; optical engineering; engineering metrology; electromagnetic and particle metrology; manufactur-

ing systems (including advanced machining and low-level automation); industrial training; laser technology; energy conversion and transmission; photonics; and system evaluation and special product design.

It is confident of further breakthroughs to help manufacturing industry.



M. McDowell, PhD
Maurice McDowell (42) joined the National Physical Research Laboratory in 1971 to establish its optical design and evaluation facility. This facility now ranks as one of the most sophisticated in the world outside the USA.

A founder member of the South African Optical Society and its chairman from 1982 to 1984, Dr McDowell is the author of more than a hundred research papers, articles and reports. He was awarded the Coleman Memorial Award of the Institute of Physics and the Royal Photographic Society of Great Britain for his skill as an optical designer and as successful organiser of the International Congress on High Speed Photography in 1986.

Married, with two sons and a daughter, he is a graduate of Queen's University, Belfast.

ROADS AND TRANSPORT TECHNOLOGY

The division undertakes research into the planning, design, construction and maintenance of roads and transportation systems. A multi-disciplinary approach aims at promoting safe and efficient transportation of goods and people throughout Southern Africa by providing cost-effective, innovative and practical solutions to transportation problems.

Target markets are the national and regional transport and road authorities as well as the motor vehicle industry and transport contractors. The division provides a forum for interest groups in the transportation industry, as well as specialist services in the fields of motoring, testing and consulting on a contractual basis.

In 1987 the division generated 98 percent of its own revenue.

A major focus of the division's work during 1987 was transportation in developing areas of Southern Africa, a subject receiving increasing attention and on which our publication "Transportation research – Focus on development" provides information. The promotion of an efficient and cost-effective transportation infrastructure has social and economic benefits for the population in both urban and rural developing areas.

In South Africa more than R120-million a year is spent to seal and overlay cracked pavements and part of this expenditure can be invalidated if cracks reflect through the overlay. The Crack Activity Meter (CAM) was developed by the division to measure load-associated crack movement in the field. The CAM service was used during 1987 by the Department of Transport and other road authorities to assist in the rehabilitation design of roads. Its use will bring considerable savings in this field.

As well as continuing to address the needs of current clients, the division will focus on the transportation needs of the private sector, and will become more involved in technology transfer and research implementation.

C.R. Freeme, PhD
Charles Richard Freeme (48), joined the National Institute for Transport and Road Research in 1961, and earned his PhD (Natal) in 1971 for his work on the fatigue of thin bituminous surfacings. He became head of the roads branch in 1987.

He is a fellow of the Engineers Association of South Africa, a member of the American Transportation Research Board's Flexible Pavement Committee. He also serves on the Technical Advisory Committee of the Sixth Annual Conference on the Structural Design of Asphalt Pavements.

Awards he has received include the CAPSA Award of the Conference on Asphalt Pavements for South Africa in 1984, and the SABTA Award of the Southern African Bitumen and Tar Association for a paper entitled "The value of asphalt in the 1990s" in 1987. His and his team's research on accelerated testing using the Heavy Vehicle Simulator won the SAICE Award of the South African Institution of Civil Engineers in 1985.

Dr Freeme is a graduate of the Universities of Cape Town and Natal, is married and has three grown-up daughters.

WATER TECHNOLOGY

This division focuses on research into South Africa's most limiting natural resource, water. It provides research and technology useful to all who supply and use water, and its vast range of services impacts on a wide cross-section of industry.

In 1987, 27 percent of its R13-million income was derived from public and private sector clients, including government departments, local authorities, municipalities, water boards, funding bodies, industries, mines and consultants. Additional staff from the fluid mechanics division of the National Mechanical Engineering Research Institute and the Laboratory for Molecular and Cell Biology brought its total staff complement to 216.

Nine former research divisions have been restructured into 13 programmes directed at the satisfaction of specific market needs. Research, as well as technology development and transfer, is done in areas such as:

- appropriate technology to ensure a safe water supply for small communities (with emphasis on Third World situations)
- aquaculture
- water care advisory services for developing states
- analytical services
- process development (both physical-chemical and biological treatment processes)
- solid wastes and concentrated effluents
- catchment management
- health aspects
- biofouling
- groundwater
- estuaries and coastal processes

A product development programme is concerned on the one hand with the commercialisation of products developed internally in response to market needs and on the other with technological refinement and optimisation of external products in collaboration with industrial partners.

One such industrial partner, Control Chemicals, having developed an automatic, in-line continuous chlorinator operating on replaceable cartridges containing chemical disinfectants, asked for it to be improved. Within three months, changes leading to an operationally better product could be incorporated.

During 1987 a user-friendly decision support system, simulating the effects of over-enrichment of dams with phosphate, was completed for the Department of Water Affairs. This is now being applied to predict the impact of imposing a phosphate standard on effluents discharged into a river. Where the impact is found to be insignificant, exemption from the standard may mean a local authority can save millions of rand in sewage treatment.

An electro-dialysis system for treating effluents with high salt loads will scale down the number of evaporation pans which Sasol Fertilisers (Pty) Ltd. presently requires for effluent treatment.

Defluoridation techniques were worked out for areas with a high concentration of fluoride and a smallscale unit for household use designed for commercialisation by Portals Water Treatment (Pty) Ltd. A new organic carbon analyser was developed, which can be used to minimise the cost of effluent discharges.

Activated carbon technology and low-cost chemical dosing techniques will be developed further in the coming year, while in the process development area significant technological headway is expected for recovery of energy, water and chemicals from waste streams.

Assistance to local authorities in their decision-making on water usage and environmental pollution will be stepped up.

D.F. Toerien, DSc
Danie Francois Toerien (47) is a former director of the Institute for Environmental Sciences at the University of the Orange Free State, a post he took up after an early career in the National Institute for Water Research and two years at the University of California in Berkeley. He became chief director of the National Institute for Water Research in 1984.

Author and co-author of about 100 publications on water research, he is South Africa's representative on the International Committee on Microbial Ecology, of whose executive he has been a member from 1984 to the present. A former president of the Limnological Society of Southern Africa, he is currently the president of the South African Society for Microbiology and a member of the council of the Water Institute of Southern Africa.

Married, he has two daughters. He is a graduate of the University of Pretoria.

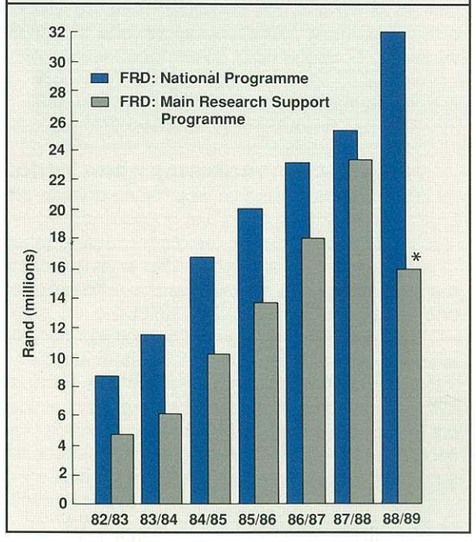
FOUNDATION FOR RESEARCH DEVELOPMENT

For the Foundation for Research Development (FRD), 1987 proved the validity of a strategy begun in 1984, while new challenges to be met in co-operation with universities, museums and technikons were delineated.

Since its founding more than 40 years ago, the CSIR has made a great contribution towards the research efforts of South African universities. This has been done through the funding of research in the natural applied sciences and engineering, and through post-graduate and engineering bursary awards – using approaches developed in close collaboration with the universities.

The contribution remains based on the belief that science and engineering in South Africa must have the financial resources to remain at the leading edge of discoveries and to produce the scientific and technical personnel the country needs. Essential at any time to maintain South Africa's industrial and agricultural competitiveness, these two objectives are even more important in times of progressive academic and economic isolation and must be funded even in times of financial stringency.

FOUNDATION FOR RESEARCH DEVELOPMENT GROWTH OF FUNDS



* The Energy and Microelectronics Programmes are no longer the responsibility of Foundation for Research Development (see page 24).

FRD's basic purpose of supporting the research of individual scientists and strengthening people entrusted with research leadership, is carried out through its Main Research Support Programme – a full report on which appears on the next page. This provides support for global expenses, employment of research staff, acquisition of better equipment and international travel. In addition there are bursaries, assistantships, fellowships and postdoctoral awards.

R.R. Arndt, DSc MBA, Sci Nat Reinhard Richard Arndt has concentrated on research into the structure and synthesis of natural products. In the Sixties he was project leader of an investigation into South African flora as a source of useful pharmaceutical chemical compounds after having joined the National Chemical Research Laboratory's organic section in 1955.

He became the Rand Afrikaans University's first Professor of Chemistry in 1967 and in 1979 Professor of Organic Chemistry at the University of Stellenbosch. Between 1975 and 1979 he also served as research director of the pharmaceutical company Adcock Ingram.

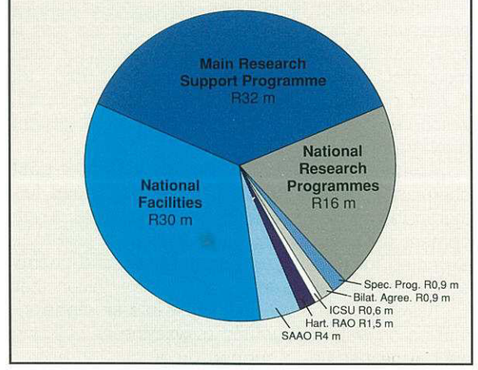
He was appointed a deputy president of the CSIR in 1981.

In 1959, Dr Arndt was a post-doctoral bursar in the laboratories of the National Research Council, Ottawa, Canada, and in 1964 worked as a research associate at Stanford University, California. In 1972, with the aid of an Ernest Oppenheimer Memorial Trust stipendium, he undertook research at the ETH, Zurich, and in 1978 was a visiting professor at Cambridge on a British Council award.

Author of more than 30 research publications, he is a past president of the SA Chemical Institute, the current chairman of the SA Akademie vir Wetenskap en Kuns, and a member of the South African Council for Education.

Married, he has four daughters.

HOW FOUNDATION FOR RESEARCH DEVELOPMENT'S FUNDS ARE SPENT



awards.

Research efforts often need a cooperative approach, since research fields have been widening even as universities have established and expanded their research capability with thinly-spread scientific manpower. FRD's National Programmes, also reported on in full below, are the umbrellas for collaboration between the CSIR, other research councils, universities, technikons, government departments and industry – particularly in addressing identified national problems. Two or more Programmes may fall under the same manager, and on the following pages a profile of the responsible managers follows each Programme or group of Programmes.

Mindful of the large gaps in the research capabilities of the younger universities, FRD has instituted a special programme for the development of research at these institutions. And together with the technikons, which are in the process of developing a research base, it is studying their specialised requirements (see next page).

The coming year should see the first steps taken to set up a national computer network for scientific research. The project is being tackled in co-operation with universities, the Human Sciences Research Council, and the Council for Medical Research.

In November 1986 FRD took over responsibility for the South African ICSU secretariat and for bilateral scientific exchange agreements. From April 1988, the management of three national scientific facilities – the National Accelerator Centre, the South African Astronomical Observatory and the Radio Astronomy Observatory – will fall under FRD's management.

Occupation of the FRD building at the main gate of the CSIR towards the end of 1988 is certain to help the foundation to strengthen its own identity in South Africa's scientific community. It hopes that the building will give further expression to the concept of a "clubhouse of scientific excellence" which is its driving motive.

Research Support Programmes

MAIN RESEARCH SUPPORT PROGRAMME

The low rate of publication by their scientists from the Fifties onwards could carry an interpretation that universities focused less on research achievement and more on teaching ability and other factors in making their promotions. Even when staff were engaged in research, the lack of comparative statistics and a sound basis for the evaluation of researchers removed a great deal of the competitive pressure felt at the typical European or North American university.

This situation was transformed almost overnight in 1984 when the FRD's programme of evaluation and comprehensive grant allocation got under way. Substantial benefits in terms of support posts, travel and running grants became available to the more active researchers and some 37 percent of those selected as qualifiers received support – for competition-engendered excellence.

The value to the country of this development at universities vastly exceeds the relatively small outlay involved – R24-million in the year just past.

Guidelines accepted internationally and a great deal of assistance from the world's scientific community are used in evaluating researchers. Whereas in the past most recipients of FRD postgraduate bursaries were students taking honours degrees, today most are working on master's degrees and the number of doctoral students is increasing rapidly.

The greatest proportional increase in FRD's funding has taken place in the field of engineering research. This results in part from recognition that South African industry will not be able to import as much know-how in this field as was the case in the past. A new strategic support programme in engineering is being launched and initially focusses on process control, telecommunication and advanced materials engineering.

FRD has found that, as the CSIR restructures to meet its reformulated mission, universities have a full appreciation that, more than ever, guardianship of each of the scientific disciplines is passing to them. At the same time, they are aware that they can make a considerable contribution to the practical needs of industry without sacrificing any of their academic responsibility.

It has been rewarding, within the Main Programme, to find that the FRD's President's Awards are gaining enormous prestige as research bursaries and becoming a target which young scientists set for themselves. Ten, totalling R1-million, were awarded during 1987.

Prof D.G. Roux, PhD David Gerhardus Roux (67) led the first definition of "linear"-, "angular"- and "branched"-type tannin oligomers, as well as the first accurate definition of their absolute stereochemistry up to the tetrameric level.

This structural knowledge of tannins – for which Prof Roux's group received international recognition – has been important in developing alternative uses for wattle bark extract. He played a part in the introduction of a starch adhesive for corrugated cardboard, resorci-

nol being replaced by modified wattle-bark extract adhesive as a fortifying agent.

Prof Roux began working at the Leather Industries Research Institute, Grahamstown, in 1947, becoming chief research scientist there in 1963. In 1968 he became Professor of Organic Chemistry at the University of the Orange Free State, being at first joint and from 1980 sole head of the university's chemistry department – which was awarded the CSIR's research unit for flavonoid chemistry in 1970.

He joined FRD as special assistant to Dr Arndt in October 1987 and is now manager of the Main Support Programme.

He has been chairman of the South African Wattle Industry Research Advisory Board since 1967, and a member of the Council of the Royal Society of South Africa since 1981. He has been awarded the Havenga Prize of the Suid-Afrikaanse Akademie vir Wetenskap en Kuns (1969), Gold Medal of the South African Chemical Insitute (1977) and Fellowship of the Royal Society of South Africa (1980).

Prof Roux won the Donald Burton Prize of the British Society of Leather Chemists for the best paper in leather-chemical literature in 1950, and bursary and various stipendia took him to Heidelberg, Cambridge and Harvard Universities in the Fifties and Sixties. Author of 225 papers in international journals, he has also delivered numerous papers at international conferences, including plenary lectures in Honolulu (1979), Munich (1981), Pretoria (1982), Swansea (1983) and Durban (1987).

Married, with four children, he is a graduate of Rhodes University.

TECHNIKON RESEARCH SUPPORT PROGRAMMME

Since 1982 this programme has provided financial assistance for the promotion of implementation-orientated research at technikons, as well as to full-time students and staff who wish to improve their qualifications.

Grants may be towards the cost of capital equipment, running costs or assistantship subsidies. They may also cover the cost of visits to other institutions in South Africa, short overseas visits (including attendance at conferences), or the cost of visits by overseas scientists to South Africa.

Scientists from abroad who will work in South Africa for longer periods may qualify for fellowships.

Bursaries for full-time study are awarded to candidates to obtain the National Higher Diploma, Masters Diploma in Technology, Laureatus in Technology, as well as for research and study abroad.

This programme's budget in 1987/88 was R97 000.

W.J. Weideman

Willem Jacobus Weideman (58) joined the State Advances Recoveries Office in Pretoria in 1948, and became involved inter alia in the administration of bursary loans to ex-servicemen who wished to undertake graduate studies. This interest led to his appointment in the University and Medical Research Division of the CSIR in 1956.

Ever since, he has been instrumental in the development and administration of various awards schemes of the CSIR, becoming head of the University Research Division (for the general sciences) in 1969. Despite chronic shortages of funds, the improved schemes continuously devised have helped materially in building a solid body of active research workers and postgraduate students at universities.

Several of the schemes have been adopted as models by other organisations.

Mr Weideman is an Associate Member of the Transvaal Museum. He is the author of numerous articles on research support and administration.

National Research Programmes

ECOSYSTEMS

Main source of financial support for this programme is the Department of Environment Affairs, with additional support coming from the Water Research Commission and various conservation organisations. The programme is directed at developing the expertise necessary for the solution of a wide diversity of environmental problems, and its total budget in 1987/88 was R3,3-million.

Some highlights of activities during 1987:

• South African participation in the International Geosphere-Biosphere Programme of the International Council of Scientific Unions was launched. The first contribution was a national conference on longterm data series relating to Southern Africa's renewable natural resources, held between October 12-14 in Pretoria. Over 100 researchers from the marine, atmospheric, hydrological and ecological sciences attempted to integrate and compare their knowledge of environmental change in the sub-continent, particularly that recorded over the past 100 years.

• The South African contribution to the Decade of the Tropics Programme of the International Union of Biological Sciences was launched. Activities centred on tropical soil biology and fertility, and the reaction of savannas to stress and disturbance. This programme builds on the expertise developed within the Savanna Ecosystem Project, which has become a world focus of ecological research in semi-arid savanna ecosystems.

• Publication of "The Conservation of South African Rivers", containing guidelines for professional conservationists, managers and planners, followed a workshop. Further workshops covered minimum river flows required by aquatic ecosystems, management of wetlands and support in identifying river priorities. An interdisciplinary study of the Hartbeespoort Dam providing a number of management options was completed, and a programme, now published by the Natal Town and Regional Planning Commission, launched for the Ngeni catchment area.

• The South African Red Data Book – Fishes was republished in a comprehensively revised edition recording change both in the conservation status of the country's freshwater fish species and in current knowledge of them. The text provides background information on species and habitat conservation and resource planning, especially in river systems impacted by development.

• Proceedings of a national synthesis symposium on the ecology of biological invasions were published as "The ecology and management of biological invasions in Southern Africa." The book is the culmination of this country's contribution to an international project of the Scientific Committee on Problems of the Environment. This was set up to draw attention to biological invasions and to formulate environmentally safe and cost-effective control strategies.

• A Working Group on Commercial Veld Flower Resources was appointed in cooperation with the veld flower industry. Its purpose will be to determine how veld flower resources can be used on a sustainable basis, while at the same time the rich diversity of this natural asset is preserved.

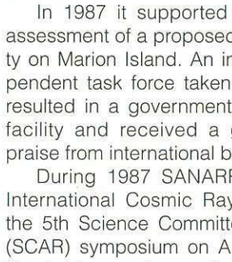
AQUACULTURE

Since its inception in 1985 this programme has gained impetus through numerous workshops and symposia and funding of specific research projects. The proceedings of the 1986 Aquaculture Symposium held at Rand Afrikaans University were published, as well as a document outlining the status of trout farming in South Africa.

Eleven projects mainly concerned with catfish, trout and tilapia were funded and are currently being undertaken at university institutions. A workshop on marron (freshwater crayfish) was convened at Jonkershoek, Stellenbosch, to update conservation policies and regulations.

Numerous workshops and an Aquaculture Symposium, notably to deal with the selection of candidate species of catfish and tilapia, are being planned for 1988.

The programme has facilitated considerable interaction between regulating authorities, entrepreneurs and scientists. Good liaison has been established with the South African Agricultural Union and the Commission for Administration on the topic of a government "lead agency" for aquaculture.



B.J. Huntley, MSc

Brian John Huntley's research has included ecological studies in moist forest (Ngoye, Kwazulu), the sub-Antarctic (Marion Island), the bushveld of the Northern Transvaal and desert to rainforest in Angola.

Since 1976 he has been responsible for the development of cooperative interdisciplinary ecological research programmes in the savanna, fynbos, karoo, grassland and forest ecosystems of South Africa. He has headed the Ecosystem Programmes of FRD since 1980.

He is active in international ecological programmes and is still a member of the International Union for the Conservation of Nature (IUCN), Species Survival Commission and a council member of the Society for Conservation Biology, a major new US-based professional society. He has been a member of the IUCN Commission on National Parks and Protected Areas (1980-1987), the IUCN Programme Review Task Force (1983) and the editorial board of "Science of the Total Environment", an international journal published in the Netherlands (1980-1985).

Married with two children, he is a graduate of the Universities of Natal and Pretoria.

ANTARCTIC RESEARCH

The South African National Antarctic Research Programme (SANARP) had a budget of R2,1-million in 1987/88, provided by the Department of Environment Affairs. The programme comprised 38 projects conducted by 23 research groups at 16 research institutions in SA.

In 1987 it supported an environmental impact assessment of a proposed emergency landing facility on Marion Island. An in-depth report by an independent task force taken to the island in February resulted in a government decision not to build the facility and received a great deal of unsolicited praise from international bodies and researchers.

During 1987 SANARP scientists attended the International Cosmic Ray Conference in Moscow, the 5th Science Committee for Antarctic Research (SCAR) symposium on Antarctic Earth Sciences in Cambridge, and a meeting in Woods Hole, Mass, to plan a new international scientific ocean-drilling initiative in the South Atlantic and the southern oceans.

In the 1987/88 summer season, the programme

has initiated an aeromagnetic research project in two key areas of Western Queen Maud Land. This is also associated with planning for the SCAR Antarctic Geotransect Project in collaboration with scientists from West Germany, Norway and Sweden – for which SANARP scientists attended meetings in Bremerhaven and Cambridge.

The SANARP Southern Ocean Programme, planned and developed during 1986, was implemented in 1987 with research voyages to the Agulhas Retroflection and sub-tropical convergence region, and to the Prince Edward Islands region.

A complete re-planning of the SANARP physical sciences programme was initiated in 1987 and will be completed this year.

OCEANOGRAPHY

The South African National Committee for Oceanographic Research (SANCOR) had a 1987 budget of R3,5-million provided by the Department of Environment Affairs, the CSIR and the Central Energy Fund. It co-ordinates seven major research programmes involving 16 research organisations in studies of the basic structures and processes of the marine environment around South Africa.

The Marine Linefish Programme focused on stock assessment, growth rates, sex reversal and migration patterns of 27 different species to improve the scientific basis of their management. Benguela Ecology Programme studies increased the accuracy with which pelagic fish stocks can be estimated – and a doubling of the anchovy quota for 1987 (processed value R180-R190-million) resulted. The Marine Pollution Programme developed criteria for preserving marine and estuarine water quality and designing well-engineered discharges to minimise impact on human health.

The sensitivity of the hinterdune area has been highlighted by the Coastal Processes Programme, whilst basin-subsidence studies in the Marine Sedimentology Programme provided a means of predicting whether hydrocarbons stored in sedimentary basins off the south coast will be gaseous or in liquid form. SANCOR-supported studies of the Eastern Cape estuaries showed that, provided an estuary mouth remains open, a wide diversity of biological communities can withstand up to five years of low or zero river flow (Estuaries Programme).

The new Ocean Engineering Programme has already achieved significant results on calcareous formations similar to those at the proposed site of the Mossgas platform and on wave/current interactions. One objective of the programme is to ensure that local scientific and engineering communities gain and retain the maximum possible amount of the technology involved in this project.

GEOSCIENCES

The National Geoscience Programme, which had a budget of R774 000 in 1987, focusses on the origins of ore deposits in various geological formations. In the Northern Transvaal studies centred largely on the origin and localisation of gold and emeralds, whereas in the Northern Cape the numerous base metal deposits came under scrutiny.

Research on the distribution and genesis of platinum-group elements in the Bushveld Complex contributed to the recent upswing in exploration for those metals. The effect of various geological parameters on the industrial properties of coal is under study in the Witbank area.

WEATHER, CLIMATE AND ATMOSPHERE

Findings were published on the way in which present-day wet and dry spells of variable duration result from adjustments of general circulation over Southern Africa and elsewhere. Due for publication by the programme, which had a total 1987 budget of R1,4-million, is a comprehensive synthesis of evidence for climatic change in South Africa over the past 125 000 years.

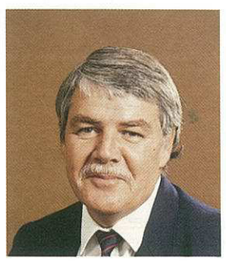
Also being prepared for publication are the findings of collaborative research into air pollution in the Eastern Transvaal Highveld. A longterm study at Cape Point as part of a global measurement programme continues to help assessment of the impact of manmade pollution on the global climate.

Basic studies were begun into the nature and extent of photochemical smog in urban areas and whether it would be worsened by the addition of alcohol to petrol in South Africa. A study of air pollution over Soweto underlined the need for more effective abatement measures.

REMOTE SENSING

This programme co-ordinates research into the use of remote sensing – with particular emphasis on satellite data – to study, monitor and map the natural resources of South Africa. Promising results were obtained in crop estimation, and a forestry map now being completed will be used for forestry planning.

The programme, with a 1987 budget of R650 000, also played an important supporting role in bringing about modernisation of satellite reception at Hartebeesthoek, so that South Africa and its neighbours can benefit from the latest satellites in monitoring natural resources. Several user organisations in the private and public sectors were encouraged to acquire in-house image processing facilities, and training workshops and information sessions were held for the benefit of national and neighbouring states.



O.A. Van der Westhuysen, MSc Ockert André van der Westhuysen (48) worked abroad for the CSIR for a number of years, serving first in its London liaison office and then establishing and running its Paris office between 1968 and

1972. Since then, he has worked for the Science Cooperation Division and the other forerunners of the present FRD.

He first joined the Science Cooperation Division in 1965, after working for a year as a research assistant at the University of Stellenbosch in the field of direct reading methods of determining noble metals.

Married with a son and daughter, he is a graduate of the University of Stellenbosch.

RENEWABLE FEEDSTOCKS

This programme comprises a series of cooperative undertakings of the CSIR, government, industry and university research groups – some of which are independently funded. The programme itself provided R580 000 in 1987.

Some of the undertakings are aimed at developing technology for the production from plant material of industrially important chemicals and other products. Others are aimed at developing expertise which will be important to South Africa in the future. The undertakings involve:

Biological utilisation of bagasse. Successfully completed in 1987, this programme developed processes to break down the cellulose and hemicellulose components of sugar cane bagasse to fermentable sugars, using enzymatic hydrolysis of the cellulose. Participants were the CSIR, the Sugar Milling Research Institute, 13 university research groups and advisers from industry.

The processes with the greatest economic potential were the production of ethanol from furfural factory residue and yeast protein from the hemicelluloses. Developed at a total cost of R927 000 between 1980 and 1987, they are now being considered by the sugar industry.

Guayule. The aim is a local source of natural rubber – of which 30 000 tons are imported each year – from this plant, which could be grown in marginal agricultural areas. In the first phase of the programme (1979-87), participants have been six university research groups, the Department of Agriculture and Water Supply, the governments of Bophuthatswana and Lebowa and the rubber manufacturing industry.

Seed of different cultivars has been successfully established, potential growing areas determined and promising preliminary yield data obtained. Research has helped to elucidate the metabolic pathways by which rubber is synthesized in the plant – and the role therein of stress factors such as drought and cold. In the second phase, the focus is on producing enough seed for a pilot development, and producing definitive cost and yield data.

Plant cell suspension culture. This technology is fundamental to modern plant research, agricultural breeding practice and industrial production of plant-derived chemicals. It has so far been successfully established in three university research groups in collaboration with the Department of Agriculture and Water Supply, and eight students are receiving advanced training.

BIOTECHNOLOGY TRAINING

This programme provides R250 000 each year for studentships, research and organisation of specialised courses in advanced biotechnology. Six university research groups and one in the Department of Agriculture and Water Supply focus on such topics as recombinant DNA technology for bacteria, virusses, yeasts, and animal and plant cells. Eighteen students have been awarded advanced degrees, and the facilities for post-doctoral work have induced several not to seek careers outside South Africa and even to return here.

WASTE MANAGEMENT

This programme, carried out on behalf of the Department of Environment Affairs, involves a large number of CSIR and university research groups, as well as government, local government and both the chemical and waste management industries. Many of the participants carry their own expenses and the programme itself provided R1,2-million in 1987.

Disposal and leachate management. To prevent the long-term pollution of groundwater resources, methods have been developed to monitor, follow and model leachate plumes underground, both in the attenuation zone and the water table. Successfully tested during 1987, these will make it possible to improve disposal site design, locate leaks and anaerobic areas, and predict chemical reactions.

Urban wastes. A major concern in urban waste management is to reduce costs, so that local authorities – particularly newly-established ones – can deal effectively with wastes resulting from rapid urbanisation. Models have been developed for the prediction of generation rates and comparison of planning options – such as staged transport and transfer sites and regionally-integrated disposal.

Chemical and hazardous wastes. Several projects on the utilisation of chemical wastes are in progress – and one is yielding results of considerable economic importance to agriculture. Field trials demonstrate that maize and lucerne show spectacular improvements in root development when treated with waste phosphogypsum. They also show that such treatment is better than any other for treating acidic soils giving low yields as a result of aluminium toxicity.

Pulverised fuel ash. This intensive cooperative programme is to find economic uses for coal ash and change it from a serious environmental problem to a useful resource. Some 25-million tons of the ash were generated in South Africa in 1987 and this is expected to grow to 35-million in 1997. So far, the greatest success has been in using the ash as a cement extender in cement and concrete applications. Fly ash in concrete sleepers is being commercialised and the ash could bring savings in the

Lesotho Highlands Water Scheme.

Organic waste. Several organic wastes present serious environmental problems and a technique using earthworms to produce compost from them is emerging. Current research could make commercialisation feasible in the near future.

R.G. Noble, PhD
The research work of Robert Graham Noble (51) has covered mainly the environmental tolerances of ephemeropterans, fish and other aquatic animals to explain their distribution, observed events like mass mortalities, and the effects of pollution. It has also covered the physiological effects of environmental stress on aquatic animals and statistics of limnological sampling.

Winner last year of the Gold Medal of the Limnological Society of Southern Africa, he began his career in the National Institute for Water Research in 1960. He became general manager of the CSIR's Cooperative Programmes in 1978 and a manager in FRD at its formation in 1984.

From 1973 to 1978, he was a member of the executive committee of the ICSU Scientific Committee on Problems of the Environment (SCOPE). He is a member of the Commission on Ecology of the International Union for the Conservation of Nature and Natural Resources and since 1980 has been chairman of its Inland Water Ecosystems Working Group.

Married with two daughters and a son, he is a graduate of the University of Cape Town.

MICROELECTRONICS

Microelectronics is a foundation technology in the electronics industry, and since the inception of this programme in 1983 its strategy has been to complement ongoing research. It strengthens research quality and addresses key issues which will create capabilities likely to be needed by local industry.

A need is apparent for a technical foundation to concentrate scarce resources.

During 1987 a small group of international experts in the field were invited to South Africa to assess the situation. Their main recommendation centres on the lack of training in microelectronics towards the PhD level, and on the need for a closer association with the local microelectronics industry.

The CSIR executive has agreed to a revised microelectronics activity in which training of high-level manpower will be the responsibility of FRD. The lead programmes in FRD's activity are now being drawn up.

During 1987 R1,49-million was allocated to 37 projects and a further R1,47-million to major capital equipment for 24 research groups at 10 laboratories.

ENERGY

Energy management and co-ordination in South Africa enters a new era in 1988 as the new National Energy Council established in terms of the White Paper on Energy takes over the State's and FRD's activities in the field. This is the last time, therefore, that FRD will report on its National Programme for Energy Research. The aim of this programme was to use co-ordinated R&D to reduce the country's dependence on imported energy sources and to promote the efficient use of energy both directly and indirectly. Its different components focused on coal, liquid fuels, energy efficiency, renewable energy sources, energy for developing areas, and information and future energy needs.

Coal. Research at two universities led to the building of pilot plants at two coal mines to upgrade coal fines resulting from mechanised mining. Only the difficult international market has delayed the building of a fullscale plant.

R&D on coal for local consumption produced Natal University's Judd-gasifier which converts both fine and coarse coal to synthesis-gas without the need for an oxygen plant. A new development is the coupling of this gasifier to the production of both liquid fuel and electricity (via Multiple Cycle Generation) – making coal use 50 percent more efficient. Local and overseas partners are being sought to give South Africa a technological edge.

Liquid fuels. Research centred on ethanol, methanol and the phenomenon of "high speed knock" in engines. Particularly important was the inauguration of a laser-based apparatus for analysing fuel-combustion which will enable researchers to study dynamic temperature measurements and chemical concentrations in combustion chambers.

Efficiency in energy use. Eighteen papers were delivered in March at the first conference of participants in the energy efficiency programme, which was launched only in 1984. It's estimated that some R100-million is spent each year by industry on drying – mainly hot-air – processes, and that efficiency could be improved by 50 percent. As far as offices are concerned, computer simulation of thermal processes shows that proper design can ensure comfortable conditions and proper lighting in north-facing ones though the south-facing will require heating.

Renewable energy sources. A preliminary survey showed that a considerable market for solar cells exists, provided their cost continues to fall as expected. To meet the need for accessible design data, microcomputer-based sunshine and wind atlases are being drawn up.

Energy for developing areas. In identifying priorities and problem-areas, it was discovered that the low-cost, energy-efficient woodstove that was developed has a durability and acceptance problem. Now being tried are a "do-it-yourself" cast-iron plate and hearth with which users can build their own

Foundation
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stoves using brick and clay as additional materials.

Completed during the year were studies on the role of water pumps of various kinds in developing areas and on the provision of electricity – the latter based on the electrification of Soweto.

The energy economy and projection. A study has shown that South Africa's high energy use per rand of the Gross National Product, in comparison with similar countries, is due to such factors as the structure of industry, and availability and cost of local energy sources. Energy modelling has reached the point where net energy consumption as a factor of future economic activity can be conveniently and reasonably accurately estimated.

G.P.N. Venter DSc
Gert Petrus Nicolaas Venter (44) devoted 15 years to research in pollution physics and boundary layer meteorology related to atmospheric diffusion, plume behaviour, micro and mesometeorology, and atmospheric fluid dynamics. From 1976 to 1980 he guided the development of the CSIR's Air Pollution Research Group, of which he was earlier research officer and chief physicist.

In 1981 he became manager of FRD's National Programme for Energy Research. He will soon be moving to the National Energy Council, where his managerial responsibilities will broaden and be related to coal, electricity and the use of energy.

He was a member of the council of the National Association for Clean Air from 1977 to 1984 and president in 1981 and 1982. A member of the committee which organised the international conferences on air pollution in Pretoria in 1979 and 1984, he continues to be a member of the National Air Pollution and Coal Research Advisory Committees, among others.

In the 1970s, he studied at Goethe University in West Germany on an exchange fellowship, and at the Von Kärmän Institute of Fluid Dynamics in Belgium and Colorado State University University in the US.

Married, he has two children, and is a graduate of the University of Pretoria.

National Facilities

HARTEBEESTHOEK RADIO ASTRONOMY OBSERVATORY

The observatory (HartRAO) is a national facility for astronomical research at radio wavelengths. Established in 1975 as a division of the National Institute for Telecommunications Research, it operates a 26m radio telescope equipped with receivers for major astronomy bands between 2,5 and 18cm wavelengths.

Now under the management of FRD, HartRAO will continue to provide research facilities for astronomers in the universities and will cooperate in a variety of international projects. There will be a core programme to address relevant problems in astronomy and astrophysics and the techniques of radio astronomy will be applied to appropriate fields of research such as geodesy.

A supporting programme will ensure that the facilities are maintained and developed for frontier astronomical research at radio wavelengths.

During 1987, the department of physics and electronics at Rhodes University used its allocation of 20 percent of telescope time to continue mapping the southern sky at a wavelength of 13cm.

International cooperative projects continued to play a central role in activities. Principal among them is the application of the technique of very long baseline interferometry, or VLBI, in which global networks of radio telescopes resolve details in astronomical objects on an angular scale of 0,001 arc seconds. VLBI observations between HartRAO and Australia of a prompt radio flare from Supernova 1987A in the Large Magellanic Cloud, five days after the explosion, showed that the source was larger than 0,0025 arc seconds.

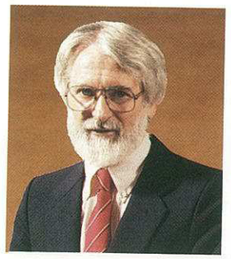
Baselines connecting HartRAO to various telescopes in Europe and the USA were re-determined with an accuracy of 5cm. This is the first time that this accuracy has been achieved for a station in the southern hemisphere and establishes Hartebeesthoek as the most precise reference point in Southern Africa. Geodesists and oceanographers now have the means to link local tide guages into a globally referenced network with consequent improvements in the monitoring of ocean levels.

Other programmes made use of the catalogues of far infrared objects produced by the Infrared Astronomy Satellite to search for hydroxyl masers in circumstellar shells. A new receiver was developed to study recently discovered methanol masers at 12,2 GHz. Nine new masers were discovered.

Long-term monitoring programmes include observation of 31 pulsars at 10-day intervals to determine rotational behaviour of associated neutron stars.

In 1988, HartRAO will undergo a major restructuring to meet the needs of local and international users. A permanent MarK III VLBI recording terminal is planned which will allow geodetic observations to be uniformly spread over the year – and possible

seasonal effects eliminated.



G.D. Nicolson, PhD
The field of research of George Duncan Nicolson (49) is radio emission from x-ray binaries, quasars and active galaxies and the application of very long baseline interferometry (VLBI) in astronomy and geophysics.

He has been head of the Hartebeesthoek Radio Astronomy Observatory since its founding after NASA closed its Deep Space Station on the site in 1975, having been a full-time astronomer at Hartebeesthoek since 1965. He has thus led development of the 26m antenna and associated equipment into a national facility for South African astronomers which is also participant in global VLBI networks of radiotelescopes.

After graduating BSc at Wits he joined the National Institute for Telecommunications Research in 1960 and spent a year at the NASA Minitrack Satellite Tracking Station at Esselen Park, Transvaal, before transferring to the Deep Space Station. In addition to responsibility for the antenna, he had the brief to develop a local research programme in radio astronomy.

This led to a "Survey of Southern Galactic Radiation at 960 MHz", for which he received an MSc (Eng), later receiving a PhD for a thesis on "The Spectrum and Variability of Extragalactic Radio Sources". Between 1970 and 1974, he took part in the first Southern Hemisphere experiments with Australia using VLBI and used the results to study the nuclear regions of quasars.

Married, he has two sons.

NATIONAL ACCELERATOR CENTRE

After a design-and-building phase which lasted about 10 years, the new 200 MeV separated-sector cyclotron at Faure, Cape, was taken into regular use in February 1987 as one of the country's most important scientific and medical facilities.

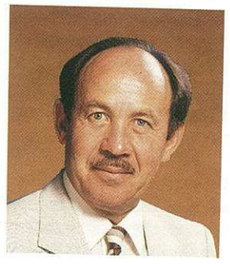
In the ensuing 11 months of day-and-night operation the locally made accelerator has thoroughly proved its dependability and reliability. Beam availability has compared favourably with that achieved by any of the world's other large cyclotrons in the first year of operation. The cyclotron has already performed at full design energy (200 MeV for protons) and maximum beam intensity (100 uA protons under 100 MeV).

Each of the three main groups of users has been able to take advantage of the availability of accelerator beams. A variety of physics experiments with protons and alpha particles at energies between 40 and 200 MeV have already been carried out. The neutron therapy facility for the treatment of cancer has been completed and since mid-1987 has been regularly used for calibration studies and radiobiological tests, a pre-requisite for treatment of patients. In addition, the new cyclotron has produced its first radioisotopes of several different kinds. One of these, the ^{123}I, has already been delivered to the Tygerberg Hospital and used in diagnostic studies.

While the separated-sector cyclotron has been in regular operation, good progress has been made in designing and building of further accessory equipment. This includes the second injector cyclotron, a magnet spectrometer, a beam swinger for neutron experiments and the facilities for routine production of radioisotopes.

The Centre's Van de Graaff accelerator at Faure was again used regularly during 1987 by a large number of users tackling a wide variety of projects. The Pretoria cyclotron continued to provide radioisotopes for nuclear medicine to the country's large hospitals and was also used for radiobiological and biophysical studies with fast neutrons. It is expected that this cyclotron, which has been in use for more than 30 years, will be shut down at the end of 1988 – when the new cyclotron at Faure should be in a position to provide the same (and other) radioisotopes.

The NAC hopes that, during 1988, it will be able not only to provide reliable beams to users but also to make progress with the incomplete facilities already mentioned and with training of scientists and technologists. In addition it hopes to give attention to applications – such as the use of proton beams for cancer therapy – which have had to be postponed because of limited manpower.



D. Reitmann,
DSc D. Phil, Sci Nat
Daniel Reitmann (53) proceeded to a DSc at the University of the OFS and then continued his studies at the University of Oxford, where a D. Phil was awarded to him at the end of 1961. He then moved to Argonne National Laboratory in Illinois, USA, for two years of postdoctoral training.

Returning to South Africa at the end of 1963, he joined the staff of the Atomic Energy Board, where his research involved the use of a Van de Graaff accelerator for studies in nuclear structure and nuclear reactions at low energies. In 1969 he became deputy director of the AEB's physics division responsible for the experimental nuclear physics and plasma physics groups.

In 1980 he was appointed director of the National Accelerator Centre at Faure.

He has been a council member of the SA Institute of Physics since 1969 and was president from 1979 to 1983. He was a council member of the Joint Council of Scientific Societies from 1970 to 1980 and president in 1975-76. He was also a member of the national committee of the International Union of Pure and Applied Physics from 1975 to 1983 and again from 1985.

He has been a council member of the SA Council of Natural Scientists since 1982, as well as member of its executive committee and chairman of the Professional Advisory Committee for Physical Sciences. He has been a member of the Nuclear Safety Council since 1986.

Dr Reitmann has authored some 50 papers in international scientific journals and also a number of popular articles.

He is married and has two daughters and a son.

SOUTH AFRICAN ASTRONOMICAL OBSERVATORY

The processes at work in supernovae are of importance to nuclear and particle physics and the study of highly condensed matter, as well as being central to problems in astrophysics and cosmology. For this reason, observations of Supernova 1987A in the Large Magellanic Cloud, the brightest supernova for nearly 400 years, have excited great interest in the international scientific community.

The geographical position of the South African Astronomical Observatory (SAAO) at Sutherland, Cape, as well as its equipment and the local climate, have enabled it to make a major contribution to the study of this object. In particular, it has obtained a much more extensive set of observations of the light variations of the supernova, at a wide range of optical and infrared wavelengths, than has been possible elsewhere.

Among the direct results of this work is the striking verification of the theoretical prediction that the late stages of supernova evolution are powered by radioactive heating from the unstable nucleus ^{56}Co.

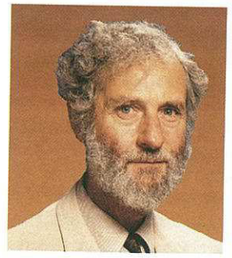
Further study of the supernova will certainly consume much more of the time and energy enthusiastically devoted by both the observatory's own staff and visiting scientists, in 1988.

Another success in 1987 was the cooperation of SAAO staff and visiting astronomers in obtaining the most complete record ever of grain information and dispersal in nova ejecta. For this programme, simultaneous far ultraviolet, optical and infrared data was yielded by SAAO, the Anglo-Australian Observatory, the European Southern Observatory and the International Ultraviolet Explorer satellite IUE.

Other cooperative work has involved astronomers of the University of Leicester, as well as a group of eight British and American astronomers studying the distribution in space and in velocity of elliptical galaxies. SAAO made 660 of the nearly 2 000 photometric measures needed for the latter study.

In work with American astronomers to investigate the structure of our galaxy, new planetary nebulae have been discovered and studied in the region of the central Bulge.

The rapid advance of modern astronomy means that if SAAO, and South African astronomy generally, is to remain a major force in this science internationally, a large new telescope will be needed in the near future. This will naturally also play a valuable training role in the important scientific discipline of astronomy.



Prof M.W. Feast, PhD
The main fields of interest of Michael William Feast (61) are the structure and dynamics of our galaxy, the Magellanic Clouds, galactic and extragalactic distance scales and the late stages of stellar evolution and variable stars. He has more than 200 publications to his name.

He joined South African Astronomical Observatory in 1974 and became its director in 1977, after working at the Radcliffe Observatory in Pretoria from 1952 to 1974. In 1949 and 1951 he was a Postdoctoral Fellow of the National Research Council of Canada in Ottawa.

He has been chairman of the International Astronomical Union's working group on Magellanic Clouds since 1979. He was a vice-president of the IAU and member of its executive from 1979 to 1985 and earlier had been president of its commissions on both stellar spectra and variable stars.

Awarded the Gill Medal of the Astronomical Society of Southern Africa in 1983 – in which year he also became honorary professor at the University of Cape Town – he became a Fellow of the Royal Society of South Africa in 1982. He was a Fellow of the Royal Astronomical Society until 1980, when he became an Associate (ie Honorary Foreign Fellow).

Married, he has three children studying at the University of Cape Town.

International Scientific Liaison

INTERNATIONAL FELLOWSHIP SCHEME

The aim of this programme is to invite to South Africa:

- scientists and engineers who are opinion-formers and policy-makers for their specialist fields
- highly-trained manpower in specific fields for specified periods
- scientists with special expertise in specified disciplines

Funds are available to hosting bodies other than universities, technikons and museums, and in 1987/88 the programme's budget was R526 000.

A total of 24 leading scientists and engineers from all over the Western world were brought to South Africa during 1987. They made definite contributions to South African science and technology, either by imparting specialist knowledge and skills and cooperating in local projects, or by using their influence to maintain interaction between South African and scientists overseas.

A mission of five South African industrialists which visited the Republic of China produced a comprehensive report on that country's electronics industry and development facilities. The report has been widely distributed in the electronics industry and government.

(Manager: Mr W.J. Weideman – see Technikon Research Support Programme on page 20.)

SOUTH AFRICAN ICSU SECRETARIAT

In the past year 25 South African scientists attended key meetings in 10 countries which dealt with affairs within the International Council of Scientific Union family. Their attendance was arranged by the South African secretariat for ICSU – part of FRD since 1986 – in consultation with the national committees of various scientific bodies.

The secretariat itself also had valuable personal contact with secretariats of many of the ICSU unions in Europe during the year. South Africa is a founder member of ICSU, which was formed in 1931.

Six top-level scientific leaders and policy-makers within the ICSU family visited South Africa during the year to meet scientists at universities and other organisations.

Another development was that the South African Committee for Genetic Experimentation (SAGENE) was reconstituted as a joint venture of the CSIR, the Medical Research Council and the Department of Agriculture and Water Supply. The committee, which has played a sterling stimulatory role in the field of genetic engineering using recombinant DNA techniques, was launched in 1978 as the link with COGENE, the responsible ICSU body.

During the year ICSU fulfilled its function of initiating multinational, interdisciplinary research programmes – launching one to study planet earth in great detail. South Africa enthusiastically planned its participation in the long-term International Geosphere-Biosphere Programme.

In September 1988, four South African scientists will attend the 22nd general assembly of ICSU in Beijing, China – only the second to be held in Asia. A South African delegation has attended every general assembly since 1931.

E.P. du Plessis (nee Immelman), MSc
Enid Phoebe du Plessis (58) has been responsible since 1972 for various aspects of South Africa's liaison with the International Council of Scientific Unions (ICSU) and its member unions.

After matriculating at Eunice High School in Bloemfontein, she obtained a BSc in botany and zoology at the then University College of the Orange Free State and a secondary teachers' diploma at the University of Cape Town, followed by an MSc at UOVS. She was a lecturer in botany at the Universities of Cape Town and Rhodes before working at the National Botanic Gardens, Kirstenbosch, immediately before she came to the CSIR.

INTERNATIONAL SCIENTIFIC EXCHANGE

Scientific exchange has taken place over many years in many forms and with many countries. The exchange generally covers relatively short visits to and from the relevant countries. They might last between one week and three months, and some will be formal and some ad hoc.

But the consequences of such short initial visits can be far-reaching – the "seed money" bringing forth quite considerable results.

D.H.R. Hellwig, PhD
Dieter Heinz Richard Hellwig (59) had his schooling in Germany interrupted by the war, during part of which he worked as a farm apprentice. Later, while working as a building labourer during the day he studied for his university entrance at night, qualifying in 1951.

At the University of Bonn he obtained first a degree in agricultural science and then a PhD in agricultural chemistry.

In 1958 he emigrated to South Africa and after a short period in the Department of Agricultural Technical Services joined the National Institute for Water Research. Between 1965 and 1974 he was in charge of the Institute's regional laboratory in South West Africa.

Between 1974 and 1980 he was scientific counsellor at the South African embassy in Bonn, before becoming CSIR regional representative in South West Africa. He was appointed head of bilateral scientific exchange agreements in 1984.

Married, he has a son and two daughters.

CORPORATE SUPPORT SERVICES GROUP

By September 30 1987 this group had been restructured according to the implementation strategy laid down by the CSIR's Council in March 1987. It comprises the Centre for Advanced Computing and Decision Support, Centre for Information Services, Technical and Site Services Department, and units handling the development of human and other resources and communication services.

The mission of the group is to provide corporate and other support requirements of its client groups, which are determined interactively with them. As an example, a task group on the role of the CSIR's four overseas offices in Washington, London, Bonn and Paris – which are run by this group – includes several directors of RDI divisions. A meeting of the task group at the end of January 1988 clarified the important future role of the four offices and also considered a plan to appoint a further person as special consultant.

CSS's human resource development services will mainly be of an advisory nature to the divisions of RDI, which will each supervise their own personnel matters of a managerial and administrative nature. However, consensus may be reached that certain specialised services can be more cost-effectively provided corporately by this unit.

Further information on the two centres mentioned in the first paragraph above appears on this and the next page.

E.N. van Deventer, PhD
Edgar Neville van Deventer (58) is a former head of the CSIR's computing centre and assistant director of the National Research Institute for Mathematical Sciences. He became director of the centre in 1979 and deputy president of the CSIR in 1980.

After starting his career at the CSIR in 1947 in the National Physical Research Laboratory, he moved to the National Mechanical Engineering Research Institute and then to the National Building Research Institute. In 1965 and 1966 he was a systems engineer at IBM. His responsibilities include corporate management of the Centre for Advanced Computing and Decision Support; the Centre for Information Services; the Technical and Site Services Department; corporate public affairs, and resource development (human and other). He serves on several national advisory committees. Married with two sons and a daughter, he is a graduate at the universities of Pretoria and South Africa.

CENTRE FOR ADVANCED COMPUTING AND DECISION SUPPORT

The centre is responsible for: the development, operation and support of central computing, data communication and management information services, as well as the provision of specialised software development and statistical, economic and mathematical services. It incorporates the CSIR's former Centre for Computing Services, the National Research Institute for Mathematical Sciences, the Group for Techno-economic Studies and the Data Processing Section of the former Administrative Services Department.

It operates and maintains the CSIR's internal computer facilities. A powerful new mainframe computer for scientific computing has been installed and is now serving many scientific users within the CSIR. This brings to five the number of mainframes at the CSIR, which also serve researchers at universities around the country.

A prototype diagnostic expert system developed by the centre for a major financial institution has 500 rules and is one of the biggest ever developed in South Africa.

A software package designed for Haggie Rand Limited calculates geometric parameters in wire rope design and runs 100 times faster than the previous system. In interactive mode the system will be used by the company's engineers to experiment computationally, considerably reducing design times.

The centre is now developing a design database and data management system for the same client.

A PC-based software package, designed for the Leather Industries Research Institute to optimise use of hides in shoe manufacturing, is being marketed by the Leather Industries Research Institute to the 200-odd footware manufacturers in South Africa.

Mathematicians and other researchers were actively involved in the publication of research papers in the year. In particular, Drs Yaakov Yavin and Meir Pachter co-edited a special issue of the international journal "Computers and Mathematics with Applications".

In an effort to maximise available geographic information resources, the centre led a working group on exchange protocols for databases in such fields as geology, crops, agriculture and water resources. The project committee produced a recommended national standard for geographic protocols which is likely to become a de facto standard. Such a standard will have a major impact on the planning and siting of radio towers, dams, roads, and mining and agricultural projects.

In mathematical statistics, the centre also contributed to air pollution studies in the Eastern Transvaal and riverine and coastal pollution monitoring strategies at Richards Bay.

The centre assesses the economic value and impact of technology at the national, industrial and company level. During 1987 it undertook a techno-

economic study for the Swaziland government on the feasibility, implications, siting and technologies of ethanol production in Swaziland.

The centre expects to substantially increase its consulting and contracting projects for the CSIR's Executive and RDI divisions and private industry.

D.H. Martin,
PhD, MBL, Sci Nat
Duncan Henry Martin (46) joined the CSIR in 1977 and in 1980 became chief director of the National Research Institute for Mathematical Sciences. He is a member of the International Federation for Automatic Controls' Committee on Control Theory and of the editorial boards of the journals Quaestiones Mathematicae and Optional Control Applications and Methods. He was the president of the SA Mathematical Society in 1986.

He holds BSc and BSc Hons degrees from the University of Natal, and a PhD in mathematics and Master of Business Leadership from the University of South Africa. Before joining the CSIR, he followed an academic career at the University of South Africa, California State College at Hayward in the USA, University of British Columbia in Canada and University of Natal.

Dr Martin is author and co-author of more than 50 publications and contract reports.

He and his wife have two sons and a daughter.

CENTRE FOR INFORMATION SERVICES

The prime objective of the CIS is to assist in the development, transfer and application of technology through the provision of scientific, technical and management information. Services are provided for the management, scientific and technical staff of the CSIR as well as the broader research community, industry and public sector.

The external services of the centre are organised through the National Technical Information System (NTIS). As announced by the Minister of Economic Affairs and Technology in October 1987, NTIS will act as an information clearing house to coordinate the gathering and transfer of technological information and expertise to the public and private sectors. The aim is to assist South African industry to improve its efficiency, become internationally competitive and increase import replacement.

NTIS represents a meaningful expansion of the current information services of the CSIR to industry. Clients who use the various services regularly already number approximately 2 500. The CIS aims to expand these services in 1988 – in particular the technical enquiry and information transfer services, which include information on manufacturing technology, chemistry, biotechnology, energy, water, patents and management. Scientific and industrial liaison includes regional representation to support industry.

The CSIR's extensive collection of scientific and technological information is an important national resource, available to outside users. To enhance effective electronic transfer of information countrywide, existing computer technology for the transfer, storage, and retrieval of information is being upgraded. The centre also offers its information technology development to outside customers.

The central information service provided within the CSIR itself will be expanded in cooperation with the research divisions by focussing on project-related information. There will also be increased support of the management information needs of strategic R&D.

Some achievements in 1987:

- Approximately 4 500 enquiries were handled by the enquiry service. Where appropriate, technical enquiries were referred to experts in various fields. Some of these resulted in contracts for the CSIR
- Subscriptions to Manufacturing Technology Reviews increased by 22 percent to 1 386
- Subscriptions to Infopak: Management Reviews have grown to 370. The Service was introduced in July 1986
- Sales of documents ordered from the various services increased by 3 200 – from 118 800 in 1986 to 122 000 in 1987. Many of these documents were obtained from abroad
- Approximately 3 000 information searches on local and overseas databases were carried out
- 72 000 items were issued by the Central Library to CSIR and outside users.
- Approximately 2 000 visits to the private and public sectors were undertaken by technical liaison staff.

The CIS is currently funded by the Executive for its corporate services and by users. Further income comes from contracts to run information management services – such as the SA Water Information Centre run for the Water Research Commission.

Currently the CIS's ratio of public to private funding is about 70:30. However, prospects for increased services to industry have improved.

B. Fouché,
D.Litt et Phil
Ben Fouché (47) joined the CSIR last year from the Department of Development Aid, where he had been Director: Information Services, responsible for research, information systems and corporate planning, since 1985.

He obtained his master's degree from the University of Pretoria and doctorate in literature and philosophy from the Rand Afrikaans University. After four years in the Transvaal Library Service, he lectured in library and information science at the University of Pretoria and Rand Afrikaans University. In 1974 he was appointed professor and head of the department of Library and Information Science at the University of South Africa, a position he held until his appointment to the public service.

Dr Fouché is author and co-author of 35 research publications. He is a past president of the SA Institute for Librarianship and Information Science and serves on various professional societies, advisory committees and councils, among them the board of directors of SABINET and the council of the State Library.

Dr Fouché is married and has three sons.

COMMUNICATION SERVICES

During 1987 Communication Services evolved as a totally new entity with a mission, structure and strategy reflecting the changes in the CSIR.

At the start of 1987 the group was still known as Information and Research Services (IRS). Its functions were: handling internal communication (including the CSIR house journal, Sciendaba) and external communication (the CSIR popular science journal, Scientiae and media relations); managing the internationally recognised conference centre; organising scientific and technical conferences for many bodies inside and outside the CSIR; building and maintaining a data bank on technical and economic information; and gathering, printing and distributing information on a variety of matters such as South African scientific and learned societies, scientific conferences, etc.

These sections were supported by administrative staff who also coordinated the activities of the scientific offices of the CSIR in Washington, London, Paris and Bonn and provided support to the staff of the South African Inventions Development Corporation, Saidcor.

During 1987 the CSIR Executive commissioned a communication consultancy, TWS Public Relations, to conduct an audit of communication within the CSIR. That audit took place in June/July and was followed by a fundamental restructuring of IRS to create the group known today as Communication Services.

The Communication Services group has developed into two operational units, communication and conference services. Within the communication group, IRS staff were re-assigned to tasks in the areas of public affairs, public relations, internal communication and publication services. In the conference services unit, three sections were identified to handle: conference organising; the operation of the conference centre and reception facilities at the Pretoria site; and corporate functions and visitor programmes.

In October the Group for Techno-Economic Studies was transferred to the Centre for Advanced Computing and Decision Support. Even earlier, in January, the administrative functions were rationalised.

The result of developments in 1987 is a Communication Services group which has the same basic mission of meeting the internal and external communication needs of the organisation in a professional and cost effective manner. The structure reflects the diverse needs of the CSIR in communicating with: a variety of audiences in the public and private sectors, the international scientific community, existing and potential staff and the public in general.

It is a matter of pride that, despite the restructuring, ongoing tasks were not affected. They included the production of Impact, a journal supporting the 1986/87 annual report, the weekly internal journal Sciendaba and the quarterly journal Scientiae; and continuation of an active media relations programme.

TECHNICAL AND SITE SERVICES

The Technical and Site Services Department is structured into a number of units, each dealing with a particular service: transport, stores, catering, graphic arts, apprentice training, workshops and maintenance, design, accommodation, safety, cleaning, gardens and grounds, and regional offices.

The aim of the department is to provide services at all times that are effective, run efficiently and competitive with those in the private sector. To this end, it is carrying out a series of investigations to compare its services and facilities with external ones.

P. Lasserre, Pr.Eng.
Patrice Lasserre (44) emigrated from Belgium in 1984 to become head of technical services at the CSIR.

After initially studying the humanities and mathematics in Brussels, he graduated in electromechanical engineering in 1967. He also holds a post-graduate qualification in business administration from the Free University of Brussels.

Before coming to South Africa, he worked for various multi-national companies, primarily in the oil business.

Married, he has two sons.

CORPORATE FINANCIAL MANAGEMENT

Financial policy is to have an important role in the CSIR's change of course and in creating greater financial independence for it. The Group Executive for Corporate Financial Management will be responsible, among other things, for:

- corporate budget development, monitoring and control
- business and commercial management
- maintenance of a corporate financial management information system
- strategic financial planning
- negotiations with companies and the establishment of enterprises with interested parties for the exploitation of new or existing technological knowledge
- external and internal liaison at a high policy level on financial matters, and
- authoritative analysis, from a financial perspective, of the application of technology in industry and of industrial development generally.

The Group Executive CFM is still to be appointed. During the past year, the Executive was expertly assisted by a firm of financial consultants.

Below is an analysis of the CSIR's source and allocation of funds during the financial year 1986/87. It is followed by the financial statements for the same year.

TOTAL INCOME
(1975 prices)

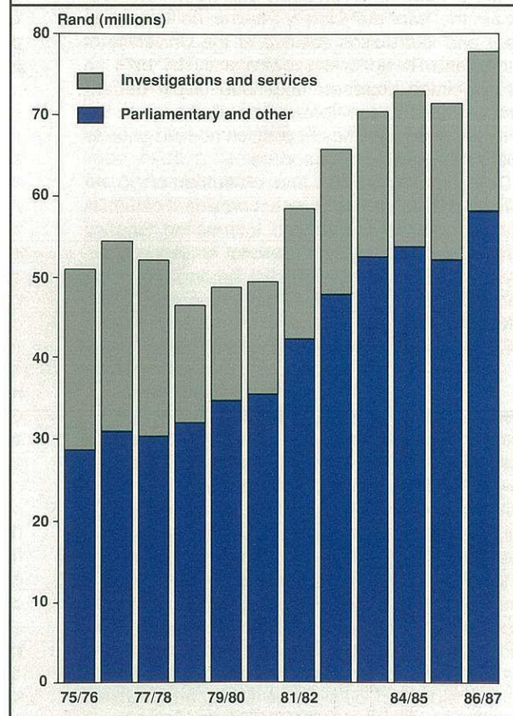


Diagram 1

SCIENCE AND TECHNOLOGY ACTIVITIES
(1986/87, total R277,8 million)

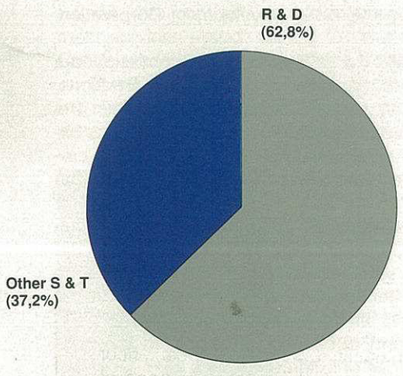


Diagram 2

TOTAL INCOME AND EXPENDITURE

Investigations and services remained important as a source of income, showing a real increase of 3 percent to 25,4 percent of total income (diagram 1). The CSIR's total parliamentary grant (70,8 percent of all income) showed a real increase of 14,1 percent, mainly as a result of funds received for laboratory equipment, as well as land and buildings.

If the R53,1 million received during 1986/87 for the establishment of advanced technology (i.e. National Accelerator Centre, Medium Speed Windtunnel, and special computer facilities) are excluded from consideration, the contract income from investigations and services constituted 30,4 per cent of the remaining income.

The CSIR's total expenditure (on fixed assets and running costs) rose 24,7 percent in nominal terms in 1986/87 and 7,5 percent in real terms after adjustment for inflation. It was devoted mainly to laboratory equipment, staff remuneration, research grants, advanced technology establishment and supplies and services.

CURRENT EXPENDITURE

Total staff remuneration remained the largest component of current expenditure at 57 percent, although lower than 1985/86's 60,7 percent and showing a real decrease of 2,9 percent. The decrease was due mainly to delays in filling vacancies and the scrapping of a number of vacant posts.

An increase in expenditure on research grants and subsidies (from 10,7 to 12,1 percent of all expenditure) showed a sustained increase in the support of own-initiated research projects (both basic and applied) at universities, museums and technikons.

A real increase of 13,2 percent in expenditure on supplies and services can be ascribed mainly to a higher outlay on computer requisites and maintenance, and on professional and research services.

CAPITAL EXPENDITURE

The increase of 20,7 percent in real expenditure on laboratory equipment (which constituted 80,3 percent of fixed-asset purchases) represents mainly investment in special facilities such as the Medium Speed Windtunnel and National Accelerator Centre. Unfavourable exchange rates raised their cost.

This increase was financed largely from the parliamentary grant and funds carried over from previous years.

EXPENDITURE PATTERN OF THE CSIR

The largest part (62,8 percent) of total expenditure (after deduction of grants and subsidies) was used for research and development, and the rest (37,2 percent) for other scientific and technological activities (diagram 2). In the latter category fall the provision and extension of South Africa's research infrastructure as well as the provision of scientific and technological services to industry and other economic sectors.

A breakdown of most this work is: information and documentation, 35,7 percent; specialised test work, standardisation and quality control, 21,9 percent; and advisory services, 18,3 percent (diagram 3).

In the distribution of R&D funds among the different fields of research, or disciplines, the biggest recipients were again the engineering sciences (40,5 percent), the physical sciences (22,5 percent) and technological sciences (16,1 percent) (diagram 4).

An analysis of socio-economic sectors served in R&D shows the CSIR's commitment to those branches of science essential to the technogical development of the country's infrastructure and industry. The largest contributions were for community development (47,8 percent) and the manufacturing sector (17,8 percent).

Other contributions were to development of the infrastructure (12,3 percent), general advancement of knowledge (11,5 percent) and other economic activities (10,6 percent) (diagram 5).

EXPENDITURE ON S & T ACTIVITIES APART FROM R&D (1986/87, total R103,3 million)

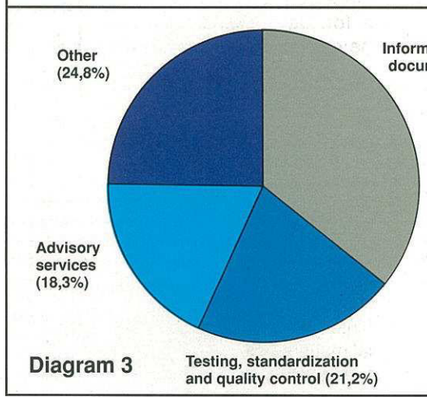


Diagram 3

R & D EXPENDITURE BY RESEARCH FIELD
(1986/87, total R174,6 million)

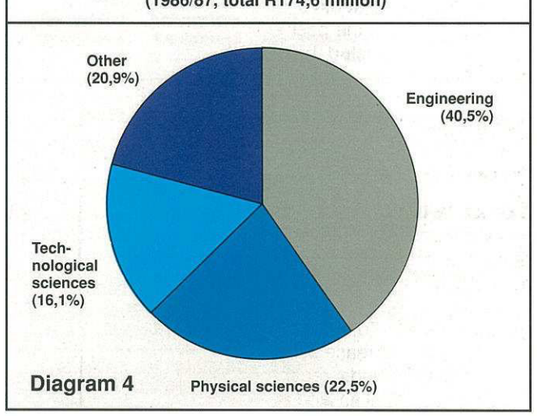


Diagram 4

R & D EXPENDITURE BY SOCIO-ECONOMIC SECTOR (1986/87, total R174,6 million)

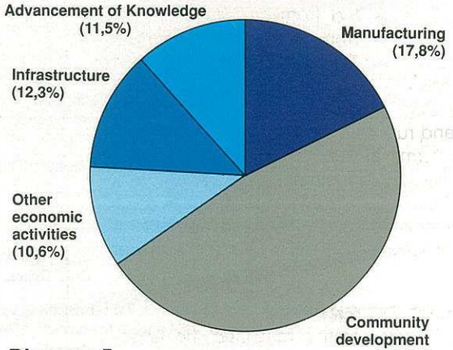


Diagram 5

Financial statements

BALANCE SHEET at 31 March 1987 — **STATEMENT 1**

	General Fund R	Building Fund R	1987 R	1986 R
Accumulated funds:				
Balance brought forward	219 162 615,73	111 229 710,53	330 392 326,26	274 720 665,60
Additions:				
Income over expenditure (Statement 2)	10 428 586,38	—	10 428 586,38 [1]	7 343 629,77
Transfer of funds	5 170 884,00	(5 170 884,00)	—	—
Capital income (Note 1)	60 968 114,01	16 484 024,07	77 452 138,08	49 707 208,11
Physical assets and funds received	1 188 089,51	—	1 188 089,51	1 080 711,51
	296 918 289,63	122 542 850,60	419 461 140,23	332 852 214,99
Reductions:	2 589 062,73	—	2 589 062,73	2 459 888,73
Physical assets and funds relinquished	284 182,85	—	284 182,85	520 441,35
Physical assets written off	2 304 879,88	—	2 304 879,88	1 939 447,38
Total	294 329 226,90	122 542 850,60	416 872 077,50 [2]	330 392 326,26
Utilisation of funds				
Fixed assets (Note 2)			390 337 986,65	303 060 488,29
Balance brought forward			303 060 488,29	242 395 988,56
Net additions			87 277 498,36	60 664 499,73
Investments			5 060 177,41	5 157 403,96
Shares in SA Inventions Development Corporation			5 000 000,00	5 000 000,00
Shares and stock			60 177,41	157 403,96
Net currrent assets			21 473 913,44	22 174 434,01
Current assets			72 989 870,38	50 793 769,71
Saleable stock			428 305,77	178 061,23
Debtors and debit balance			14 325 227,87	11 822 291,20
Advances and deposits:				
Research grants			386 222,16	6 722 107,66 [3]
Other			14 278 369,33	8 426 506,39
Cash:				
Corporation for Public Deposits			38 250 763,94 [4a]	21 095 136,49
SA Reserve Bank			4 977 036,40	2 388 767,98
Other banks			262 142,25	86 646,10
Petty cash imprests			81 802,66	74 252,66
Current liabilities			51 515 956,94	28 619 335,70
Advances for investigations and services			36 291 369,79 [4b]	12 108 446,49
Creditors and credit balances			15 224 587,15	16 510 889,21
Total			416 872 077,50	330 392 326,26

[1] Transfer from building- to general fund R5 170 884,00

[2] At 31 March 1987 contractual obligations against the General and Building Funds were R35 929 574 and R11 677 385 respectively. Legal actions being contested by the CSIR, involved an amount of R524 000,00

[3] Advances in respect of research grants for 1986/87 partially paid in 1985/86

[4a] & [4b] Increase in advances from government- and semi-government institutions resulting in higher deposits with the Corporation for Public Deposits

PRETORIA
4 August 1987

(Sgd.) **J D VAN ZYL**
Chief Director: Administrative Services

(Sgd.) **C F GARBERS**
President

The above Balance Sheet has been audited in accordance with the provisions of section 42(4) of the Exchequer and Audit Act, No.66 of 1975, read with section 16(1) of the Scientific Research Council Act, No. 82 of 1984 and, in my opinion, reflects a true and fair view of the financial affairs of the Council for Scientific and Industrial Research.

PRETORIA
19 January 1988

(Sgd.) **J DE LOOR**
Auditor-General

Corporate Financial Management
CSIR

NOTE 1: CAPITAL INCOME

	General Fund R	Building Fund R	1987 R	1986 R
Parliamentary grant	52 288 000,00	11 720 000,00	64 008 000,00	37 175 000,00
Donations	—	—	—	—
Contributions	500 580,15	—	500 580,15	227 474,25
Interest	—	4 306 763,55	4 306 763,55	5 306 880,62
Sale of assets written off	523 740,81	—	523 740,81	380 897,35
Investigations and services	7 353 793,05	453 504,23	7 807 297,28	6 322 121,96
Sale of land and buildings	—	3 756,29	3 756,29	—
Surplus on sale of leasehold property	—	—	—	7 833,93
Coal levies	302 000,00	—	302 000,00	287 000,00
	R60 968 114,01	16 484 024,07	77 452 138,08	49 707 208,11

NOTE 2: FIXED ASSETS (at cost or valuation)

	Land and Buildings R	Books and Journals R	Furniture and Equipment R	Pre-fabricated Structures R	Laboratory Equipment R	Vehicle R	Stores Stock R	Total R
Balance brought forward	101 520 666,86	9 563 423,24	10 149 463,33	81 065,78	175 437 978,34	4 530 253,43	1 777 637,31	303 060 488,29
Purchases:								
CSIR	11 870 494,25	2 406 408,32	2 145 183,70	14 434,29	70 974 520,58	933 009,22	—	88 344 050,36
Grants	—	4 663,44	44 210,05	—	—	—	—	48 873,49
Adjustments previous year:								
CSIR	—	—	61 134,88	—	—	19 620,71	—	80 755,59
Grants	—	—	10 675,36	—	—	—	—	10 675,36
Received:								
CSIR	—	—	9 389,00	2 000,00	1 276 902,30	13 966,00	—	1 302 257,30
Grants	—	—	—	—	—	—	—	—
Stores Increase	—	—	—	—	—	—	342 727,37	342 727,37
	R113 391 161,11	11 974 495,00	12 420 056,32	97 500,07	247 689 401,22	5 496 849,36	2 120 364,68	393 189 827,76
Less: Reductions	—	120 754,46	272 774,49	1 342,00	2 349 808,65	107 161,51	—	2 851 841,11
Relinquished	—	—	1 471,32	—	282 726,53	—	—	284 197,85
Written off:								
CSIR	—	—	271 274,72	1 342,00	1 925 073,20	107 161,51	—	2 304 851,43
Grants	—	—	28,45	—	—	—	—	28,45
Adjustments previous year:								
CSIR	—	120 754,46	—	—	142 008,92	—	—	262 763,38
Grants	—	—	—	—	—	—	—	—
Balance	R113 391 161,11	11 853 740,54	12 147 281,83	96 158,07	245 339 592,57	5 389 687,85	2 120 364,68	390 337 986,65

STATEMENT OF INCOME AND EXPENDITURE for the year ended 31 March 1987

STATEMENT 2

	Grants R	CSIR R	Total R	1985/86 R
Income				
Parliamentary grant	18 477 000,00	144 136 000,00	162 613 000,00	133 928 200,82
Contributions to CSIR projects	9 000,00	1 632 517,55	1 641 517,55	2 372 257,57
Coal levies and penalties	—	2 573 152,17	2 573 152,17	2 303 141,60
Investigations and services	—	73 447 046,91	73 447 046,91	61 609 175,11
Publications	337,26	752 401,38	752 738,64	710 428,81
Sundry	86 966,79	1 437 527,32	1 524 494,11	1 308 094,01
Total	R18 573 304,05	223 978 645,33	242 551 949,38	202 231 297,92
Less: Expenditure	R18 177 429,27	213 945 933,73	232 123 363,00	194 887 668,15
Salaries, wages and allowances	231 819,23	138 105 376,84	138 337 196,07	122 656 041,64
Consumable stores and services	99 664,44	64 766 305,18	64 865 969,62	50 751 371,21
Subsistence and transport expenses	115 864,62	6 661 668,76	6 777 533,38	6 022 887,69
General expenditure	140 217,88	17 022 653,42	17 162 871,30	13 715 609,34
Extraordinary expenditure	—	11 763,27	11 763,27	155 462,41
Grants	17 080 119,75	10 771 732,17	27 851 851,92	20 201 057,86
Subsidies: Research by industry	—	1 499 235,88	1 499 235,88	1 342 434,56
Levies and depreciation	518 472,00	23 426 008,34	23 944 480,34	21 868 864,32
	18 186 157,92	262 264 743,86	280 450 901,78	236 713 729,03
Less: Income – internal services	8 728,65	48 318 810,13	48 327 538,78	41 826 060,88
Income over expenditure	R395 874,78	10 032 711,60	10 428 586,38	7 343 629,77

PRETORIA
4 August 1987

(Sgd.) **J D VAN ZYL**
Chief Director: Administrative Services

(Sgd.) **C F GARBERS**
President

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