CSIRO Annual Report 1989–1990



CSIRO Annual Report 1989-90



Credits

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The Honourable Simon Crean, MP Minister for Science and Technology Minister Assisting the Prime Minister for Science Minister Assisting the Treasurer Parliament House CANBERRA ACT 2600

We have pleasure in submitting to you, for presentation to Parliament, the forty-second annual report of the Commonwealth Scientific and Industrial Research Organisation.

One of the year's most significant projects, now nearing completion, has been the joint effort of CSIRO management and staff unions to prepare our proposals for award restructuring. The evidence collected to argue our case for an improved award package for CSIRO staff has clearly shown how successful we have been in changing our ethos to meet the more demanding, commercially-oriented environment in which we are asked to operate.

The year has also seen an enhanced role for CSIRO in national policy-making. Our advice has been sought on several environment and development issues in the public eye. We need to build on this role as 'honest brokers' to ensure unbiased scientific advice is available to decision makers.

Neville Wran (Chairman of the Board)

Van. Im.

John W. Stocker (Chief Executive)

November 1990



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Chairman's Foreword

In 1989-90 CSIRO came to terms with the pressures for change of the past decade and reassumed a leadership role in the Australian community.

We are still mindful of the constant need for change in the modern world, but it no longer dominates our attention. Instead, we are now attending clearly and vigorously to the fulfilment of our mission — service to all Australians through scientific excellence.

During this watershed year, a new Minister and a new Chief Executive have taken up their tasks; an increasing recognition of science and technology by government and the community is being translated into greater public recognition of CSIRO and more resources for research; and our new internal structure is ensuring that we make the best use of our intellectual capital, so critical for Australia's future success on the world's competitive stage.

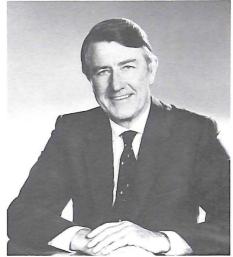
Firstly however, on behalf of the Board, I would like to pay tribute to the former Minister for Science, Customs and Small Business, the Hon Barry Jones MP for his work in promoting the cause of science and CSIRO. All Australians, I am sure, thank the former Minister for his tireless and highly visible fight to promote the importance of science.

The year also saw Dr Keith Boardman retire from his position as Chief Executive at the end of his five-year term. On behalf of CSIRO I take this opportunity to acknowledge publicly his commendable leadership during those demanding five years. He managed the Organisation through substantial and complex structural change in a difficult funding environment.

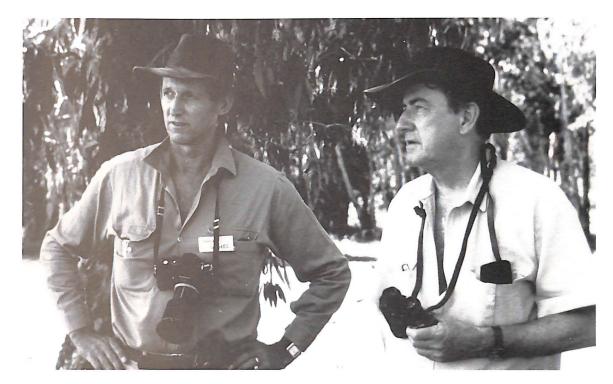
The Board is very pleased to welcome both the new Minister for Science and Technology, the Hon Simon Crean MP, and our new Chief Executive, Dr John Stocker. I know that the coming years will bring great opportunities and growth for CSIRO. Making Australia the 'clever country' will require CSIRO to interact with business, government and the general community as never before. The new partnership between Simon Crean, the Board and John Stocker is one that can make this happen.

Success is already being achieved. Our relationship with industry continues to strengthen. Last year the cash expenditure of funds provided for sponsored research by Australian companies amounted to \$20.1 million; this year the figure is \$28.1 million — a very pleasing increase of 40% and proof that Australian industry is responding to CSIRO's efforts to stimulate their interest. In total, CSIRO received research funding from sources other than its annual budget appropriation amounting to \$166.9 million — an increase of 23% over the previous year and concrete evidence of CSIRO's growing ability to compete in the marketplace.

In 1988, CSIRO persuaded the Government to provide it with triennium funding; the benefits are now beginning to show. This funding creates a stable environment for scientists and predictability for industry partners in research. The waste management program we initiated with BHP is just one example of the longer planning cycles that triennium funding has helped us adopt. We are now able to give substance to our calls for Australian business to adopt a



The Hon. Neville Wran AC QC



CSIRO Chairman, Mr Neville Wran, inspected a number of CSIRO research sites in the Northern Territory during a week-long visit in August 1989. Mr Wran is pictured at Kapalga Research Station in Kakadu National Park discussing research programs with Dr Laurie Corbett of the Tropical Ecosystems Research Centre

longer term view of market development instead of chasing short-term profits on the boom-bust merry-go-round.

The Government has also made more money available in two important areas.

One exciting new major program is the Cooperative Research Centres. Announced by the Government in March, it will set up 50 centres to foster cooperation between all kinds of research institutions to link advances in science and technology to applications in industry and other sectors, such as health and the environment. The program will also significantly boost Australia's capacity for scientific training and education. CSIRO welcomes this new program and is preparing its nominations for the new Centres.

Another important injection of funds went into our research into the greenhouse effect — the Government has allocated \$8.8 million over the next four years for study of one of the most pressing problems of our time.

Over the past year CSIRO has found itself much more in the public eye — and this is how we want it to be. We welcome our role as 'honest brokers' in policy debates in areas of our expertise. Our most public involvement was in the Wesley Vale pulp mill debate, where our independent scientific advice had a major influence on the outcome. We are continuing work with Government and industry to find acceptable solutions to the management of Australia's forests — essential to reducing our annual \$2 billion deficit in timber products.

The CSIRO Board this year took a number of steps to encourage young people into science by making it a more attractive career. We allocated special Board Funds to expand the Students and Careers in Science and Technology

Program. We gave priority to the development of a CSIRO human resources plan which would provide fitting rewards to talented staff and offer more stable and fulfilling career paths.

A proposal for major award restructuring developed during the year has demonstrated CSIRO's commitment to improving salaries and conditions for its staff. Management and unions together made the proposal which provides significant increases in scientists' salaries and reduces the many existing CSIRO classification levels into just nine levels embracing all staff. This innovative proposal will better link performance with rewards and is a powerful statement of CSIRO's confidence in the future of Australian science.

Considerable progress was also made on developing a more rigorous methodology for identifying research priorities. This will ensure that resources are better directed to resolving problems and grasping opportunities which have the greatest potential benefit for Australia. The next CSIRO strategic plan will reflect the allocation of our resources to these priority areas.

Cleaner fuels, a breakthrough in native forest management, new cattle breeds for northern Australia, better crop yields, stronger and safer buildings — these are just some of the achievements detailed in the following pages that are set to boost Australian productivity and quality of life. They are the kinds of achievements that make me proud to be so closely associated with CSIRO as it responds to the challenges of today and tomorrow.

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N. K. Wran AC QC

Chief Executive's Review



Dr John Stocker

Australia needs to adopt a longer term vision in managing both our economy and our environment.

The consequences of chasing the quick buck are starkly apparent in our corporate collapses and in serious environmental problems such as the disposal of toxic wastes and land degradation. The fast buck is often gone when the bill arrives.

CSIRO's scientific research can help us develop a longer term vision for our nation.

CSIRO has a proud record of achievement in improving the nation's performance—be that measured in environmental, economic or social terms. The challenge to maintain and surpass these past achievements is eagerly accepted.

The reorganisation of CSIRO introduced by the Board and implemented by my predecessor, Dr Keith Boardman, has given the Organisation the management structure appropriate to this task. Our corporate planning processes are now systematically identifying national research priorities. This will

help ensure that our resources are allocated to the fields of both greatest need and greatest promise.

Regular and rigorous evaluation of the progress of our research is also an integral part of ensuring that we are getting the best value for our research dollar. Economic evaluations of various research activities were presented in CSIRO's submission to the Review of Public Sector Research and Development by the Joint Parliamentary Committee of Public Accounts. CSIRO welcomes this as another chance to demonstrate the relevance of our activities to national need.

The public recognition of CSIRO as a source of independent scientific advice—a recognition well documented in opinion research we conducted—has enabled the Organisation to adopt the role of 'honest broker' on environmental issues such as the siting of pulp mills, reafforestation, land degradation and air pollution. We are also able to point the way towards reconciliation of environmental protection with continued industrial development by means of new and better technologies, such as waste treatment processes and new technologies for processing agricultural products and mineral ores.

Improving the transfer of the results of CSIRO's research to industry is also a key issue for CSIRO. We are taking the lead in showing industry the benefit of investing in scientific research in general and in CSIRO's work in particular.

Dr Colin Adam, the Director of the Institute of Industrial Technologies, has taken up a temporary assignment as Managing Director of our commercial arm, Sirotech. Dr Adam will develop a plan to set this company on an appropriate course for the 1990s. I have assumed the Chairmanship of Sirotech to improve further the management links between research and its commercialisation.

CSIRO's research will also keep step with the activities of a wide range of Australian scientific and technological organisations: links between CSIRO and governments, industry and other research organisations are paramount. My membership of bodies such as the Prime Minister's Science Council and its Coordination Committee on Science and Technology, the Multi-Function Polis—Adelaide Management Group, the Primary Industries and Energy Research Council and the Victorian Government's Strategic Research Foundation, ensure complementarity between CSIRO and the nation's peak science bodies.

CSIRO's most valuable asset is its staff. I believe an important task in my position as Chief Executive is to visit all CSIRO sites early in my term of office, to talk with staff about their work and so to gain first-hand knowledge of the Organisation. I have so far been able to visit 39 sites spread throughout Australia. I have seen many exciting research projects and I know that I will see many more.

In my first hectic few months as Chief Executive, I have greatly appreciated the support of the Chairman and Board Members and the warmth and enthusiasm of people throughout the Organisation. I shall work to ensure that CSIRO continues to lead the crucial processes of discovery and the transfer of new technology to where it serves Australia best.

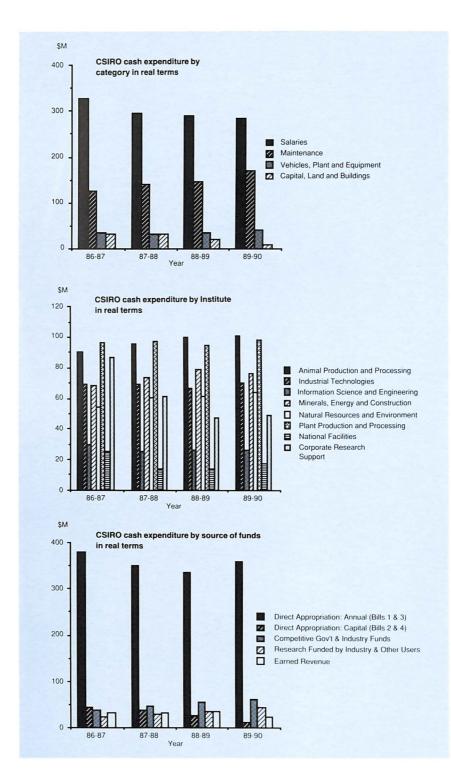
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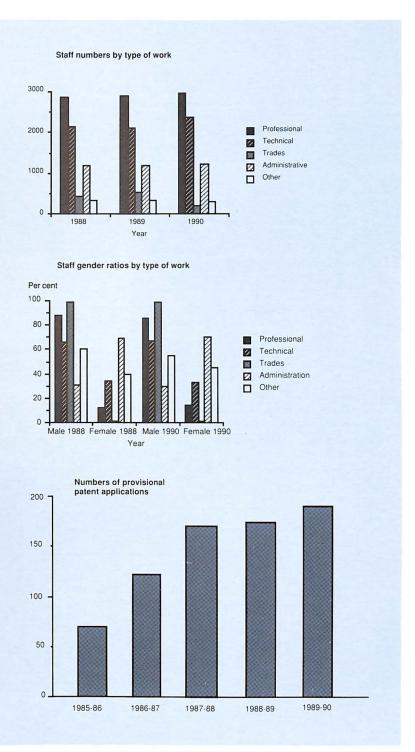
J. W. Stocker



Dr Stocker examines a meteorological balloon with scientist Lynette Malcolm at the Pye Laboratory. CSIRO Centre for Environmental Mechanics

About CSIRO Statistics at a glance





Charter, functions and powers

CSIRO is an independent statutory authority operating under the provisions of the *Science and Industry Research Act* 1949. From 1 July 1989 to 3 April 1990 the Minister responsible for CSIRO was Mr Barry Jones (Minister for Science, Customs and Small Business, and Minister Assisting the Prime Minister for Science and Technology). From 4 April 1990 to 30 June 1990 the Minister responsible for CSIRO was Mr Simon Crean (Minister for Science and Technology, Minister Assisting the Prime Minister for Science, and Minister Assisting the Treasurer).

CSIRO's primary functions are

- to carry out scientific research
 - —to assist Australian industry and to further the interests of the Australian community;

—to contribute to national and international objectives and responsibilities of the Commonwealth Government;

• to encourage or facilitate the application and use of the results of scientific research.

Its secondary functions include international scientific liaison, training of research workers, publication of research results, and dissemination of information about science and technology.

The Organisation has power to do whatever is necessary or convenient for the best performance of its functions.

In particular it may

- arrange for research and other work to be undertaken outside CSIRO;
- form partnerships or companies;
- make its discoveries and inventions available for fees, royalties or other considerations;
- pay bonuses to staff for discoveries or inventions;
- charge fees for research, facilities or services provided to others.

The Board



Chairman The Hon. Neville Wran AC QC Chairman Turnbull & Partners Formerly Premier of New South Wales (1976–1986) 5 Dec. 86—4 Dec. 91



Dr John Stocker MB BS PhD FRACP Chief Executive of CSIRO 5 Mar. 90—4 Mar. 95



Mr Laurie Carmichael Assistant Secretary of the Australian Council of Trade Unions 13 Mar. 89—12 Mar. 93



Sir Roderick Carnegie BSc MA(Oxon) MBA FTS Company Director 5 Dec. 86—4 Dec. 91



Professor Adrienne Clarke BSc PhD FTS Director, Plant Cell Biology Research Centre, University of Melbourne 5 Dec. 89—4 Dec. 91 (reappointment)





Dr Kevin Foley MCom PhD Managing Director, Kevin Foley and Associates Pty Ltd and Chairman, Wine & Grape Industry Advisory Council 5 Dec. 89—4 Dec. 91 (reappointment)

Professor Sir Gustav Nossal AC CBE MB BS BSc PhD

FTS FAA FRS

Eliza Hall Institute

of Medical Research

5 Dec. 86-4 Dec. 91

Director of the Walter and

Dr Tony Gregson PhD DSc FRACI Primary producer, formerly Associate Professor of Chemistry at the University of New England 5 Dec. 86—4 Dec. 90



Mr Ralph Ward-Ambler BMechE Company Director 8 Feb. 89—7 Feb. 93



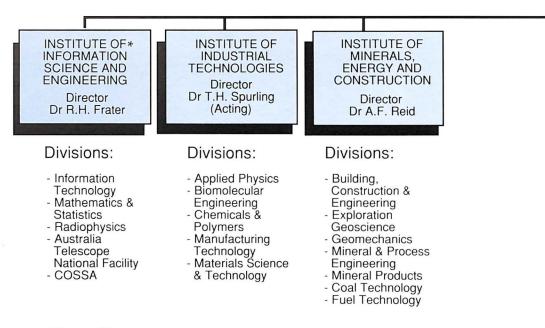
Mr David Hoare BEc AASA ASIA Chairman, Bankers Trust Australia Ltd and OTC Pty Ltd 5 Dec. 86—4 Dec. 90

Organisation Chart

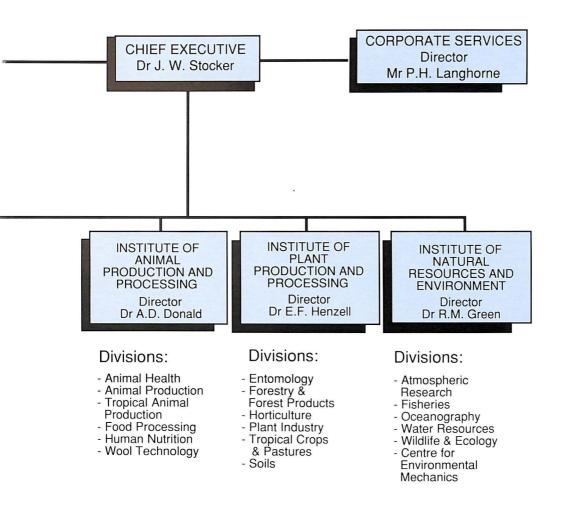
As at 30 June 1990



Dr J. W. Stocker Sir Roderick Carnegie Prof. A. E. Clarke Dr K. J. Foley Dr A. K. Gregson Mr D. M. Hoare Mr L. N. R. Carmichael Prof. Sir Gustav Nossal Mr C. R. Ward-Ambler



* See page 19



Structure, management and staff

CSIRO's current structure was established by the *Science and Industry Research Amendment Act* 1986. This established a ten-member Board responsible for determining policy and ensuring the efficient functioning of CSIRO. The Chief Executive, who is a member of the Board, is responsible for the Organisation's activities.

The Chief Executive, six Institute Directors and the Director of Corporate Services form the Executive Committee, which assists the Chief Executive in managing the activities of the Organisation.

Research is performed in 34 Divisions and research units, grouped into six Institutes. Each Institute has its own management committee, which consists of the Director and Divisional Chiefs. The Institute Committee provides a forum for setting the strategic direction for the Institute and assisting in the formulation and implementation of corporate and Institute policies for research and management.

A Corporate Centre provides central services to support managers and staff in the development and implementation of policies, and to provide services such as payrolling that are best performed at the corporate level.

Divisions and Institutes are located all over Australia, with many Divisions having more than one site. CSIRO also maintains a small number of field stations overseas, mainly concerned with biological studies that could benefit Australia.

CSIRO staff are employed under Section 32 of the *Science and Industry Research Act* 1949. At 30 June 1990 CSIRO had a total staff of 7051. The numbers employed in different job categories are shown in the chart on p.9. Materials Science and Technology Chief: Dr M.J. Murray Normanby Road CLAYTON VIC 3168 Tel: (03) 542 2787

INSTITUTE OF MINERALS, ENERGY AND CONSTRUCTION Director: Dr A.F.Reid 105 Delhi Road NORTH RYDE NSW 2113 Tel: (02) 887 8212

Divisions and Chiefs

Building, Construction and Engineering Chief: Dr D.C. Gibson Graham Road HIGHETT VIC 3190 Tel: (03) 556 2690

Exploration Geoscience Chief: Dr B.J. Embleton Underwood Avenue FLOREAT PARK WA 6014 Tel: (09) 387 0729

Coal Technology * Chief: Dr L.J. Lynch (Acting) 51 Delhi Road NORTH RYDE NSW 2113 Tel: (02 887 8666

Fuel Technology * Chief: Dr P.G. Alfredson New Illawara Road LUCAS HEIGHTS NSW 2234 Tel: (02) 543 3111

Geomechanics Chief: Dr B.E. Hobbs Kinnoull Grove SYNDAL VIC 3149 Tel: (03) 881 1285

Mineral and Process Engineering Chief: Dr R. La Nauze Bayview Avenue CLAYTON VIC 3168 Tel: (03) 541 1113 Mineral Products

Chief: Dr T. Biegler 339 Williamstown Road PORT MELBOURNE VIC 3207 Tel: (03) 647 0300

INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING Director: Dr A.D. Donald 105 Delhi Road NORTH RYDE NSW 2113

NORTH RYDE NSW 211 Tel: (02) 887 8250

Divisions and Chiefs

Animal Health Chief: Dr M. Rickard Cnr Flemington Road and Park Drive PARKVILLE VIC 3052 Tel: (03) 342 9727

Animal Production Chief: Dr O. Mayo Great Western Highway PROSPECT NSW 2149 Tel: (02) 688 0833

Food Processing Chief: Dr D.J. Walker 39-51 Delhi Road NORTH RYDE NSW 2113 Tel: (02) 887 8341

Human Nutrition Chief: Dr P.J. Nestel Gate 13, Kintore Avenue ADELAIDE SA 5000 Tel: (08) 224 1865

Tropical Animal Production Chief: Dr D.F. Mahoney Meiers Road INDOOROOPILLY QLD 4068 Tel: (07) 377 0800

* These Divisions amalgamated on 1 July 1990 to form the new Division of Coal and Energy Technology Chief: Dr P.G. Alfredson

Wool Technology

Chief: Dr K.J. Whiteley Princes Highway BELMONT VIC 3216 Tel: (052) 47 2777

INSTITUTE OF PLANT PRODUCTION AND PROCESSING

Director: Dr E.F. Henzell Limestone Avenue CAMPBELL ACT 2601 Tel: (06) 276 6613

Divisions and Chiefs

Entomology

Chief: Dr M.J. Whitten Clunies Ross Street BLACK MOUNTAIN ACT 2601 Tel: (06) 246 4025

Forestry and Forest Products

Chief: Dr W. Hewertson Bayview Avenue CLAYTON VIC 3168 Tel: (03) 542 2228

Horticulture

Chief: Dr J.V. Possingham Hartley Grove URRBRAE SA 5064 Tel: (08) 274 9242

Plant Industry

Chief: Dr W.J. Peacock Clunies Ross Street BLACK MOUNTAIN ACT 2601 Tel: (06) 246 5250

Soils

Chief: Dr D.E. Smiles Clunies Ross Street BLACK MOUNTAIN ACT 2601 Tel: (06) 246 5937

Tropical Crops and Pastures

Chief: Dr R.J. Clements 306 Carmody Road ST LUCIA QLD 4067 Tel: (07) 377 0217

INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT

Director: Dr R.M. Green Limestone Avenue CAMPBELL ACT 2601 Tel: (06) 276 6614

Divisions and Chiefs

Atmospheric Research

Chief: Dr G.B. Tucker Station Street ASPENDALE VIC 3195 Tel: (03) 586 7647

Fisheries

Chief: Dr F.R. Harden Jones Castray Esplanade HOBART TAS 7000 Tel: (002) 20 6264

Oceanography

Chief: Dr A.D. McEwan Castray Esplanade HOBART TAS 7000 Tel: (002) 20 6212

Water Resources

Chief: Dr G.B. Allison Underwood Avenue FLOREAT PARK WA 6014 Tel: (09) 387 0213

Wildlife and Ecology

Chief: Dr B.H. Walker Barton Highway GUNGAHLIN ACT 2912 Tel: (06) 242 1742

Centre for Environmental

Mechanics Chief: Dr J.R. Philip Clunies Ross Street BLACK MOUNTAIN ACT 2601 Tel: (06) 246 5645

Interests in companies

The companies in which CSIRO had an interest as at 30 June 1990 are as follows:

Name of Company	CSIRO's interest (%)	Principal activity
SIROTECH Ltd	Limited by Guarantee and controlled by CSIRO	Technology transfer
Australian Magnet Technology Pty Ltd	13.5%	From discovery to commercialisation of rare earth magnets
Bio-Coal Briquette Company Ltd	16%	Smokeless briquettes
Cassiro Pty Ltd	50%	Sewage treatment and disposal; improving soil productivity
Dunlena Pty Ltd	38.7%	From discovery to commercialisation of agricultural chemicals
Gene Shears Pty Ltd	50%	Modifying the effects of unwanted genes
Gropep Pty Ltd	50%	R&D of growth factors and related peptides
The Preston Group Ltd	26%	Simulation and scheduling systems for aviation and ground transportation

CSIRO also has less than 5% equity holdings in the following companies:

• Austek Microsystems Pty Ltd: VLSI chip designs;

• Incor Ltd: conveyor belt monitor technology;

•Queensland Metals Corp. N.L.: magnesite processing;

•Mineral Control Instrumentation Ltd: the Universal Smog Monitor.

Mission, Goals and Objectives

CSIRO's Mission

CSIRO's ethos will affirm, above all, the qualities of service and excellence—service to all the Australian people through scientific excellence. Our goal is to give Australians a better future.

Corporate Goals

• To contribute to Australia's quest for improved economic performance, living standards, environmental quality and community understanding of science and technology, through excellence, leadership and teamwork in research.

•To enhance the efficiency, international competitiveness and growth of Australia's

- -information and communications industries
- -manufacturing industries
- -minerals and energy industries
- -rural production and processing industries
- -construction industries.

•To provide the scientific knowledge required for the effective management and conservation of Australia's natural resources and environment.

•To improve human well-being and community health in Australia.

• To strengthen mechanisms for determining research priorities and resource allocation across the Organisation in order to maximise the contribution of CSIRO research to national economic and social welfare.

• To provide support to facilitate the conduct of efficient and effective research by the Organisation.

Research Objectives

Each Institute and Division has a set of objectives to support the corporate goals. The objectives for the six Institutes are:

Information Science and Engineering

[Formerly known as the Institute of Information and Communications Technology. The change was brought about by a wish to reflect the use of information science and technology in engineering applications that are attuned to the needs of users.]

—to be a leader in strategic research on information and communications technologies for the benefit of Australia;

—to help increase the international competitiveness and export orientation of the Australian information, telecommunications and space industries;
—to assist other industry sectors to improve their competitiveness through the use of advanced computer, communications and space systems.

Industrial Technologies

—to increase the international competitiveness, efficiency and scope of Australia's manufacturing industries, with emphasis on technologies that are broadly applicable to the development of new products, processes and services.

Minerals, Energy and Construction

—to increase the international competitiveness, expand earnings, and increase the gross domestic product and the value of the services provided by Australia's minerals, energy and construction industries.

Animal Production and Processing

—to improve the economic and social wealth of Australia by helping the animal and food industries to develop a wider range of quality products and by enhancing the efficiency and international competitiveness of these industries.

Plant Production and Processing

—to improve and sustain the productivity and profitability of industries based on field crops, pastures, horticulture and forests;
—to improve knowledge of Australia's soils, plants and insects.

Natural Resources and Environment

—to provide the scientific knowledge required for the effective management and conservation of Australia's natural resources and environment, particularly in relation to the conservation and protection of natural heritage and sustainable use by dependent industries.

Achievements and Activities

CSIRO's research has produced many major advances in the past year. The selection of achievements and activities described in this section demonstrates how CSIRO is achieving its corporate goals and research objectives. A more comprehensive account of the Organisation's very broad range of research activities can be found in the annual CSIRO Directory of Research Programs, which is available both electronically (on the AUSTRALIS database) and as a book (CSIRO Bookshop, 314 Albert St, East Melbourne, Vic. 3002).

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Developments

Expanding exports

Research achievements

Clean fuels

Environmental concerns about fossil fuels could have a major impact on Australia's energy markets, both domestic and export. Several CSIRO projects are investigating how to obtain cleaner fuels.

Coal

Coal is currently Australia's largest export, contributing well over \$5 billion a year to the economy, with substantial increases forecast.

However, there is a widening quality gap between the raw coal mined and tightening buyer specifications that are resulting from changed market needs and stronger environmental regulations. CSIRO's coal preparation program is helping to bridge this gap and is also providing new technologies and products for export and for import substitution. Highly beneficiated coals are also important for more efficient power generation technologies that are associated with lower carbon dioxide emissions.

Superclean coal (5% ash) and ultraclean coal (below 1% ash), were developed by the Divisions of Coal Technology and Fuel Technology. These products can replace oil in power generation and industrial use and can also provide a feedstock for high value-added carbon products and chemicals.

CSIRO has formed a joint venture, Auscoal, with White Industries and the Australian Coal Industry Research Laboratories Ltd (ACIRL) to undertake commercial development and marketing of these premium fuels.

Natural gas

Interest in natural gas as an alternative fuel to coal and oil is increasing. Natural gas is a much cleaner burning fuel than other fossil fuels, with a substantially lower yield per unit of energy of carbon dioxide, a major 'greenhouse' gas.

Australia possesses substantial reserves of conventional natural gas (methane) but a very large alternative source of methane exists locked in coal seams. This coal-bed methane is a very attractive resource as coal basins are often located nearer to population and industry centres than are conventional natural gas reservoirs, making domestic supply and export potentially cheaper.

The Division of Geomechanics has started a research program aimed at providing a local R&D base for the infant coal-bed methane industry in Australia. Close links have been established with coal companies to ensure research results can be implemented successfully. The research is concentrating on exploration techniques to locate good reserves of methane, evaluation techniques for likely productivity and techniques to improve recovery.

A search for genes important to the nation's wheat crop The Division of Plant Industry, in collaboration with Departments of Agriculture and universities throughout the country, is exploring and mapping the genetic make-up of 'primitive wheats'—naturally occurring grasses that are related distantly to domesticated wheat. This is providing a vital genetic resource base to boost Australia's wheat breeding programs.

The successful transfer of genes that help plants to resist disease or parasites can often lead to improvements in yield. However, eventually the genetic make-up of most parasites adapts to overcome the inhibiting plant genes. The researchers have to stay one step ahead of the parasite changes so that commercial yields can be maintained and breeders have a varied source of resistance genes with which to work.

The Division has identified populations of the grass *Triticum tauschii* that carry resistance to at least six important parasites and diseases of wheat. 'Synthetic wheats' derived from these grasses are now in breeding programs and are already providing new sources of disease resistance.

In collaboration with the Universities of Adelaide and Sydney, the Division is also developing biochemical/molecular markers that will help to identify disease resistant genes in *T. tauschii* and other grasses and to indicate their level of transfer into commercial wheat in breeding programs.

Statistics to aid crash tests

The export drive of the Ford Motor Company of Australia in selling its new Capri car in the USA has been materially helped by CSIRO.

The Capri had to meet tough new American motor vehicle safety standards and Ford sought help from CSIRO to achieve this goal. The problem for the company was that the cost of manufacture, air freighting to the USA and crash testing the vehicles was about \$200 000 per car.

The Division of Mathematics and Statistics devised simple statistical models to interpret crash test results. These models enabled Ford to find out the effects that design features of the car had on the maximum decelerations of the head and chest of a dummy driver.

Use of the statistical models meant that fewer cars were needed in crash tests to gain the information needed to meet the American safety standards. Ford was saved considerable expense and was also able to avoid delays in exporting.

Magnesite processing

The Division of Mineral Products is helping Queensland Metals Corporation in its development of a large deposit of magnesium carbonate ore (magnesite) at Kunwarara in central Queensland. CSIRO's research is aimed at further processing of the raw materials to gain greater export value and to replace some chemical imports.

Several products are being developed: high-grade refractory magnesia (for which a \$180 million plant is under construction); magnesium chloride feedstock (for making high-purity magnesium metal); and stable magnesium cements for walls and flooring.

Effluent treatment can also benefit from a Kunwarara magnesite product. Lightly calcined magnesia may prove to be a safer, more cost-effective chemical for neutralising acid effluents than the more conventional lime and caustic soda. Kunwarara has the long term capacity to produce very large quantities of this material much more competitively than that manufactured from sea water or from most other magnesite deposits. CSIRO is therefore seeking ways of using magnesia in several effluent treatment problems to stimulate demand in Australia and overseas.

Fabric Assurance by Simple Testing

Fabric Assurance by Simple Testing (FAST) is a simple objective measurement system developed by the Division of Wool Technology.

It consists of a set of instruments designed to enable users of Australian wool to produce high-quality fabrics and garments consistently. The system provides accurate measurements of the mechanical properties of fabrics that determine how well wool garments can be tailored and how they will perform during wear.

Difficulties in predicting the performance of fabrics currently cost the world textile industry about \$500 million a year in rejected or downgraded garments.

A joint commercialisation program with the Australian Wool Corporation is well advanced and FAST is already being used by fabric and garment manufacturers in Australia, England, France, Germany, Israel, Italy, Japan and the USA.

The FAST system is cheaper and faster than existing alternatives and is easy to use. Results can be obtained within one hour either manually or with a personal computer. A software package enables the user to get an expert evaluation of the results and to predict the behaviour of the fabric during tailoring.

Engineering seed proteins

A CSIRO research team has been the first to determine the three-dimensional atomic structure of a legume seed storage protein.

Knowledge of the structure of this protein provides the basis for genetic

engineering attempts to produce nutritionally-enriched legumes.

The protein whose structure has been determined is phaseolin, which occurs in the French bean. Given the similarity of their storage proteins, the research is of immediate relevance to all economically important legume crops such as soybean, peas and lupins.

Cereal and legume seeds are of major importance in world nutrition as they provide a source of protein for both animals and humans. However, they are deficient in certain key amino acids. Genetic engineering could produce crops enriched in these missing amino acids and so help add value to one of our major agricultural crops.

CSIRO staff member Roslyn Raison with the three FAST instruments. They are (from left) the compression meter, the bending meter and the extension meter An attempt made by an overseas company to engineer enriched phaseolin failed in the absence of the detailed structural information now unravelled by the CSIRO team.

Developments

Sensory research in Japan expanded

The Division of Food Processing has expanded the activities of its Sensory Research Centre (reported on in last year's Annual Report). The Centre studies the food preferences of people in Asian countries in order to help Australian exporters provide acceptable food products. A research and product evaluation centre has been established at Chuo University in Tokyo, Japan, using funds provided to CSIRO by the Government in its 'May Statement' of 1989.

Siroclear commercialised

CSIRO and the International Wool Secretariat have successfully commercialised a system to detect dark fibre and vegetable matter contamination in white wool yarns. Invented by the Division of Wool Technology, Siroclear offers wool processors a ten-fold cost saving by eliminating contaminants at the yarn rather than the fabric stage. Large scale industrial trials are under way in Switzerland.

Cotton research agreement signed

The Division of Plant Industry has signed a research agreement with Monsanto Company (US) and Cotton Seed Distributors Pty Ltd (Australia) to genetically engineer insect resistance into CSIRO-developed cotton varieties. The main target will be the *Heliothis* moth pest. (This research was highlighted in last year's Annual Report.)

Increasing productivity

Research achievements

The Young Eucalypt Program

This program was a cooperative endeavour between CSIRO, the forest services of Tasmania and Victoria, and forest industries in these States. It explored ways of increasing the productivity of the young regrowth forest that is common to much of south-eastern Australia. Options for managing these forests are extremely important in the conflict over logging native forests.

Seven research projects studied a number of issues associated with growth, harvesting and use of these forests during the four year-long program. The results are being compiled into a report: *The Young Eucalypt Report*, 1990.

The report states that intensive management of regrowth forests will enable them to make a significant contribution to the economies of the two States. It is already apparent that the work will have a substantial impact on forest and industrial practice.

The program was also an experiment in research management. The ownership of Australia's forests and its dependent industries is fragmented to a degree that seriously inhibits an integrated approach to research and development. The program was run by a Management Board, drawn from its participants, and CSIRO scientists led each of the projects. This arrangement proved most effective in providing direction and in gaining access to existing information and resources.

Improving crop yields during drought

Scientists in the Division of Tropical Crops and Pastures have made a discovery that should greatly reduce some of the massive crop losses Australia suffers every time there is a drought.

The research has been carried out in collaboration with the University of Queensland and the Queensland Department of Primary Industries.

The discovery concerns osmotic adjustment, a natural process that minimises the effects of water shortages in plants. The scientists found that, under water stress, grain sorghum varieties with a high level of osmotic adjustment yielded 30 per cent more than varieties that have low levels of this characteristic.

Plant breeders should be able to use this information to develop grain sorghum varieties with a greater ability to yield well under dry conditions. Research is now aimed at identifying the genes that control osmotic adjustment and developing a quick method to screen plants for the desired characteristics.

New cattle breeds

A joint venture between CSIRO and Australian beef producers has resulted in the arrival of 73 Boran and Tuli calves in Australia in March 1990. This is the largest single importation of new cattle genetic material ever made into Australia.

It is also the first time cattle have been imported from a high risk disease area (Africa), a task that demanded complex technologies and procedures devised and overseen by the Division of Tropical Animal Production.

This new genetic material is expected to make a significant impact on the cattle industry. Crossbreeding could increase productivity by between 5 and 30 per cent, resulting in an increase in value of the beef herd of at least \$100 million a year by 2014.

The breeds combine high fertility, a docile temperament and excellent beef characteristics with high levels of resistance to the environmental stresses that exist in many parts of Australia. Both breeds will now be multiplied and undergo studies to assess their role in commercial beef production.

The project required the cooperation, assistance and support of other Federal and State organisations, in particular the Australian Quarantine and Inspection Service (Department of Primary Industries and Energy), the

Department of Foreign Affairs and Trade, the Queensland Department of Primary Industries and the Western Australian Department of Agriculture.

Vaccine to prevent lupinosis

CSIRO has developed a new vaccine that controls lupinosis, a poisoning disease of livestock. The vaccine is now being commercialised. Poisoning of livestock by toxins from plants and micro-organisms is responsible for production losses of about \$100 million a year in Australia. Contamination of the food chain by some of these toxins is also of concern to Australian and overseas consumers.

Until now, attempts to produce a vaccine to prevent this poisoning have not been successful. The lupinosis vaccine developed by the Division of Animal Health is the first of its type in the world. Lupinosis results when livestock graze lupin stubble that is infected with a toxin-producing fungus. Use of the new vaccine would enable animals to graze infected but otherwise highly nutritious lupin stubbles and give farmers greater flexibility in managing their flocks and pastures.

It would also encourage wider planting of lupins, which are a high-protein cash crop. Lupins greatly increase the fertility of poor sandy soils and provide a disease break and other benefits for subsequent crops such as wheat. The Division is also commercialising a test to detect lupinosis toxins at very low levels. This will help ensure that Australia's lupin seed exports, currently earning over \$120 million a year, meet the highest quality and safety standards for both animal and human consumption. CSIRO Senior Technical Officer Rex Holmes with 'Lumimba' the Boran bull, on its arrival at the Tropical Cattle Research Centre in Rockhampton in March 1990

Developments

Vaccine to control cattle pregnancies launched

A vaccine to control pregnancy in cows was launched in Queensland in June 1990. 'Vaxstrate' was developed by the Divisions of Animal Production and Tropical Animal Production in collaboration with a consortium formed by Arthur Webster Pty Ltd and Peptide Technology Ltd.

Better beef processing technology released

'Alternative slaughter' technology, developed by the Division of Food Processing and the Australian Meat and Livestock Research and Development Corporation, was released in November 1989. The \$10 million prototype of this automated system for processing beef cattle has been operating at the Brisbane abattoir as a demonstration unit. The technology eliminates many of the dangerous and arduous tasks in traditional abattoir operations and significantly reduces unit costs. It will be installed in two Australian commercial abattoirs in 1991 and should be fully operational early in 1992.

New laboratory to be built in France

At Montpelier in Southern France in December 1989, Mr Barry Jones, Minister for Science, Customs and Small Business, formally agreed to the purchase of land by CSIRO from AGROPOLIS for use as a new biological research centre. (AGROPOLIS is the representative body of all French agricultural research organisations present in Montpelier.) The Division of Entomology's current research station at Montpelier has played a vital role in the development of biological control agents for use against weeds of European origin that invade Australia. The Wool, Wheat and Meat Research Councils are contributing funds to the building of this more permanent and modern base.

Band seeder commercially produced

The large farm machinery manufacturer, Connor Shea Napier, has begun production of a band seeder developed jointly by the Division of Tropical Crops and Pastures and the Queensland Department of Primary Industries. The seeder sows pastures legumes with minimal soil disturbance and uses much less energy than conventional cultivation methods.

Developing new industries, technologies and products

Research achievements

Software for planning electoral boundaries

The Division of Information Technology and the Australian Electoral Commission have pioneered the development of a computer-based support system for planning electoral districts.

The Commission intends to use the new system, which is based on the Division's Interactive Territory Assignments software, in the revision of Commonwealth electoral boundaries.

In analysing boundaries the Commission has to take into account several factors such as existing boundaries, population density, demographic changes, common interests of communities, and transport and communication links within planned electorates.

These dynamic factors mean that the distribution of voters within Australia must be under constant review. Although large amounts of data must be collected and

analysed, changes must be made quickly with a minimum of technical fuss. The CSIRO software offers powerful map display and problem solving features. Commission staff can use these features to examine more options in a shorter time.

Progressive lenses for better vision

Sola Optical, a spectacle lens manufacturer based in Adelaide, has an extensive R&D centre. For the last three years scientists from the Division of Mathematics and Statistics have been working with the company on the design and manufacture of progressive multi-focal lenses.

Progressive lenses are an alternative to bifocals. Like bifocals, they have different zones for correcting near and distance vision, but the transition between the zones is continuous. This eliminates many of the optical and cosmetic problems associated with bifocals. The mathematical input to the design was crucial to its success.

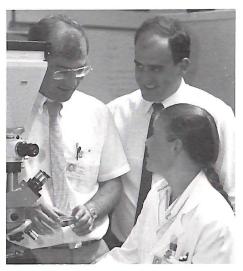
CSIRO's input includes assisting Sola's R&D staff with quality control and providing training on quality management.

New colour imaging unit for world market

CSIRO has signed a licence agreement with Bio-Rad Laboratories Pty Limited, Australia, to manufacture and market a 'Real Time Colour Imaging Unit for Scanning Electron Microscopes'.

The product was developed by the Division of Forestry and Forest Products.

The electron microscope normally presents a black and white image. The CSIRO development provides an immediate colour picture, requires no specialist training to operate, nor any computer support and is simpler and less costly than digital alternatives.



CSIRO Division of Mathematics and Statistics scientist Tony Miller (left) and Sola Optical staff discuss the design of progressive lenses Apart from the visual attraction of colour images, they have an increased information content, making it easier to identify various materials in a sample. The device provides a pleasing blend of colours with a clearer image than digital alternatives. It can be fitted readily to existing electron microscopes as well as being included in new equipment.

The Division's scientists are now looking at potential applications of this technique in medical and forensic science.

Continuous microwave reactor

In July 1989 a novel chemical reactor was launched onto the commercial market, under the name 'Microlab'. It was invented by the Division of Chemicals and Polymers for laboratory use and developed under licence by Industrial Microwave Applications (Australia) Pty Ltd.

The continuous microwave reactor allows chemical reactions to be carried out at higher temperatures and pressures than conventional equipment will accomplish. As a result, reactions that used to take hours or even days in the laboratory, can now be carried out within minutes. For example, isopropyl acetate, a commonly used perfumery and solvent, takes 18 hours to prepare for a 47% yield by the conventional method. In the continuous microwave reactor, the process takes about 2 minutes and the yield is over 86%.

This new technology appears ideally suited to scale-up for industrial production of chemicals. Since the launch, orders for the unit have been received from several countries including the US, Canada, Japan, France, the UK and the Netherlands.

Surface coatings

CSIRO has several projects under way to investigate surface treatments and ways of improving them.

The performance of many industrial and domestic products can be affected by the properties of their surface. Special coatings are often applied to improve performance. For example, drills and cutting tools are usually coated to give greater resistance to abrasion and corrosion.

Surface properties are also important in modern technologies such as optical fibres, integrated circuits and ceramics.

A new electronically controlled plasma torch for spraying of metallic, ceramic or composite powders has been developed at the Division of Manufacturing Technology. This is one outcome of a Generic Technology Grant made to the Division to study the electric arc and its application to surface treatment.

The Division's industrial partner in the project, Siddons Ramset Limited, has now finalised commercial arrangements for manufacture and marketing of the plasma torch.

Plasma spraying is widely used in the aircraft turbine engine industry. The technology is rapidly reaching the stage where engineered surfaces can be obtained under controlled and automated manufacturing environments.

The electronically controlled plasma torch will provide significant advantages over existing commercial systems because it is simpler to use yet faster and more accurate and can coat a larger surface area at one time.

The Division of Applied Physics has developed a tool that can provide

information about the properties of coatings and near-surface materials. It is called an ultra micro-indentation system (UMIS).

There is great industrial potential for continuing improvement of surface properties of materials by further research and development. The UMIS instrument can provide essential information on the performance of different kinds of surfaces and coatings. It is already in demand from several scientific and industrial laboratories in Australia and the USA.

There is a worldwide market for the instruments, which are valued at about \$90 000 each, and pilot production by the Division has already achieved sales to three major high-technology firms in the United States.

Isasmelt

The Isasmelt process has been developed jointly by Mount Isa Mines Limited and the Division of Mineral and Process Engineering to treat lead concentrates, drosses and battery scrap to recover pure lead. It is based on the successful Sirosmelt process developed by CSIRO for use in a variety of smelting applications.

Since a pilot Isasmelt plant was built at Mount Isa in 1984, overall smelter production of lead bullion has increased. The company has now decided to construct a \$50 million smelter that will use the process to produce 60 000 tonnes of lead a year.

Britannia Refined Metals, a subsidiary of Mount Isa Holdings (UK) also plans to use Isasmelt at its Northfleet plant in Kent.

In addition to its cost savings, Isasmelt also helps recover sulphur dioxide and restricts lead emissions, so that better working conditions and a cleaner environment result.

Developments

Supercomputer facility opened

A new Cray supercomputer facility for CSIRO and Leading Edge Technologies was opened in March 1990 in Melbourne by the Minister for Industry, Technology and Commerce, Senator Button, and the Minister for Science, Customs and Small Business, Mr Jones. The supercomputer will also be available to users outside CSIRO, thereby providing opportunities for collaborative research programs with industry.

Award for processor

The Division of Radiophysics and Austek Microsystems Pty Ltd won a special award for Australian innovation and endeavour for their A41102 Frequency Domain Processor. The award, from ETI magazine, was presented at the Convention of the Institute of Radio and Electronics Engineers (IREECON) in Melbourne in September 1989. It was one of a set of awards given to recognise outstanding electronic products in various categories.

Biomolecular research bodies established

Following a review that examined the strategic directions for biotechnology research in CSIRO, Dr Peter Colman was appointed Chief of a new Division of Biomolecular Engineering in December 1989. The mission of the Division is to

assist in the development of Australian pharmaceutical and health-care industries, and to assist other CSIRO biological research activities by maintaining state-of-the-art facilities for molecular and cellular biology.

In June 1990, Victoria's Strategic Research Foundation and CSIRO announced the formation of The Biomolecular Research Institute. The Institute (a joint venture) will function as a centre where research groups from CSIRO, Melbourne's universities and other medical research institutes will have access to the advanced technology needed to study the structure of biological molecules that can be used to make new pharmaceutical drugs and biological control products. Dr Peter Colman is interim Director.

Gene Shears joint venture formed

The Gene Shears joint venture, reported on in the last year's Annual Report, was officially formed in July 1989. The French company Groupe Limagrain is investing \$22.5 million over six years to help exploit CSIRO's new gene shears technology. Negotiations are under way to bring an Australian partner into the company.

Scrimber plant opened

In November 1989, the world's first commercial Scrimber plant was officially opened at Mount Gambier, South Australia, by the Premier of South Australia, the Hon. John Bannon, MP. Scrimber, a reconsolidated timber product, was invented by the Division of Forestry and Forest Products.

Joint NMR facility opened

This joint venture between the University of Sydney and CSIRO was opened in March 1990 by Dr John Stocker (newly appointed Chief Executive of CSIRO) and Professor Don McNicol (newly appointed Vice-Chancellor of the University of Sydney). Over \$2 million of nuclear magnetic resonance spectroscopy equipment has been bought, with CSIRO's contribution of \$1.1 million being part of a special grant given to CSIRO by the Government in 1989 for capital equipment. The facility will carry out research on new classes of materials for use in the health care industry, environmental pollution control, and the minerals, energy and manufacturing industries.

WINDLOADER expert system developed

In 1989, the Division of Building, Construction and Engineering completed the development of WINDLOADER, an expert system used to determine wind loads on structures and to help engineers comply with the Australian Wind Loading Code AS11702. Developed in collaboration with Standards Australia, this is the first expert system in Australia to be sold to a mass market.

Major research agreements signed with BHP

CSIRO and The BHP Co Ltd signed a five year agreement in February 1990 committing both parties to spending a total of \$10 million on research into waste management, remote sensing and gas conversion.

Community and environment

Research achievements

Pulp mills and the environment

Over the past year CSIRO has provided top level advice to government on pulp mill technology and the effects of pulp mill effluents on the environment.

CSIRO scientists provided expert advice on the Environmental Impact Statement on the bleached pulp mill proposed for Wesley Vale, Tasmania. The same expert team subsequently took part in an overseas study tour to report to government on the latest pulp mill technology.

CSIRO is now managing the National Pulp Mills Research Program, a multi-million dollar program to provide the research information required by government to strengthen and update the pulp mill guidelines issued in late 1989.

Funding will be \$15 million over 5 years, with \$7.7 million from the Federal Government. Industry and State governments are being asked to contribute \$7.3 million.

The Program will research and develop pulp and paper technologies and investigate and monitor environmental impacts of bleached eucalypt mill operations.

The ultimate twin objectives are to protect the Australian environment and to add value to Australia's forest resources.

Climate change

The top environmental issue of the decade—climate change—is under intense scrutiny by CSIRO.

Scientists across the Organisation are involved in the most comprehensive program ever established in Australia on climate change research.

CSIRO expenditure on climate change amounted to some \$4.5 million in 1989–90, with a further \$3.3 million committed by the Federal Government for the year.

The benefits flowing from this work will come from a vastly improved ability to predict climate change and will far outweigh the cost of the program.

In a complementary activity, a program of regional climate change assessment has begun, in which CSIRO undertakes to provide specific assessments of likely climate changes for the States and the Northern Territory.

CSIRO is also collaborating with the Bureau of Meteorology to develop an Australian regional climate prediction model. This model will be fundamental to planning in all sectors of the community in response to the greenhouse effect.

New remote sensing techniques have been developed for interpreting the satellite data which are so essential to studies of climate change. This has led to the improved definition of land surface features and improved measurement of sea surface temperatures. A prototype satellite-borne instrument is being developed for determining atmospheric pressure from space.

Earthquake engineering advice

At 10.27 a.m. on 28 December 1989, the city of Newcastle in New South Wales was shaken by a major earthquake. Within three hours CSIRO scientists were in the city inspecting damage.

The Division of Building, Construction and Engineering has two of the few specialists in earthquake engineering in Australia on its staff. They were able to play a significant role in the subsequent investigation of the performance of buildings and facilities.

A major report was prepared jointly by The Institution of Engineers, Australia, the University of Newcastle and CSIRO for the New South Wales Government on engineering aspects of the disaster. Its recommendations are expected to lead to changes in Australian building regulations and structural design codes.

At the time of the quake, the Division was already involved in the revision of the earthquake code being undertaken by Standards Australia and is now collaborating with the insurance industry to assess the implications for insurance risk. It is also researching new methods of repairing and strengthening masonry construction damaged by the earthquake or shown to have inadequate resistance to earthquakes.

Nutritional control of high blood pressure

In a quest to provide a drug-free alternative for treating high blood pressure, the Division of Human Nutrition is investigating a dietary combination of more fish oil and less salt.

A recent CSIRO trial with elderly people showed that their blood pressure was reduced significantly if they ate less salt and included fish oil in their diet.

The Division had previously found that fish oil was the only polyunsaturated oil capable of lowering blood pressure. In another study of mildly hypertensive people, salt restriction was modestly effective. When both measures were used, the lowering of blood pressure was striking.

This phenomenon is being investigated in a strain of rats with inherited hypertension (most human hypertension is also inherited). The diet is successful and much has been learnt about exactly how blood pressure is

lowered. CSIRO scientists believe that this unique nutritional strategy will pay an important role in the treatment of hypertension.

Parkes, Voyager and Neptune

In August 1989, the Voyager 2 spacecraft skimmed past Neptune, sending back astonishing pictures of the giant blue planet and its largest moon, Triton.

To capture Voyager's historic signals, America's National Aeronautics and Space Agency (NASA) used the Parkes radio telescope run by CSIRO's Australia Telescope National Facility, as well as its own telescopes in California and Spain, and at Tidbinbilla, near Canberra.

Blood pressure screening outside a large supermarket in Adelaide to discover and enlist mildly hypertensive volunteers



During the crucial hours of 'close encounter', Voyager's signals were best received in the southern hemisphere. The signals were so weak that by itself, NASA's receiving dish would have been inadequate. The extra collecting area of the Parkes telescope was essential if enough signal was to be captured.

For six months before the flypast, NASA had required almost sole use of the Parkes facility; in return for this, CSIRO received A\$1.2 million.

The Neptune encounter is only the latest event in a relationship between CSIRO and NASA that stretches back to the 1960s. Parkes has complemented NASA's facilities for a number of space missions, and the Parkes and Tidbinbilla antennas are often used together for radio astronomy studies.

Land and Water Care Program

CSIRO has in place a major research program to tackle Australia's land degradation problems, using special funds provided by the Federal government.

The Land and Water Care Program has four primary objectives:

—to overcome gaps in our knowledge of degradation in the cattle grazing lands of the lower and higher rainfall regions of central and northern Australia;

—to assemble information on soil conservation and salinity control options for agricultural land and water catchments, and provide practical decision support systems;

—to address the need to increase crop and livestock productivity in the high potential areas;

—to provide new technologies for reafforesting land that is highly eroded or the source of saline groundwater, and for regrassing denuded grazing and vulnerable crop land.

The program consists mainly of applied research that builds on CSIRO's existing research base. The aim is to provide practical solutions to land management problems.

The work will be closely monitored and evaluated against specific goals, particularly that of transferring practical results to users. The national network of land care groups will be a priority audience.

As part of the formal reporting process, there will be an annual 'seminar' at which project leaders will present their work. This will provide a forum for open debate of the achievements and proposed future directions.

Billabongs yield clues to water management

Scientists from the Centre for Environmental Mechanics have begun an experimental study on that quintessential Australian water body, the billabong. The work, in collaboration with the Murray Darling Freshwater Research Centre, aims to investigate the mixing processes in a billabong in the River Murray floodplain near Albury, New South Wales.

It is such mixing processes that largely determine how algae are distributed within the billabong. Algal cells that are nearer the surface receive more light and nutrients and so grow faster. Excessive algal growth is becoming of great concern to water management authorities as it leads to a reduction of oxygen (eutrophication) and tainted water.

Early results are revealing how the water temperature in a billabong

varies and how fast water evaporates from its surface. This information is of great use to biologists studying biological processes such as algal growth.

Developments

Prime Minister's Science Council addressed

CSIRO provided two of the four speakers on the Greenhouse Effect at the first meeting of the Prime Minister's Science Council in October 1989. Chief Executive and Science Council member Dr John Stocker presented a paper on science education to the Council's second meeting in May 1990.

Marine laboratory at Jervis Bay opened

A \$25 000 laboratory for the Division of Fisheries was opened at Jervis Bay, New South Wales, in November 1989. This laboratory is the key element in a major program of marine environmental studies of the Jervis Bay area being carried out for the Department of Defence.

Pacific environmental research contracts won

CSIRO has won two contracts to assist major research programs in the Pacific area. One contract, awarded by AIDAB, the Australian International Development Assistance Bureau, is for the design phase of a project to monitor sea level and other related climate change signals in the South Western Pacific over a long period. CSIRO also conducted the feasibility study for this project in 1989 and will be bidding for the research project itself when tenders are called.

The second contract, funded by the World Bank, requires CSIRO to identify environmental problems in the South Pacific (particularly those needing emergency treatment) and to recommend possible remedies.

Rangelands policy publication launched

In January 1990, Mr Barry Jones, Minister for Science, Customs and Small Business, launched a Division of Wildlife and Ecology publication called *A Policy for the Future of Australia's Rangelands*. The publication seeks to raise awareness of the need for a national policy for the integrated management of Australia's rangelands.

Soil care action booklet produced

A booklet produced by the Division of Soils on how to reduce soil degradation has been extremely popular. Greening Australia and Westpac have sponsored part of the printing of over 20 000 copies of the booklet, which has been distributed to schools, landcare groups and libraries around the country.

CSIRO process tested on Sydney sewage

Promising results from extensive pilot operations of the CSIRO magnetite-based treatment of sewage in New South Wales led to the Sydney Water Board announcing an \$8.4 million large-scale trial at Malabar Treatment Plant. The new plant will handle 30% of the daily flow into Malabar after it is commissioned in 1991. Successful operation at this scale will also assist CSIRO's overseas marketing of the process.

AIRTRAK launched

The AIRTRAK smog monitor was launched commercially in Australia on 21 August 1989 by Mr Barry Jones, Minister for Science, Customs and Small Business. This followed a launch in the USA in July. AIRTRAK was developed jointly by CSIRO and MCI Ltd.

Division of Soils affiliates with Waite Institute

The Division of Soils has become affiliated with the University of Adelaide's Waite Agricultural Research Institute for joint teaching and research opportunities. Australia faces a severe shortage of soil scientists; new courses in soil conservation will train staff to remedy this. Chiefs of the Divisions of Soils and of Horticulture are members of a policy committee formed to promote development of the Waite campus as a leading international centre for agricultural research and training.

Visit of the French Prime Minister

Monsieur Michel Rocard and Madame Rocard visited CSIRO headquarters on 18 August 1989. They were accompanied by a large official party which included the Minister Delegate for Foreign Affairs and the Minister for Overseas Departments and Territories. The Minister for Industry, Technology and Commerce, Senator Button, and the Minister for Science, Customs, and Small Business, Mr Jones, led the official welcoming party. This visit was in connection with renewed French-Australian research and M. Rocard announced a number of new joint initiatives, some of which included CSIRO research activities. The guests also inspected displays of CSIRO research having connections with France.

M Rocard listens as Dr Jim Peacock, Chief of the Division of Plant Industry, explains the workings of Gene Shears technology. The French company Groupe Limagrain is a partner with CSIRO in the joint venture Gene Shears Pty Ltd

Senator John Button welcomes the French visitors. Seated are Mr Jones (left) and M Rocard



Awards

CSIRO Medals

The 1989 CSIRO Medals were presented on 28 November 1989 by Chief Executive Dr Keith Boardman, in a ceremony hosted by ABC science reporter Mr Robyn Williams. The Medals were awarded to:

• the raw wool measurement team, Division of Wool Technology, for the introduction of objective measurement into the marketing of Australian raw wool (the late Dr M. W. Andrews, Mr D. Charlton, Mr H. G.



David, Mr S. A. S. Douglas, Mr J. F. P. James, the late Dr B. H. Mackay, Mr R. A. Rottenbury, Mr R. B. Whan, Dr K. J. Whiteley);

• the SIROFLOC team, Division of Chemicals and Polymers, for development of the SIROFLOC process for preparation of potable water (Mr N. J. Anderson, Dr B. A. Bolto, Dr D. R. Dixon, Dr L. O. Kolarik, Dr A. J. Priestley, Mr W. G. C. Raper, Dr D. E. Weiss);

• Dr W. J. Peacock, Chief of the Division of Plant Industry, for outstanding research leadership of the Division;

• the High Frequency Radar Division, Defence Science and Technology Organisation, for the Jindalee Over-the-Horizon Radar System (special mention to Dr G. F. Earl, Dr M. G. Golley, Mr J. A. Strath).

Sir Ian McLennan Achievement for Industry Award

Dr N. J. Thomson, from the Division of Plant Industry, received the 1989 Award for the breeding of two new and successful cotton varieties—Siokra and Sicala. The Award was presented by the Governor of New South Wales,

Rear Admiral Sir David Martin, at a ceremony in September at the Sydney Convention and Exhibition Centre.

This Award was established by the former CSIRO Advisory Council in 1985 to recognise outstanding contributions by CSIRO scientists to Australian industry. With Chief Executive Dr Keith Boardman and ceremony host Robyn Williams are the 1989 CSIRO Medal Winners, from left: Dr H. Green (DSTO Division Chief), Dr J. Peacock, and team leaders Dr B.Bolto and Mr R. Rottenbury

Dr Norman Thomson, winner of the 1989 Sir Ian McLennan Achievement for Industry Award, with winners of Certificates of Commendation, from the left Dr Bruce MacA Thomas, Dr Graham Price and Mr Donald Beech



Corporate Affairs

Corporate Planning

Strategic, operational and evaluation plans

Since its reorganisation in 1988, CSIRO has been placing much emphasis on structured planning of its activities. Through such planning, the Organisation determines its goals, and how it should go about achieving these goals for the greatest good of the nation.

The Corporate Planning Office works closely with planners and resource managers at Institute and Divisional levels. Together, they prepare the ground for discussions between the Board, Chief Executive, Directors, Chiefs, line managers and other staff.

The tasks involved in corporate planning can be grouped under four headings:

1) Scan the environment

In fulfilling its mission and goals, CSIRO must take account of the wider world in which it operates.

The Corporate Planning Office provides analyses of external factors (economic, technological, environmental, social and political) in the form of 'outlook' statements for the Organisation as a whole as well as for particular Institutes or research areas. (See box on next page.)

2) Determine strategic directions

A sub-committee of the Board was established in 1989 to develop a perspective on national research priorities as an aid to the Board in determining strategic directions and broad priorities for the Organisation.

3) Prepare corporate plans

CSIRO is required by its Act to produce a Strategic Plan and an Operational Plan.

The Strategic Plan, formulated and approved by the Board, outlines broad strategic goals, corporate objectives, policies and strategies over a five-year period.

The Operational Plan, prepared annually by the Chief Executive, gives effect to the Strategic Plan by providing details of strategies, activities, resources and projected outcomes of programs in key performance areas.

The Corporate Management Plan, for use by CSIRO managers, is prepared every three years to meet the requirements of the Commonwealth budget cycle. This Plan relates strategies and action for the key performance areas (research, technology transfer, funding, employee development, communication, and corporate development) to their proposed budgets and allocations of resources.

4) Integrate plans and budgets

CSIRO is synchronising its planning process with the Commonwealth Budget Cycle to facilitate the work of preparing bids for additional appropriation funds for new research areas.

CSIRO must submit an Evaluation Plan each November to the Government through the Department of Finance. This is a result of a Cabinet decision in November 1988 associated with the development and implementation of the Financial Management Improvement Program in the Commonwealth Public Service.

The first of these plans, submitted for the 1989–90 period, identifies the

reviews and evaluations of major research areas and programs to be conducted in that year, together with evaluations planned for the following two years.

Evaluating the outcomes of research is not an easy task, as results of projects may take many years to be translated by industry or other users into tangible benefits. Nevertheless work is going on in Australia and overseas to develop suitable evaluation mechanisms for research. CSIRO is monitoring these and trialling those methods that seem most suitable.

Outlook: external factors affecting CSIRO planning for the 1990s

- the changing pattern of population growth, both in geographical spread and in age distribution;
- the changing pattern of economic growth and world trade;
- the continuing shift to information and knowledge based industries, and the decreasing resource use in mature economies;
- the risk of increasing protectionism and the move to large trading blocs;
- the continuing decrease in the share of Australian primary products in world and domestic trade;
- the continuing influence of Government policy settings and infrastructure efficiency on industry competitiveness;
- · increasing environmental awareness within Australia and globally;
- the implications for Research & Development of emerging technologies and associated issues;
- the implications for R & D of the future path of industry development;
- the essential role of education and training in restructuring the industry base and expanding the R &D effort;
- the need to boost export performance and import replacement. These areas will be given R & D priority.

Distribution of research effort

CSIRO's distribution of research effort for the year is shown in the figure on page 43.

The data are presented using the classification scheme introduced last year, although a greater range of 14 areas of industry and community interest activity has been identified, based on the Socio-economic Objectives sub-divisions of the interim Australian Standard Research Classification. (The development of this classification is described in more detail below.) This greater range allows the Organisation to plan and set priorities more effectively.

Importantly, the level of research into the environmental effects of economic activity is shown for the first time this year. Previously, this work was reported under the main relevant area of economic activity, e.g. the rural industries sector or the minerals and energy industries sector. Research into key environmental areas such as climate, atmosphere, oceans and natural ecosystems continues to be shown separately.

In addition, research in support of minerals industries is shown separately from energy industries research. The animal, plant and processing components of research in support of the rural industries are also shown separately. The research now classified to the interim Australian Standard Research Classification sub-division 'Advancement of knowledge' remains primarily CSIRO's leading research in radio astronomy. More detailed information on the distribution of research effort may be found in the *CSIRO Data Book*, a pocket-sized compendium of key information on the Organisation's research effort and its financial and human resources.

Classification Scheme

During the year, CSIRO co-operated with the Australian Bureau of Statistics (ABS) in revising the two classification schemes used by the Bureau to collect and present data on the national research and development effort in the biennial Survey of Research and Experimental Development (SRED).

These data are the primary source of information used in debate and policy formulation in relation to science and technology in Australia.

The two research classification schemes used in SRED are

• the Fields of Research classification: the type of research being undertaken in terms of the disciplines involved;

• the Socio-economic Objective classification (SEO): the purpose for carrying out the research or the most direct Australian beneficiary.

The results of CSIRO's revision of the CSIRO Research Classification Scheme in February 1989 (reported last year) were used by the ABS in revising the SEO classification.

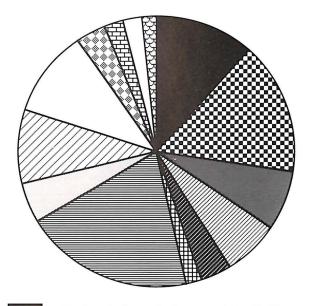
Other revisions set up new classes for environmental research and primary agricultural products.

The ABS is proposing to develop these revised research classifications into an Australian Standard. Until this happens, CSIRO has adopted the interim Australian Standard for its own data collection and analysis purposes.

Research Priorities

In December, as part of its strategic planning, CSIRO began work on developing a methodology for establishing research priorities across the broad range of its research areas. To collect information in a common format, Australian industry and community interest activity has been separated into broad sub-divisions, based on the sub-divisions of the interim Australian Standard Research Classification's socio-economic objectives.

CSIRO DISTRIBUTION OF RESEARCH EFFORT 1989-90 (Proportion of cash expenditure from all fund sources)



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Plant production and primary products 11.4% Animal production and primary products 15.7% Rural manufacturing 7.1% Minerals industries 6.7% Energy resources 3.6% Energy supply 2.0% Manufacturing industries 19.6% Information and communications industries 4.8% Economic development:environmental aspects 8.9% Environment 10.2% Transport, construction and commercial services 3.7% Health, social development and defence 2.2% Advancement of knowledge 2.3% International aid 1.8%

TOTAL CASH EXPENDITURE: \$501.3 million

Corporate Services

Human Resources

Employee development

A pilot career development scheme for senior staff began in March 1990. The scheme aims to provide staff identified as having senior management potential with individual development plans spanning a number of years. The concept of career planning and counselling will be extended to all staff in 1991–92.

Two research leadership courses were conducted during the year. Aimed at Research Program Leaders, Assistant Chiefs and Deputy Chiefs, the courses included an outdoor team challenge to develop leadership, trust, communication and team building skills. Independent evaluation of the courses has found that participants have made significant changes in the way they plan and structure their work.

More than 1500 person training days were invested in professional, technical and trades skills development to help staff perform their current jobs more effectively and safely. Courses organised by Divisions and Regional Employee Development Committees covered areas ranging from off-road driving techniques to statistical analysis and vacuum technology.

Occupational Health and Safety

The network of regional health and safety advisers was this year extended to cover all key CSIRO sites and 70% of CSIRO staff.

The Occupational Health and Safety Agreement between CSIRO and its principal unions was officially launched in October 1989. Under this Agreement, union health and safety representatives have been trained and appointed to cover designated areas.

Under a new policy, all research projects must undergo regular health and safety assessments.

A study into the incidence of gastro-intestinal cancer amongst workers in plant physiology at the Division of Plant Industry concluded that the incidence was not statistically significant. The study recommended more emphasis on laboratory ventilation, and that records be kept of the chemicals used and of the estimated exposure level of staff to them.

Work continued on removing contaminated materials from a former research site at Fishermens Bend in Melbourne, described in last year's Report. Authorities have advised CSIRO that the materials pose minimal environmental and health risks; nevertheless, CSIRO advertised and helped to conduct sessions to provide testing and health counselling for staff and ex-staff who were concerned about their health as a result of the contamination.

Equal Employment Opportunity

While monitoring of existing employment practices continued, emphasis was given to encouraging the career advancement of employees in the four designated EEO target groups.

Work experience opportunities were increased for people of Aboriginal descent, from non-English speaking backgrounds and for those involved in Commonwealth rehabilitation programs.

Annual Scholarship and Training Schemes for senior secondary students

were established. The schemes are now included in CSIRO Education Programs (see p. 49).

Many existing buildings have been modified, and proposed buildings have been planned, with equitable access and facilities in mind.

Progress continued in the establishment of three child care centres in Sydney, Canberra and Melbourne.

The EEO contact officer network has increased to 84 members.

Award restructuring

In June 1990 the Industrial Relations Commission approved a radically revised salary and classification structure for CSIRO. The new unified structure encompasses all staff from the most junior to the Chief Executive.

The number of classifications and grades within the Organisation is reduced from 157 to eleven.

Extensive discussions between CSIRO, the Commission and the six involved unions will also usher in performance-linked rewards, competency-based career progression, revised salary awards, and a more flexible use of human resources in general.

The Commission will hear in August and September 1990 arguments in support of the salary rates proposed for the new classification structure.

Tenure

A comprehensive CSIRO tenure award was endorsed by the Industrial Relations Commission with effect from December 1989. The award provides for indefinite employment to be the normal basis for engagement with CSIRO but permits term appointments where the job needs are clearly short term.

Under transitional arrangements in the award, CSIRO has offered conversion to indefinite tenure to all existing term staff who have completed more than six years of continuous employment. Other current term staff have been given formal consideration for conversion.

Consultative Council

The Consultative Council is the central forum for consultation between management and staff in CSIRO. Composed of an equal number of management representatives and representatives from staff associations, it formally meets in April and October each year with continuing work carried out by its various sub-committees.

These sub-committees deal with personnel policy and conditions, industrial participation, human resources strategy, equal employment opportunity and employee development. The Council is chaired by CSIRO's Chief Executive and the current deputy chairperson is the President of the CSIRO Technical Association.

The main issues considered in the past year were the development of a human resources plan, guidelines on sexual harassment, provision of scholarships to secondary students from Equal Employment Opportunity



Dr Ted Henzell, Director of CSIRO's Institute of Plant Production and Processing, awarded study scholarships to two Aboriginal and Torres Strait Islander students from Townsville in February 1990. More detail can be found on p49 target groups, and improvement of staff training opportunities.

In October 1989, at the Council's 10th anniversary meeting, Mr Barry Jones, Minister for Science, Customs and Small Business, and Minister Assisting the Prime Minister for Science and Technology, officially launched the Organisation's Industrial Participation Plan. The Plan promotes the establishment of Divisional consultative committees aimed at providing opportunities for staff to be consulted on, and contribute to, decisions that affect them and their work environment.

Corporate Finance

In April 1990, a Corporate Finance Unit was established to provide a direct reporting line between the Director, Corporate Services and the groups responsible for accounting services and for developing the Organisation's budget.

Increased emphasis on timely and accurate budget information helped senior management make decisions on resource allocation. Improved Explanatory Notes on budgeting were provided for Parliament.

Returns on CSIRO's invested funds were significantly boosted when the Unit took on a limited treasury function. A professional investment service is to be engaged, and should increase such returns even more.

The first edition of the *CSIRO Data Book* was published in November. This pocket-sized compendium of key information on the Organisation's finances, human resources and distribution of research effort will be updated annually. In addition, two personnel statistics data books were prepared.

Corporate Resources

Property

CSIRO sold four properties during the year for a total of \$2 755 300.

Three properties were acquired: the former Department of Transport and Storage Building at Woodville, South Australia; the residual fifty-year lease on the Australian Coal Industry Research Laboratories at North Ryde; and a house in Canberra.

Work was completed on major building projects at the Division of Chemicals and Polymers in Clayton, Victoria (\$14.7 million), and at the Floreat Park site in Western Australia (\$11.3 million).

Smaller building projects completed were the laboratories at Gungahlin, ACT, for staff transferred from Deniliquin, NSW, and the Division of Entomology's Quarantine Insectary in Canberra.

Negotiations continued during the year between CSIRO and the State Governments of Queensland and Western Australia for the construction of State Government-funded facilities for use by CSIRO.

A redevelopment planning study of CSIRO's major metropolitan site in Sydney (at North Ryde) was completed. The study is to be presented to the Board in the 1990–91 year.

Information and library services

CSIRO's information and library services collect and disseminate scientific information through print, film, video and computer systems.

Over 90 journal issues and 35 books were published during the year, grossing \$1.6 million. Overseas sales contributed \$0.7 million. The Print Advisory Service negotiated and placed over \$700 000 worth of print for the Organisation.

The Library Services Section managed the acquisition of over 11 000 journal subscriptions (worth \$4 million) during 1989–90 for CSIRO's network of 45 libraries.

Ten stories in the Film and Video Centre's 'Researchers' series were released and are being broadcast regularly by 14 TV stations across the country. The successful eight-part series 'The Good Food Show' has been sold to a satellite TV network in Europe.

The National Information Network handled more than 30 000 enquiries from the Australian community in the past year. It provided 6000 information sheets on restoring flood-damaged buildings to people affected by the floods in the eastern states. The Network also produced a book for young people about the greenhouse effect theory.

Compact Disc-Read Only Memory technology was introduced with the development of SAGE—a CD-ROM of scientific information, designed for schools and public libraries. The Information Services Unit is helping Divisions to evaluate markets for CD-ROM products.

Management Information Systems

The main activity for the year culminated in March with the contracting out of mainframe computing services to Fujitsu Australia Ltd under a Facilities Management Agreement. This move will save CSIRO \$2 million annually and, in line with government practices, supports information technology growth in the private sector. The move also provides for considerable growth in information management and for significant improvements in mainframe computing services for CSIRO.

CSIRO also completed the installation of an Australia-wide data network. The sharing of existing voice links will substantially improve the reliability and response times of the network.

This year CSIRO acquired machine-independent commercial accounting software that will enable the use of existing Divisional hardware and allow for greater choice in future hardware purchases. This software will run under at least four operating system platforms and will encourage standard accounting practices in all Divisions.

Surveys have found that user support and training functions have significantly improved computer literacy skills within the Organisation, and a nationwide support hotline has raised further user-confidence in its information management services.

Legal Services

With support from the Minister for Industry, Technology and Commerce, Senator Button, CSIRO has sought investments in several portfolios of technologies from financial institutions and industrial corporations encouraged by the Government's 150% tax deduction.

An agreement with a subsidiary of Groupe Limagrain, France, was entered into in July to commercialise CSIRO's Gene Shears technology. The agreement gave CSIRO the right to introduce an Australian commercial participant, and negotiations with interested parties are continuing.

Siromath, the mathematical consultancy which CSIRO attempted to restore to profitability with Steedman Ltd, has failed. Liquidation proceedings are continuing.

Demand for legal services in CSIRO continues to increase, largely due to the increasing complexity of the arrangements in which the Organisation is involved. A series of standard form legal documents will be produced in conjunction with Sirotech to assist Institutes and Divisions in handling these arrangements.

International Scientific Relations

In December 1989 the then Chief Executive, Dr N. K. Boardman, hosted a four-day International Meeting of Heads of National Research Organisations. Thirteen major international public sector research organisations took part. Stirred by the success of the meeting, the Finnish representative expressed interest in hosting a similar meeting in 1992.

A distinguished visitor to CSIRO in 1989 was His Excellency Domingo L Siazon Jr, the Director General of the UN Industrial Development Organisation (UNIDO). CSIRO, through its International Relations Centre (CIRC), is responsible for the placement of UNIDO-funded overseas trainees seeking training in CSIRO and other Australian organisations.

Professor Li Zhensheng, Vice President of the Chinese Academy of Sciences, spent two weeks in Australia as leader of a delegation studying Australian agriculture. CSIRO and the Academy have an exchange program which arranges some five visits annually in each direction.

Dr B. K. Filshie, Officer-in-Charge of CIRC, was elected to the board of AGRITEC Australia Ltd, a company set up last year by AUSTRADE. The company is made up of some 50 organisations and aims to export Australian agricultural technology to the developing nations of Asia, Africa and the Middle East.

On a recommendation of the Commonwealth Science Council (CSC) to the Heads of Government Meeting in Kuala Lumpur in October 1989, a meeting of Commonwealth science ministers will be held in Malta in November 1990. The proposal for the meeting came from Dr Filshie, who is Australia's representative on the CSC.

Corporate Audit

Three types of audit were performed in 1989–90: reviews of Divisional management; programmed and ad hoc project reviews; and examination of information systems relevant across the whole organisation.

Fourteen Divisions, four scientific and administrative computing areas, and seven administrative systems were reviewed during the year. Savings and risk reductions of more than \$2.5 million have been identified as a result.

The corporate audit service also worked with other groups to evaluate or establish performance indicators, copyright and intellectual property protection guidelines, divisional compliance checklists and a fraud control plan.

Community and Education Activities

The national network of CSIRO Science Education Centres was extended with new Centres being officially opened in Perth (October 1989), Brisbane (November 1989) and Darwin (May 1990). Centres are now located in every capital city except Canberra.

A travelling component of the CSIRO Science Education Centre in Tasmania was launched in Launceston in April, while a similar venture in the Northern Territory is to be launched in July 1990. They are both sponsored by IBM.

CSIRO's Double Helix Science Club used its sponsorship from BHP and the Projects of National Significance Program to greatly expand its operation, with membership jumping from 5000 to over 12 000.

The CSIRO Women in Science Project continued to encourage students aged 15–16 years to continue studying maths and science at senior secondary level.

CSIRO and BHP have again jointly organised the esteemed BHP Science Awards for science teachers and students.

The CSIRO Student Research Scheme placed a record 62 students with scientists in research institutions in Canberra. Sponsorship came from the ACT Office of Industry and Development, the Civic Advance Bank and the Institution of Engineers, Australia. Plans are being developed to extend this program nationally.

Community groups which are under-represented in CSIRO are benefitting from a program to encourage them to study science. Two South Australian students with physical disabilities and two Aboriginal and Torres Strait Islander students from Townsville were given awards which provide a study allowance, work experience in CSIRO and eventually a year's traineeship working with a CSIRO Division.

CSIRO offered ten new post-doctoral awards last year. The recipients are allowed to work overseas for one year and to spend a second year working with a CSIRO Division.

CSIRO and the Powerhouse Museum have jointly created a travelling exhibition that provides a showcase for CSIRO's varied research on the environment. 'Science for Survival' was opened officially by CSIRO Chief Executive, Dr John Stocker, in May 1990 at the National Science and Technology Centre in Canberra. It will spend approximately six weeks in capital city science museums around the country during 1990–91.



CSIRO Chief Executive Dr Stocker opened the 'Science for Survival' exhibition in Canberra in May 1990

Statutory reporting requirements

The *Science and Industry Research Act* 1949 (referred to below as 'the *Act*') and the *Audit Act* 1901 require the CSIRO Annual Report to include a general account of the operations of the Organisation and

• a statement of the policies of the Organisation in relation to the carrying out of the scientific research of the Organisation that were current at the beginning of the year, together with a description of any developments in those policies that occurred during the year (see pp. 3–9, 19 and 40–50);

• any determinations made by the Minister under sub-paragraph 9(1) (a)(iv) of the *Act* during the year;

• any directions or guidelines given by the Minister under section 13 on the *Act* during the year;

• any policies notified by the Minister under section 14 of the *Act* during the year;

• financial statements for the reporting year in a form approved by the Minister for Finance (see pages 54–73);

• the Auditor-General's report on these statements (see page 55).

The Minister made no determinations, gave no directions or guidelines, and notified no policies under the Act during the year.

Trust funds

Science and Industry Endowment Fund

In 1989–90, nine grants totalling \$14 250 were provided from this Fund, which was established under the *Science and Industry Endowment Act* of 1926. Recipients of the 1989 grants ranged from retired professional scientists through amateur naturalists to school science associations. This was in keeping with the intention of the *Act*: to promote interest in scientific and industrial research and to provide support to worthy individuals who have no institutional support.

The Science Grants come from the annual return on the £A100 000 originally allocated to the Fund by the *Act*.

The Chief Executive of CSIRO is Trustee of the Science and Industry Endowment Fund.

F. D. McMaster Bequest Trust Fund

From this fund, four Fellowships were awarded in 1989–90, totalling \$86 758. They are given to support eminent overseas scientists selected to work for a period in CSIRO Divisions in furthering research in agriculture, veterinary science or related fields of biology.

The late Sir Frederick McMaster, a prominent NSW grazier, bequeathed in his will a substantial proportion of shares in his pastoral company to CSIRO on the condition that the proceeds from their sale be used to undertake research in agriculture or veterinary science.

Sir Ian McLennan Achievement for Industry Award

Established in 1985, the Sir Ian McLennan Achievement Award for Industry recognises outstanding contributions by CSIRO scientists to national development.

The winning scientist receives a medal and a grant of up to \$10 000 to undertake an overseas study visit appropriate to the achievement. The company or organisation involved in the development and/or marketing of the innovation is presented with a plaque.

The award recognises the contributions of Sir Ian McLennan to the application of science and technology to Australia's industrial development.

Details of this year's winners can be found on p39.

Freedom of Information

The following information is presented in accordance with the requirements of section 8 of the *Freedom of Information Act*.

The *Freedom of Information Act* gives a right of access to the general public to documents held in CSIRO.

In the year to 30 June 1990, CSIRO received four requests under the Act. Of these, one request was granted in full, two were granted in part and one was withdrawn.

Categories of documents

CSIRO holds documents under the following headings: Financial Management and Administration Buildings and Property Personnel and Industrial Relations Scientific and Industrial Research The following CSIRO documents are customarily made available to the public free of charge: policy circulars; information circulars; staff circulars; *CoResearch* (staff newspaper); film catalogue; list of saleable publications; information service leaflets issued by Divisions on a wide range of technical subjects attracting frequent inquiries from the general public; conditions of CSIRO post-doctoral awards; press releases; information on careers in CSIRO; school project material; and *Industrial Research News*.

Archives and disposal arrangements for documents

CSIRO maintains an extensive archives collection dating from the establishment in 1916 of the Advisory Council for Science and Industry, the original predecessor of CSIRO.

Apart from official files, documents held include personal and scientific material, large quantities of scientific data (including much on magnetic tape) and many maps and photographs.

CSIRO archives are managed by professional archivists and the main collection is housed in Canberra. Limited use has been made of the Australian Archives for the storage of records of a routine administrative nature. CSIRO encourages the use of its archives and provides access in accordance with the provisions of the *Archives Act* 1983.

Facilities for access

Arrangements can be made for documents that are the subject of FOI requests to be made available for inspection at the CSIRO office nearest to the address of the applicant. Help will be given to people with disabilities in entering and leaving CSIRO premises if prior arrangements are made.

FOI procedures and initial contact points

A central Freedom of Information coordinator is responsible for the receipt of requests, referring these to senior officers for decision and granting access to the documents. Initial enquiries should be made to:

FOI Coordinator CSIRO Limestone Avenue CAMPBELL ACT 2601 or PO Box 225 DICKSON ACT 2602 Tel: (06) 276 6123

In accordance with the Freedom of Information Act, formal requests to CSIRO should be addressed to:

The Chief Executive CSIRO PO Box 225 DICKSON ACT 2602

Finance

CSIRO's audited financial statements for the year, which have been prepared on an accrual basis, are presented on the following pages.

Expenditure by CSIRO of funds under its control totalled about \$521m in 1990.

Of this amount, \$375m (72%) came from funds appropriated directly to CSIRO by Parliament. Another \$128m (25%) came from funds provided by industry and other contributors. The remaining \$18m (3%) came from revenue earned by the Organisation, unspent funds from 1989 and receipts from the Department of Primary Industries and Energy for its half-share of the operation of the Australian Animal Health Laboratory.

The year's expenditure from appropriation and revenue funds for salaries and general running expenses was \$465m. Australian National Audit Office Medibank House Bowes Street Woden ACT 2606

13 November 1990 The Honourable the Minister for Science and Technology Parliament House Canberra ACT 2600

Dear Minister

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION AUDIT REPORT ON FINANCIAL STATEMENTS

Section 51 of the *Science and Industry Research Act* 1949 declares the Commonwealth Scientific and Industrial Research Organisation to be a public authority to which Division 3 of Part XI of the *Audit Act* 1901 applies. Pursuant to sub-section 63M(2) of the *Audit Act*, the Commonwealth Scientific and Industrial Research Organisation has submitted for audit report its financial statements for the year ended 30 June 1990. These comprise:

- statement of activity;
- statement of capital accumulation;
- statement of assets and liabilities;
- statement of sources and applications of funds;
- notes to and forming part of the financial statements.

The statements have been prepared in accordance with the policies outlined in Note 1 to the Statements and are in accordance with the Guidelines for the Form and Standard of Financial Statements of Commonwealth Undertakings issued by the Minister for Finance. The statements are in the form approved by the Minister for Finance pursuant to sub-section 63M(1) of the *Audit Act*. A copy of the financial statements is enclosed for your information.

These statements have been audited in conformance with the Australian National Audit Office Auditing Standards.

In accordance with sub-section 63M(2) of the *Audit Act*, I now report that the statements are in agreement with the accounts and records of the Organisation, and in my opinion:

• the statements are based on proper accounts and records;

• the receipt, expenditure and investment of moneys and the acquisition and disposal of assets by the Organisation during the year, have been in accordance with the *Science and Industry Research Act* 1949.

Yours sincerely

P. U. Fanelly

P. A. Farrelly Group Director Australian National Audit Office

Commonwealth Scientific and Industrial Research Organisation Statement of Activity for the year ended 30 June 1990

	Notes	1990 \$′000	1989 \$′000
Operating revenue Parliamentary appropriations		375 161	347 855
Parliamentary appropriations for capital items transferred to statement of capital accumulation	1.4	12 154	18 006
		363 007	329 849
Other revenue	2	18 312	18 465
Grants and contributions	1.13	128 477	99 426
Total operating revenue		509 796	447 740
Operating expense Research Programs	3		
Animal Production and Processing		97 454	90 355
Industrial Technologies		63 210	56 764
Information Science and Engineering		26 836	20 991
Minerals, Energy and Construction		70 665	69 580 52 0(0
Natural Resources and Environment		55 294 92 064	52 960 86 392
Plant Production and Processing Research Support		50 293	49 300
National Facilities		9 809	8 948
Total operating expense		465 625	435 290
Operating surplus (deficit) before			
provisions and unfunded charges		44 171	12 450
Aggregate of provisions and unfunded charges	4	50 979	31 456
Operating surplus (deficit)		(6 808)	(19 006)
Surplus (deficit) on abnormal / extraordinary items	5	9 759	(9 370)
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Operating surplus (deficit) and abnormal/extraordinary items		2 951	(28 376)
Accumulated deficits at beginning of financial year	1.4	(79 418)	(51 042)
Accumulated deficits as at 30 June 1990		(76 467)	(79 418)

Commonwealth Scientific and Industrial Research Organisation Statement of Capital Accumulation for the year ended 30 June 1990

	Notes	1990 \$′000	1989 \$'000
Balance at beginning of financial year	1.4	699 158	681 152
Parliamentary appropriations for capital items transferred from statement of activity	1.4	12 154	18 006
Resources received free of charge	1.5	24 262	-
Balance as at 30 June 1990		735 574	699 158
		=======	=======

Commonwealth Scientific and Industrial Research Organisation Statement of Assets and Liabilities as at 30 June 1990

Equity Capital accumulation Accumulated deficits 1.4 735 574 699 158 Accumulated deficits 1.4 76 467 (79 418) Total equity represented by 659 107 619 740 Current assets Cash at bank and on hand Short term deposits 255 1199 Debtors 6 1425 1209 Prepayments 6 5205 4036 Non-current assets		Notes	1990 \$'000	1989 \$'000
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Total assets 823 539 764 284 Current liabilities	Investments			1 916
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Accrued expenses 7 797 7 161 Creditors 13 895 11 990 Grants and revenue received in advance 1.13 44 374 31 784 Provision for recreation leave 1.7 32 934 28 457 Provision for long service leave 1.7 7 738 7 049 Provision for superannuation benefit 1.8 948 6 409 Mon-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740	Current liabilities			
Creditors 13 895 11 990 Grants and revenue received in advance 1.13 44 374 31 784 Provision for recreation leave 1.7 32 934 28 457 Provision for long service leave 1.7 7 738 7 049 Provision for superannuation benefit 1.8 948 6 409 Image: Non-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740			7 797	7 161
Provision for recreation leave 1.7 32 934 28 457 Provision for long service leave 1.7 7 738 7 049 Provision for superannuation benefit 1.8 948 6 409 Image: Non-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740			13 895	11 990
Provision for long service leave 1.7 7 738 7 049 Provision for superannuation benefit 1.8 948 6 409 107 686 92 850 Non-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740	Grants and revenue received in advance	1.13	44 374	31 784
Provision for superannuation benefit 1.8 948 6 409 107 686 92 850 Non-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740	Provision for recreation leave	1.7	32 934	28 457
Provision for superannuation benefit 1.8 948 6 409 107 686 92 850 Non-current liabilities 107 686 92 850 Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740	Provision for long service leave	1.7	7 738	7 049
Non-current liabilities Provision for long service leave1.756 74651 694Total liabilities164 432144 544Net assets659 107619 740		1.8	948	6 409
Non-current liabilities Provision for long service leave1.756 74651 694Total liabilities164 432144 544Net assets659 107619 740			107 686	92 850
Provision for long service leave 1.7 56 746 51 694 Total liabilities 164 432 144 544 Net assets 659 107 619 740			107 000	92 000
Total liabilities 164 432 144 544 Net assets 659 107 619 740		17	56 746	E1 604
Net assets 659 107 619 740	Tovision for long service leave	1.7	30740	51 694
	Total liabilities		164 432	144 544
	Net assets		659 107 ======	619 740 ======

Commonwealth Scientific and Industrial Research Organisation Statement of Sources and Applications of Funds for the year ended 30 June 1990

	Notes	1990 \$′000	1989 \$'000
Sources of funds			
Funds from operations			
Inflow of funds from operations			
Sales revenue		4 858	3697
Other revenue		5 024	11 100
Proceeds from sale of fixed assets		5 924 128 477	11 106 99 426
Grants and contributions Miscellaneous revenues		128 477	99 426 11 495
Funds from government		10 104	11475
Parliamentary appropriations—Recurrent		363 007	324 943
		515 370	450 667
Outflow of funds from operations –			
expended in the provision of goods and services		471 199	443 123
		44 171	7 544
		11 17 1	,
Capital funds from government			
Parliamentary appropriations—Capital items	1.4	12 154	22 912
Reduction in assets			
Current assets			
Short term deposits		964	-
Debtors		-	15 420
		0(4	15 100
		964	15 420
Non-current assets			
Land, buildings & leasehold improvements		3 273	3 457
Other non-current assets		8 458	2 062
Investments		150	2 520
		11 881	8 039
Increase in liabilities			
Current liabilities			
Accrued expenses		636	1 665
Creditors		1 905	-
Grants and revenue received in advance		12 590	-
		15 131	1 665
Total sources of funds		84 301	55 580
		======	======

		1990	1989
	Notes	\$'000	\$'000
Applications of funds			
Increase in assets Current assets			
Cash at bank and on hand		36 608	73
Short term deposits		-	1 199
Debtors		397	-
Prepayments		1 169	490
			_
		38 174	1 762
Non-current assets			
Land, buildings & leasehold improvements		4 461	6 3 4 6
Other non-current assets		39 708	35 546
Investments		1 548	840
		45 717	42 732
Decrease in liabilities Current liabilities			
Creditors		_	7 335
Grants and revenue received in advance		-	3 751
			11 086
		_	11 000
Other application of funds			
Extraordinary items—costs associated with			
write-off of investment		410	-
Total applications of funds		84 301	55 580
		======	======

Commonwealth Scientific and Industrial Research Organisation Notes to and forming part of the financial statements

Summary of Significant Accounting Policies	1	62–64
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Commonwealth Scientific and Industrial Research Organisation Notes to and forming part of the financial statements

Note 1 Summary of significant accounting policies

1.1 General

Except where stated, the financial statements have been prepared in accordance with the historical cost convention, the Guidelines for Financial Statements of Commonwealth Entities, issued by the Minister for Finance, and the Australian Accounting Standards.

1.2 Fixed assets

Except where stated, all fixed assets are valued at historical cost. Last year CSIRO increased the capitalisation threshold limit of other fixed assets from \$1 000 to \$3 000. Assets costing less than the threshold limit of \$3 000 were expensed or written off. The change in accounting policy had the effect of increasing last year's deficiency by \$14 894 938 (Note 5).

The valuation of buildings and leasehold improvements was performed by the Department of Housing and Construction and CSIRO officers in June 1986. Building valuation includes plant, fixtures and fittings which form an integral part of the building.

Land has been valued by CSIRO's registered valuer in June 1986.

Computer software, scientific glassware, experimental prototype equipment, and library monographs and serials are not capitalised as fixed assets owing to either their uncertain useful lives or the uncertainty of benefits to be derived from their development.

Assets totalling \$7 755 068 (1989 \$8 739 179) which are purchased from Specific Research Funds and where the sale proceeds are refunded to the grantor under the terms of the grant agreement, have been expensed during the year of purchase. Separate records for these assets have been maintained and are disclosed in Note 12.

1.3 Depreciation and amortisation

Depreciation on fixed assets, except land, buildings and leasehold improvements, is calculated on a straight line basis, so as to write off their cost or valuation less estimated residual value progressively over their estimated useful lives.

The valuation or cost of buildings and leasehold improvements is depreciated/amortised over their estimated useful lives or the unexpired period of the leases, whichever is the shorter.

1.4 Capital Accumulation and Accumulated Deficits

In accordance with the revised 'Guidelines for the Financial Statements of Commonwealth Entities' issued by the Department of Finance in June 1990, previous years' capital accumulations have been restated to reflect the new requirement of disclosing 'Capital Accumulations' and 'Accumulated Deficits' separately. Accumulated Deficits as at 1 July 1989 represent three years' accumulated deficits since the introduction of accrual accounting in 1987. Operating surpluses on deficits prior to 1987 were reflected in the balance of Capital Accumulation when accrual accounting was adopted.

This year Parliamentary appropriations for capital items represent Appropriation Bills 2 and 4 which are essentially for capital works and services and major items of equipment over \$250 000. In previous years the threshold limit was over \$100 000. For comparative purposes last year's figures have been restated to reflect the change.

1.5 Resources received free of charge

The Commonwealth amalgamated the activities of the National Building Technology Centre (NBTC) and the Ultrasonics Institute of the National Acoustic Centre with CSIRO in 1989 and 1990 respectively. Land and buildings owned by NBTC and other fixed assets owned by the Ultrasonics Institute valued at \$23 701 000 and \$560 400 respectively have been transferred to CSIRO. These assets have been brought to account as resources received free of charge in the Statement of Capital Accumulation.

1.6 Consumable stores

Stocks of consumable stores mainly consist of fuel and lubricants, chemical supplies, maintenance materials and stationery. They are not material in terms of total expenditure or total assets and are expensed during the year of purchase.

1.7 Employee benefits

Provisions for recreation and long service leave are calculated by multiplying the leave entitlements of employees by their current pay rates. Long service leave is provided for those employees with more than five years service.

1.8 Superannuation

CSIRO is an approved authority for the purposes of the Superannuation Act 1976 and is required to meet the employer's share of the cost of benefits payable pursuant to that Act to eligible employees. CSIRO discharges this liability by periodic payments to the Commonwealth of amounts, expressed as a percentage of the salary for superannuation purposes of eligible employees, estimated by the Commonwealth to be sufficient to meet CSIRO's share of the full accruing cost both of pensions granted on the retirement or death of such employees and any subsequent pension increases.

The amount of employer contributions paid in respect of 1990 was \$30 730 880 (1989 \$28 555 396) representing 15.4% of superannuable salaries.

An actuarial review has been performed to establish the rate to be applicable from 1 July 1990, the results of which are currently pending. An interim rate of 13.9% has been levied to meet the cost of benefits accruing in respect of future service. This rate has been assessed on an estimate of the percentage of CSS members who are expected to transfer to the new PSS scheme prior to 30 June 1991 and therefore could be subject to adjustment if the assumptions prove incorrect.

For the period 1 January 1988 to 30 June 1990 CSIRO has been required to finance benefit payments to eligible employees under the 3% additional superannuation benefit agreed to by the Australian Government. As at 30 June 1990 this accumulated liability represented \$12 614 069 provided as a provision for eligible employees. From 1 July 1990 the following arrangements have been brought into effect. CSIRO is to meet all 3% superannuation liability on a pay as you go basis after fulfilling a one-off funding of the liability calculated as at 30 June 1990 in respect to Non Commonwealth Superannuation Fund (CSS) members to be paid to a third party super fund administrator. This liability has been assessed at \$861 507. The liability for CSS members is to be assumed by the Department of Finance and funded from 1 July 1990 by an additional surcharge of 3% in addition to the 13.9% required to fund the CSS and PSS schemes.

1.9 Investments

Interest in companies (including associated companies) other than SIROTECH Ltd (Note 10) are shown as investments at cost or Board Members' valuation (Note 9). Associated companies are companies in which CSIRO exercises significant influence by holding shares and participating in financial and operating policies.

1.10 Research and development

Research and development costs are expensed as incurred, except where benefits are expected, beyond any reasonable doubt, to equal or exceed those costs.

1.11 Finance and operating leases

CSIRO has elected not to account and disclose finance and operating leases because the amount involved is not material. This is in accordance with the Australian Accounting Standard AAS 17 'Accounting for Leases' (Paragraph 23).

1.12 Sponsored research

CSIRO has entered into various collaborative agreements with external parties for the research and development of technologies, products and scientific know-how. Details of the ownership of intellectual properties vary from agreement to agreement. These agreements do not involve sharing in common of liabilities and interests in assets, other than assets represented by intellectual properties to which CSIRO does not attribute any value in the accounts.

All costs incurred on research and development under the terms of the agreements have been expensed in accordance with Note 1.10 above.

Where CSIRO received licensing fees and/or royalties from sale of products or technologies developed under the collaborative agreements, these have been brought to account when earned.

1.13 Grants and contributions

Grants received in advance represent unearned revenue and specific research debtors represent revenue earned not yet received by CSIRO. Offsets have been made for grants received in advance and specific research debtors. The net balance is disclosed as grants received in advance.

As at 30 June 1990 profits totalling \$15 682 845 have been recognised in specific research program/project accounts and included in this year's grants and contributions of \$128 476 906 as revenue earned in the Statement of Activity.

1.14 Workers' compensation

CSIRO's workers' compensation liability is covered by COMCARE.

1.15 Reporting by segments

CSIRO principally operates in the field of scientific and industrial research and development in Australia. It is therefore considered that for segment reporting, it operates in one industry and one geographical location.

1.16 Insurance

Commencing this year CSIRO has adopted a risk management policy and taken out external insurance for selected liabilities.

1.17 Comparative figures

Where applicable, prior year comparative figures have been restated to reflect the current year's format of financial statements.

Note 2 Other revenue

	1990 \$′000	1989 \$′000
Department of Primary Industries and Energy contribution to the cost of the		
Australian Animal Health Laboratory	4 878	4 677
Interest	4 236	3 703
Royalties	2 066	1 375
Sale of publications	1 999	1 677
Sale of produce and livestock	744	416
International consultancies	49	229
Profit on disposal of fixed assets	350	2 293
Profit on sale of investments	-	980
Miscellaneous	3 990	3 115
	18 312	18 465
	======	======

Proceeds from the sale of fixed assets \$5 925 402 (1989 \$11 106 537).

Note 3 Operating expense

General Research Funds \$'000	Specific Research Funds \$'000	Total 1990 \$'000	Total 1989 \$'000
58 490	38 964	97 454	90 355
53 775	9 435	63 210	56 764
24 344	2 492	26 836	20 991
54 012	16 653	70 665	69 580
41 574	13 720	55 294	52 960
(0.000	22.025	02.044	04 202
69 029	23 035	92 064	86 392
301 224	104 299	405 523	377 042
		100 010	
48 010	2 283		49 300
9 664	145	9 809	8 948
358 898	106 727	465 625	435 290
	Research Funds \$'000 53 775 24 344 54 012 41 574 69 029 301 224 48 010 9 664 358 898	Research Funds \$'000Research Funds \$'00058 490 53 77538 964 9 43524 3442 49254 01216 65341 57413 72069 02923 035301 224104 29948 010 9 6642 283 145	Research Funds \$'000Research Funds \$'000Total 1990 \$'00058 490 53 77538 964 9 43597 454 63 21024 3442 49226 83624 3442 49226 83654 01216 65370 66541 57413 72055 29469 02923 03592 064301 224104 299405 52348 010 9 6642 283 14550 293 9 809358 898106 727465 625

(a) Includes loss on sale of fixed assets \$4 456 318 (1989 \$206 000).

Note 4	Provisions and unfunded charges		
		1990	1989
		\$'000	\$'000
Provision f	or long service leave	5 741	(2 458)
	or recreation leave	4 477	(344)
	or superannuation benefit	6 201	4 981
Provision f	or workers' compensation	-	(1 000)
	or doubtful debts	181	-
Depreciatio	n	34 379	30 277
		50 979	31 456
		======	======
Note 5	Abnormal/extraordinary items		
		1990	1989
		\$'000	\$'000
Abnormal			
	d net adjustment relating to	(1.2.12)	5 505
non-curren		(1 343)	5 525
	legislation on the 3% Commonwealth ation funding (Note 1.8)	11 662	
Superannu	anon runuing (role 1.6)		
		10 010	
		10 319	5 525
Extraordin			
	accounting policy—expensing		
	current assets costing less than \$3,000 (Note 1.2)	-	(14 895)
	ated with the write-off of investment	(5(0))	
IN SIKOMA	ATH Pty Ltd (Note 9)	(560)	
		(5(0)	(14.005)
		(560)	(14 895)
Surplus (de	eficit) on abnormal/extraordinary		12/11/2
items		9 759	(9 370)
		======	=====
Note 6	Debtors		
		1990	1989
		\$'000	\$'000
Interest rec	eivable	_	19
Advances -	-SIROTECH Ltd	300	(44)
	–Other	136	80
	earch debtors	1 143	1 241
Other accru	aed income	121	7
		1 700	1 303
Provision f	or doubtful debts	275	94
		1425	1 209
		=====	=====

Note 7	Land, buildings and leasehold improvements	
	(Notes 1.2 and 1.3)	

	Land (a) \$'000	Buildings \$'000	Leasehold improve- ments \$'000	Total 1990 \$'000	Total 1989 \$'000
At valuation	94750	458 478	17 485	570 713	550 773
Accumulated depreciation	-	62 796	6 001	68 797	52 364
	94 750	395 682	11 484	501 916	498 409
At cost	4 569	43 733	894	49 196	16 620
Accumulated depreciation	-	547	90	637	283
	4 569	43 186	804	48 559	16 337
Work in progress —at cost	-	942	_	942	29 151
	99 319 ======	439 810	12 288	551 417	543 897

(a) Includes Crown land and land held in Commonwealth title totalling \$12 075 000 (1989 \$12 575 000). Negotiations are continuing between CSIRO, the Commonwealth Government and the ACT Government to have leases or title deeds issued in CSIRO's name.

Note 8 Other non-current assets (Notes 1.2 and 1.3)

Equipment	At cost \$'000	Accumulated depreciation \$'000	Written down value 1990 \$'000	Written down value 1989 \$'000
Transport equipment	29 649	1 361	28 288	19 842
Agricultural equipment	2 264	907	1 357	1 370
Computing equipment	55 974	25 339	30 635	28 765
Workshop equipment	5 850	2 771	3 079	3 509
Office furniture and equipment	9 650	3 415	6 235	6 542
General scientific equipment	115 433	53 677	61 756	58 498
Total equipment	218 820	87 470	131 350	118 526
National facilities				
Oceanographic research vessel				
'Franklin'	14 622	5 708	8 914	9 849
Australia Telescope	48 171	1 376	46 795	45 457
Total national facilities	62 793	7 084	55 709	55 306
Total equipment and national facilities	281 613	94 554	187 059	173 832
	=======	=============		==========

Note 9 Investments (Note 1.9)			
	% CSIRO	1990	1989
	interest	\$'000	\$'000
Shares—at cost			
SIROMATH Pty Ltd (Note 5)	49.5	-	150
Other		6	6
		6	156
		6	156
Shares – at Board members' valuation			
Associated companies			
Australian Magnet Technology Pty Ltd	13.5	275	-
Bio-Coal Briquette Pty Ltd	16.0	80	-
Gene Shears Pty Ltd	50.0	500	-
Dunlena Pty Ltd	38.7	365	315
Preston Group Ltd	26.0	495	495
Gropep Pty Ltd	50.0	1	-
Other companies			
Austek Microsystems Pty Ltd		100	100
Incor Ltd		10	10
Queensland Metals Corporation NL		1 303	840
Mineral Control Instrumentation Ltd		260	-
		3 389	1 760
		3 395	1 916
		=====	=====

Mineral Control Instrumentation Ltd and Queensland Metals Corporation N.L. are public listed companies. As at 30 June 1990 the total market values of these quoted shares were \$260 000 and \$1 442 242 respectively.

CSIRO is a minority shareholder (less than 5%) in 'Other companies' listed above.

Note 10 SIROTECH Ltd

SIROTECH Ltd was established by CSIRO, limited by guarantee and governed by a Board of Directors. It was incorporated on 15 November 1984. SIROTECH's main source of revenue comes from service fees paid by CSIRO to cover day to day commercial and intellectual property advice. During the year fees received from CSIRO totalled \$3 514 423 (1989 \$2 875 286). SIROTECH's net assets as at 30 June 1990 amounted to \$727 196 (1989 \$657 936). Due to SIROTECH's commercial activities, it is considered inappropriate for its accounts to be consolidated in CSIRO's financial statements.

Note 11 Commitments

Commitments for expenditure not brought to account in the statement of assets and liabilities as at 30 June 1990 were:

	1990 \$′000	1989 \$'000
Capital	\$ 000	\$ 000
Land and Buildings	777	1 954
Plant and equipment	2 830	5 917
·		
	3 607	7 871
Lease		
Plant and Equipment	12 091	-
Other		
Service Contract	2 013	-
	17 711	7 871
	=====	=====
Due and payable	(()7	7 071
Not later than one year	6 637	7 871
Later than one year but not later than two years	3 148	
Later than two years but not later than five years	7 926	-
	45 511	= 0=1
	17 711	7 871
	=====	=====

Note 12 Resources provided free of charge (Note 1.2)

	Land(a) \$'000	no Buildings \$'000	Other on-current assets \$'000	Total 1990 \$'000	Total 1989 \$'000
At valuation or cost	22 804	14 121	35 425	72 350	91 874
Accumulated depreciation	-	3 268	13 943	17 211	15 228
	22 804	10 853	21 482	55 139	76 646

(a) Includes lands \$10 816 000 (1989 \$10 816 000) which have been purchased out of specific research funds and are in CSIRO titles. In accordance with the grant agreements, any sales proceeds from disposal of these assets shall be refunded to the grantors.

Note 13 Contingent liabilities

Contingent liabilities for which no provision has been provided in the accounts as at 30 June 1990 were:

	1990 \$'000	1989 \$'000
a) Guarantee of bank accommodation and		
debts for associated companies,		
including performance guarantees.	-	1 020
b) Estimated common law claims which are pending but not admitted and		
will be defended.	870	627
win be detended.	070	027
	870	1 647
		=======

Note 14 Monies held in trust

Trust funds are represented by the following investments at cost and cash at bank:

	1990 \$'000	1989 \$'000
Investments		
St George Building Society	80	-
State Electricity Commission of Victoria	12	12
Canberra Advance Bank	303	293
Commonwealth Bank of Australia	2 143	1 861
Westpac Banking Corporation	20	-
	2 558	2 166
Cash at bank	177	114
Total funds held as at 30 June 1990	2 735	2 280
		====
The components of trust funds are as follows:		
William McIlrath Trust Fund	167	139
David Rivett Memorial Lecture Fund	82	71
F. D. McMaster Bequest	2 379	1 964
Sir Ian McLennan Achievement for Industry		
Award	107	106
Total funds held as at 30 June 1990	2 735	2 280
	=====	=====

Note 15 Auditor's remuneration

The total amount paid and payable to the Auditor-General for the audit of CSIRO amounted to \$204 910 (1989 \$234 341). No other benefits were received by the Auditor-General.

Note 16 Board members' emoluments

Emoluments or other benefits received or due and receivable directly or indirectly by full-time and part-time Board members were as follows:

	1990 \$'000	1989 \$'000
Full-time members Part-time members	243 117	97 107
	360	204
	====	====

The numbers of Board members whose total emoluments (including 3% superannuation, recreation and long service payouts on termination) fall within the following bands were as follows:

	\$	
1	-	10 000
10 001	-	20 000
20 001	-	30 000
30 001	-	40 000
40 001	-	50 000
90 001	-	100 000
200 001	-	210 000

CERTIFICATION OF STATEMENTS

In our opinion, the Statement of Activity, Statement of Capital Accumulation, Statement of Assets and Liabilities, Statement of Sources and Applications of Funds, and the accompanying notes to and forming part of the statements, have been prepared in accordance with the Guidelines for the Financial Statements of Commonwealth Entities and show fairly the operations of the Commonwealth Scientific and Industrial Research Organisation for the year ended 30 June 1990 and the state of affairs as at that date.

J. W. Stocker Chief Executive

12.11.90

P. H. Langhorne Director Corporate Services 12. 11. 90



