CSIRO

Annual[®] Report

1996 971



CSIRO — the Commonwealth Scientific and Industrial Research Organisation — is one of the largest and most diverse scientific institutions in the world. It has a staff of more than 6700 working in laboratories and field stations throughout Australia.

CSIRO is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act* 1949.

CSIRO'S VISION

To be a world class research organisation vital to Australia's future.



ANNUAL REPORT 1996-97

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The Honourable John Moore MP Minister for Industry, Science & Tourism Parliament House CANBERRA ACT 2600

We have pleasure in submitting to you, for presentation to Parliament, the forty-ninth Annual Report of the Commonwealth Scientific and Industrial Research Organisation.

We commend the Organisation's achievements to you.

J. C. .. Alten

D Charles K Allen, AO (Chairman of the Board) October 1997

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Malcolm K McIntosh (Chief Executive)

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1996-97 AT A GLANCE

- Research highlights:
 - as part of a Cooperative Research Centre team, invention of the world's first nanomachine, an extremely sensitive biosensor;
 - development of a new method for X-raying soft tissue;
 - new improved drug delivery techniques and improvements in the diagnosis and treatment of prostate cancer;
 - production of one of the world's first genetically-modified grapevines;
 - identification of introduced marine pests in Australian waters;
 - development of genetically-modified sugarcane varieties to reduce the browning of raw sugar.
- Commercialisation highlights:
 - three major companies have joined with Queensland Metals Corporation and CSIRO in the development of a commercial magnesium plant in Queensland;
 - launch of Skin Polarprobe™ melanoma diagnosis machine;

- launch of ZERO₂, a new type of food packaging to extend shelf life;
- international launch of *Fastflo* computing software for solving partial differential equations;
- development of new clean, green automotive paints to be manufactured by Du Pont;
- commercial field trials of INGARD, the first genetically engineered cotton crop in Australia.
- CSIRO's restructuring has been substantially completed, with strategic plans and budgets for research in 22 Sectors finalised and a number of Divisions merging.
- Professor Adrienne Clarke, AO completed her term as Chairman of CSIRO in December and was succeeded by Mr Charles Allen, AO.
- A National Awareness Program was begun to increase public awareness of CSIRO's activities and their contribution to the nation.

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F O R E W O R D

First and foremost, the year saw the continuation of exciting science and technology of considerable importance to Australia and our research achievements continue to uphold our high international scientific reputation.

We have developed the world's first genetically-modified grapevine and Australia's first commercial geneticallyengineered crop of cotton. We are part of the team from the Cooperative Research Centre for Molecular Engineering and Technology that has invented the world's first nanomachine, a minute biosensor with extreme sensitivity. Our completed Port Phillip Bay study is now a model for the future management of Australian water catchments. We developed a new method for taking accurate X-rays of soft tissue and have commercialised an automated diagnosis system for melanomas. Our work on development of a magnesium industry for Australia has taken a step forward with industry partners building a demonstration plant, and we have discovered a chemical that may reverse the effects of ageing in cells.

This year also saw the consolidation of the new CSIRO management structure. We now look forward to a period of relative stability and intense scientific activity across the Organisation as the new arrangements settle down and CSIRO builds on its capacity to deliver research outcomes to its customers and stakeholders.

A major sign of the change is our new three-year Strategic Research Plan to cover 1997-98 to 1999-2000. The Plan reflects a purposeful redefinition of the way CSIRO identifies, plans, conducts and markets its research, reinforcing the notion that CSIRO is a single entity whose diverse skills are coordinated and harnessed to meet national economic, environmental, societal or scientific needs. The Plan, which is an amalgam of the overviews of the 22 individual Sector Plans, results from extensive work over the past year by staff throughout the Organisation in consultation with over two hundred members of our Sector Advisory Committees.

The Sector Advisory Committees were established in mid-1996 to assist with the identification of priorities in each Sector and to provide informed external user input. The Committees represent key stakeholders from industry and Government (their membership is listed in Appendix 7) and CSIRO places significant importance on the advice they provide regarding the direction of research effort within individual Sectors. Each Sector Plan is signed off by the relevant Sector Advisory Committee. We have found our interactions with these Committees most rewarding and thank the members for their ongoing interest and commitment to the work of CSIRO.

We were especially pleased to see representatives of many of our Sector Advisory Committees at the second CSIRO-Government Workshop held in February 1997. The primary aim of these Workshops is to enable senior representatives from CSIRO and Government Departments and Agencies to exchange information about each others' plans and progress, and to discuss what might be needed in science and technology in the future; they provide valuable guidance and input to our Strategic Plan.

The final facet of our restructuring to provide strong support for our customers through the new Sector and Alliance arrangements has been the move towards Divisions operating more as the business units of the Organisation.

We aim to have fewer Divisions, each of sufficient size to ensure an appropriate focus on our underlying scientific base, and each able to accommodate likely fluctuations in income and expenditure. This strategy will assist our overall objective of doing the most research with our available resources.

All of this requires scientific leadership of the highest order together with efficiency in all aspects of our management and administration. The last factor sometimes requires rationalisation of our sites and increased sharing of support staff and facilities.

This change in approach reflects the view that in the last few years we have had too many research units with some too small to be viable or effective in the long-term.

We therefore began a process of rationalisation in mid-1996 which led to a reduction in the number of Divisions and Units from 33 in June 1996 to 27 in June 1997 and 24 in July. All corporate support groups have also been significantly reduced.

During 1996-97 CSIRO mounted cases for continued Government investment in R&D. We are pleased to record not only the Government's agreement to maintain essentially the same level of funding for the 1997-2000 triennium as was received through the triennium just concluded, but also the restoration of \$60 million to CSIRO's base funding through additional appropriations of \$20 million a year for each of the three years of the new triennium. This latter decision was accompanied by a requirement to provide returns from CSIRO to the amount of \$60 million over the same period, to be obtained from efficiency gains, asset realisations and other measures. Overall this has the potential to leave CSIRO significantly better off than we might have been.

CSIRO's external earnings remain in good shape in the changed climate following the Government's introduction of a range of policy changes to R&D schemes, tax concessions and tax syndication. The impact of these changes and other recent decisions, as well as any future decisions on the issue of competitive neutrality, will need to be managed carefully to ensure we can maintain our overall research effort.

To ensure that CSIRO continues to receive an appropriate ongoing level of financial support from both Government and industry, we depend very much on good public awareness of CSIRO's achievements and scientific contributions. CSIRO recognises a responsibility to tell the public what it does with its funds and without public support and endorsement of our work, CSIRO's resources will soon dwindle. We therefore embarked on two major initiatives in public communication this year.

The first was the establishment of a National Awareness Program in July 1996, headed by former science writer for *The Australian* newspaper, Julian Cribb. This program has produced a significant improvement in national and regional media coverage of CSIRO science. One of our most successful initiatives has been the regular briefings at Parliament House, in partnership with other science bodies, where key scientists speak on subjects topical to national policy at meetings well attended by Parliamentarians and their staff.

The second initiative culminates several years of vigorous effort by our Division of Plant Industry to establish a visitors centre in Canberra. In May 1997 we were proud to announce the start of construction of "Discovery", a \$5.5 million centre comprising an exhibition hall, café, merchandise outlet, education laboratories and a hightech conference centre, that will showcase real Australian science in action. The \$19 million complex will combine Discovery with working CSIRO laboratories. Optus Communications is the prime sponsor and the ACT Government is also contributing strong financial support.

In December 1996 Professor Adrienne Clarke, AO, completed her five year term as Chairman of CSIRO's Board. Professor Clarke had been involved with CSIRO since 1985, first as a member of CSIRO's former Executive, then as a Board member and then Chairman from December 1991. The Board and CSIRO have greatly appreciated the very active support she has given the Organisation. Professor Clarke displayed great personal drive and commitment and saw many matters through to a conclusion that reflected the best interests of both CSIRO and Australia. Professor Clarke worked with five Chief Executives (Dr Paul Wild, Dr Keith Boardman, Dr John Stocker, Dr Roy Green and Dr Malcolm McIntosh) and since the establishment of the Board in December 1986, was associated with two major restructures of the Organisation. The result of the most recent restructure is a CSIRO that today provides a much sharper focus on our customers and stakeholders whilst ensuring the health of the Organisation's underlying basic science.

Professor Clarke provided dedication and leadership to CSIRO and science in Australia, often through difficult times; she has been a consistent and persuasive advocate on behalf of CSIRO and science as a career. The Board and CSIRO record their warmest thanks to Professor Clarke and wish her well in the continuance of her academic and many other varied endeavours.

In December 1996 Professor Clarke was succeeded as Chairman by Mr Charles Allen, AO, a geophysicist by training and most recently, Managing Director of Woodside Petroleum (1982-1996).

During 1996-97 there were a number of other changes on the Board. Mr Doug Shears and Mr Nigel Stokes completed their terms and Mr Greg Taylor resigned when he was transferred from the position of Secretary of the Department of Industry, Science and Tourism. Mr Shears, Mr Stokes and Mr Taylor made many substantial and valuable contributions to the Board's activities, particularly in the commercial and financial area, and were actively involved in the work of several important Board sub-committees. In May 1997 we welcomed new members Professor Mary O'Kane, Mr Norbury Rogers and Mr Russell Higgins.

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D Charles K Allen, AO Chairman of the Board

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Malcolm K McIntosh Chief Executive

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CORPORATE OVERVIEW

CORPORATE VISION AND PURPOSE

Vision

To be a world class research organisation vital to Australia's future.

Purpose

We serve the Australian community through outcomes which provide:

- benefit to Australia's industry and economy;
- environmental benefit to Australia;
- social benefit to Australians; and
- support to Australian national and international objectives

through excellence in science and technology, and in the provision of advice and services.

Values critical to our success

1. Satisfied customers and supportive stakeholders through application of our research

Operating principles

- We determine our research and commercialisation priorities by assessing the needs of, and potential benefit to, our customers, based on an understanding of their business and the world markets in which they operate.
- We contribute our expertise to the development of science and technology policy and priorities in Australia.

- We commit ourselves to excellence in technology transfer to ensure timely exploitation of research results.
- We provide quality advice and service.
- We deliver our research and services on time, within budget and in accordance with legal, contractual and ethical obligations.

2.CSIRO - unity of purpose, diversity of means

Operating principles

- We determine priorities and implementation strategies at all levels of the Organisation by a systematic process.
- We apply the highest standards of management practice in all our operations. We pay particular attention to excellence in project management. We foster a culture of teamwork.
- We evaluate all of our activities, working towards the world's best practice in quality and productivity.
- We accept accountability for our decisions on the use of CSIRO's resources and take pride in our achievements for Australia.
- We use lessons from our own and others' practices and experience to improve our performance continually.

3.Top people, top performance, integrity, trust and respect

Operating principles

We work together to create an organisation that:

Seeks to recruit the best and the brightest, provides

a stimulating environment to encourage individuals to develop their full potential, and provides career opportunities which make CSIRO an attractive development base for future industry leaders.

- Fosters adaptability and recognises exceptional performance with appropriate rewards.
- Cares for the safety and well being of all employees with employment policies to support corporate goals.
- Fosters creativity which underpins our performance and delivery.
- Draws upon the breadth and depth of our skills to assemble excellent teams to tackle major challenges and uses networks of special skills inside and outside CSIRO.
- Respects the unique skills, professionalism and knowledge of all our employees, and recognises that we are responsible for creating and maintaining our reputation.

4. First class science — because it helps Australia

Operating principles

- We maintain a world standard of scientific and engineering excellence in order to deliver agreed outcomes to our customers in industry, Government and the community, on time and within budget.
- The quality of our scientific research enhances Australia's international standing.
- We work with Australia's education and training organisations to increase awareness of science and technology, and to enhance the supply of excellent graduates into the scientific and technical workforce.

CHARTER, FUNCTIONS AND POWERS

CSIRO is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act* 1949.

Functions

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; and
- to encourage or facilitate the application and use of the results of its own or any other scientific research.

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

Powers

The Organisation has power to do whatever is necessary 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; and
- charge fees for research, facilities or services provided to others.

A full description of CSIRO's functions and powers can be found in Appendix 3.

RESPONSIBLE MINISTER

From 1 July 1996 to 30 June 1997, the Minister responsible for CSIRO was the Honourable Peter McGauran, Minister for Science and Technology.

Under the Act, the Minister has the power to:

- direct CSIRO to carry out scientific research for any purpose (sub-paragraph 9(1)(a)(iv));
- provide to the Board in writing, directions and guidelines with respect to the performance of the functions, or the exercise of the powers, of the Board or of the Organisation (section 13 (1)); and
- direct the Board, in the performance of its functions and in the exercise of its powers, to have regard to any relevant policies of the Commonwealth Government.

The Minister did not exercise any of these powers during 1996-97.

C O R P O R A T E G O V E R N A N C E

Role of the CSIRO Board

The CSIRO Board was established under the *Science and Industry Research Legislation Amendment Act* 1986 (the *Act*), which came into operation on 5 December, 1986.

The functions of the Board are:

- to ensure the proper and efficient performance of the functions of the Organisation;
- to determine the policy of the Organisation with respect to any matter; and
- to give directions to the Chief Executive.

The Board meets formally every second month for one or two days. Additional meetings may be scheduled as required. In accordance with the *Act*, Board members, with the exception of the Chief Executive, are not involved in the day to day running of the Organisation.

Board membership

Under the *Act*, the CSIRO Board comprises a part-time Chairman and up to eight other part-time members plus the full-time Chief Executive. Details of 1996-97 Board members, their qualifications and terms of appointment are shown on page 9. The Financial Statements contain details of remuneration of Board members (page 104) and their attendance at meetings (page 105).

Board Committees Audit Committee

The Audit Committee, a formal sub-committee of the Board, meets at least five times a year and comprises Dr S M Richards (Chairman), Mr D C K Allen, Prof E J Woods, and Ms E Alexander (external advisor).

The Chief Executive and the Deputy Chief Executive Finance, together with the General Manager Risk Assessment and Audit, and representatives of the Australian National Audit Office, attend meetings at the invitation of the Audit Committee Chairman.

The Audit Committee's purpose as detailed in the Committee's Terms of Reference is:

"to assist Board members in fulfilling its responsibilities relating to accounting and reporting practices of the Organisation. The Committee oversees the Organisation's risk management policies, practices and controls in relation to:

- financial and commercial activities;
- legislative and regulatory conformance; and
- asset protection.

The Committee has unlimited access to both the internal and external auditors and to senior management".

The Committee has recently broadened the scope of the Charter for the Risk Assessment and Audit function to include the audit of policies, systems and management across CSIRO, with particular emphasis on the review of matters "non-financial" as well as "financial", and to receive reports on areas of significant non-compliance.

Other committees

Other sub-committees of the Board are established from time to time to address specific issues, such as the identification of a potential new Chief Executive; they are not permanent entities.

Risk management program

The Board has the responsibility for ensuring an appropriate Risk Management framework is in place to identify and manage high and significant risks to the Organisation.

To this extent, CSIRO undertakes a systematic program of Organisation-wide and Divisional risk assessments designed to identify, evaluate and prioritise risks and develop risk mitigation strategies. The Risk Assessment and Audit Unit facilitates this process with a three year rotation program, utilising a methodology consistent with the Australian Risk Management Standard AS/NZS-4360.

The Audit Committee reviews the Divisional high risk profiles and the risk mitigation strategies through regular reports from the Risk Assessment and Audit Unit.

A risk management policy, and associated guidelines, is currently being promulgated.

Ethical standards

In September 1994 the CSIRO Board endorsed a Code of Conduct that applies to the Organisation's Board, management and staff. The Code provides a benchmark against which conduct can be assessed to ensure that the highest ethical standards are met.

Fraud control

The Organisation's Fraud Control Policy was issued with the Board's endorsement in April 1996. Since then fraud risk assessment has been conducted across CSIRO and a detailed Fraud Plan developed, in line with the guidelines set out by the Commonwealth Law Enforcement Board. The Audit Committee receives a regular six monthly fraud report from the Fraud Control Officer.

Independent professional advice

In the interests of their duties, Board members may seek independent professional advice at the Organisation's expense. However, the Chairman's prior approval is required in all instances.

The CSIRO Board (1996-97)



Chairman 5 December 1991 -4 December 1996

Professor Adrienne Clarke AO BSc PhD FTS FAA

Director, Plant Cell Biology **Research** Centre University of Melbourne



Chairman 5 December 1996 -14 December 2001

Mr Charles Allen AO MA MSc FTSE

Company Director Member 6 November 1996 - 4 December 1996





Chairman Aberfoyle Limited 12 December 1995 - 11 December 1997 (Reappointment) **Mr Norbury Rogers**

Dr Max Richards

BSc PhD FAIMM

BCom FCA Senior Consultant Ernst & Young 28 May 1997 - 31 December 2000

Mr Doug Shears Executive Chairman ICM Australia Ptv Ltd

5 December 1991— 4 December 1996 (Resigned 18 August 1996)



Members

Dr Malcolm McIntosh BSc PhD FRAeS FIEAust CPEng Chief Executive of CSIRO 3 January 1996 -2 January 2001





Dr Eric Tan AM MBBS FRACS FACS

Mr Nigel Stokes

Company Director

1 September 1996 - 30

BEC BA

Managing Director Medical Corporation Australia Ltd 12 December 1995 — 11 December 1998

November 1996 (Reappointment)

Mr Greg Taylor AO BEc(Hons)

Secretary Department of Industry, Science and Tourism 23 April 1996 — 22 April 1999

(Resigned 6 April 1997) **Professor Beth Woods** OAM BAgrSc PhD

Professor of Agribusiness University of Queensland, Gatton 9 June 1995 — 8 June 1998



Joint National Secretary Finance Sector Union of Australia 1 September 1994

- 31 August 1997

Mr Russell Higgins

Secretary, Department of

BEc(Hons)

Mr Kevin Davern





Professor Mary O'Kane BSc PhD Vice-Chancellor, University of Adelaide

28 May 1997 - 31 December 2000

Industry, Science and Tourism

7 April 1997 — 30 June 2000









STRUCTURE, MANAGEMENT AND STAFF

The *Science and Industry Research Amendment Act* 1986 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. He is supported in this role by four Deputy Chief Executives, who together with the Chief Executive, constitute the Executive Committee that oversees CSIRO's operations.

CSIRO's research is planned and resourced on a Sectoral basis. The Organisation has defined 22 Sectors covering research in agribusiness; environment and natural resources; information technology, infrastructure and services; minerals and energy; and manufacturing.

Each Deputy Chief Executive oversees a group of Sectors and a number of corporate functions.

Research is performed by the Divisions or business units of CSIRO. Divisions are largely organised by scientific discipline, and most contribute to more than one Sector.

Details of responsibilities and participation in this new matrix structure are in the Organisation Charts following. (Chart 1: Corporate responsibilities; Chart 2: Sector responsibilities; Chart 3: Operational arrangements).

CSIRO staff are employed under Section 32 of the *Science and Industry Research Act* 1949. At 30 June 1997 CSIRO had a total staff of 6709, which has an equivalent full-time value of 6347 units. The numbers employed in different job categories are shown below.

Staff by gender and principal functional area

	FEMALE	MALE
Admin Support	694	265
Communication & Information	207	121
Corporate Management	8	47
General Services	101	97
Research Management	12	212
Research Projects	920	1730
Research Scientist	148	1264
Senior Specialist	1	25
Technical Services	134	723

CHART 1: CORPORATE RESPONSIBILITIES AS AT 30 JUNE 1997

THE BOARD

Mr Charles Allen, AO (Chairman)

Mr K W Davern Mr R A Higgins Dr M K McIntosh Professor M J O'Kane Dr S M Richards Mr A E N Rogers Dr E G C Tan, AM Dr E J Woods, OAM

CHIEF EXECUTIVE

Dr M K McIntosh

Corporate Executive Office Corporate Secretary

Dr E N Cain

Risk Assessment & Audit

General Manager Mr P O'Callaghan

DEPUTY CHIEF EXECUTIVES

Dr Colin Adam Chair: Minerals & Energy Alliance Alternate Chair: Manufacturing Alliance Dr Bob Frater, AO Chair: Information Technology, Infrastructure & Services Alliance Chair: Manufacturing Alliance Dr Chris Mallett Chair: Agribusiness Alliance Dr John Radcliffe, OAM Chair: Environment & Natural Resources Alliance

CSIRO DIVISIONS AND CORPORATE SUPPORT UNITS

DIVISIONS

Building Construction & Engineering Coal & Energy Technology Exploration & Mining Materials Science & Technology Minerals Petroleum Resources

Commercial Group Corporate Property Legal Network

DIVISIONS

Australia Telescope National Facility Biomolecular Engineering Chemicals & Polymers

Manufacturing Technology Mathematical & Information Sciences

Telecommunications & Industrial Physics

Information Technology Services CSIRO Publishing Strategic Planning & Evaluation Leadership, Career & Team Development

DIVISIONS

Animal Health Animal Production Food Science & Technology Human Nutrition Tropical Agriculture Wool Technology

Corporate Finance

DIVISIONS

Atmospheric Research COSSA Entomology

Forestry & Forest Products Land & Water Marine Research Plant Industry Wildlife & Ecology

Corporate Human Resources

CHART 2: SECTOR RESPONSIBILITIES AS AT 30 JUNE 1997



ENVIRONMENT AND NATURAL RESOURCES (DCE: Dr John Radcliffe)



Dr Brian Walker	Wildlife and Ecology
Dr Brian Sawford	Atmospheric Research
Dr Roger Swift	Land and Water
Dr Chris Fandry	Marine Research

SECTOR COORDINATOR

INFORMATION TECHNOLOGY, INFRASTRUCTURE AND SERVICES (DCE: Dr Bob Frater)

Built Environment

Information Technology and Telecommunications

Measurement Standards

Radio Astronomy



Mr Larry Little	Building, Construction and Engineering
Dr Dennis Cooper	Telecommunications and Industrial Physics
Dr Barry Inglis	Telecommunications and Industrial Physics
Prof Ron Ekers	Australia Telescope National Facility
Dr Ron Sandland	Mathematical and Information Sciences

SECTOR COORDINATOR

MANUFACTURING (DCE: Dr Bob Frater)



MINERALS AND ENERGY (DCE: Dr Colin Adam)



Dr John Wright	Coal and Energy Technology
Dr John Read	Exploration and Mining
Dr Rob LaNauze	Minerals
Dr Adrian Williams	Petroleum Resources

CSIRO OPERATIONS AND REPORTING Chief Executive - Dr Malcolm McIntosh

ALLIANCES AND SECTORS

		A	gribu	siness			Environment & Natural Resources				Information Technology Infrastructure & Services					Manufacturing			Minerals & Energy			
Deputy Chief Executives	Field Crops	Food Processing	Forestry, Wood & Paper Industries	Horticulture	Meat, Dairy & Aquaculture	Wool & Textiles	Biodiversity	Climate & Atmosphere	Land & Water	Marine	IT & Telecommunications	Built Environment	Measurement Standards	Radio Astronomy	Services	Chemicals & Plastics	Integrated Manufactured Products	Pharmaceuticals & Human Health	Coal & Energy	Mineral Exploration & Mining	Mineral Processing & Metal Production	Petroleum
DIVISIONS			-																			
Dr Chris Mallett																						
Animal Health						•																
Animal Production																						
Food Science & Technology																•	•					
Human Nutrition					•																	
Tropical Agriculture																						
Wool Technology																						
Dr John Radcliffe																						
Atmospheric Research								•														
COSSA			•				•	•	•	•				•						•		
Entomology			•	•	•		-	•				•				•		•				
Forestry & Forest Products							•		•			•				•						
Horticulture				•								- >										
Land & Water						•		•	•	•									•	•	•	•
Marine Research					•					•												•
Plant Industry	•		-	•		•	•	•									•					
Wildlife & Ecology	-		•		•	•	-	•	-	•					•					-		
Dr Bob Frater			-													1.46						
Australia Telescope National Facility	_													•								
Biomolecular Engineering																						
Chemicals & Polymers	-																	•				•
Manufacturing Technology	_	•										•			•	•	•		•	•	•	
Mathematical & Information Sciences	•		•	•	•	•	-	•	•	•	-	•			•		•	•		•	-	-
Telecommunications & Industrial Physics						•		•			-	•	•		•				-	•		-
Dr Colin Adam		-									2.55											
Building, Construction & Engineering												•					•				•	
Coal & Energy Technology	-							•	•										-	-	•	
Exploration & Mining										•									-	•	•	•
Materials Science & Technology	_						-	-	-								•	_	-	-	-	
Minerals	_							_	-										•		•	-
Petroleum Resources									1										-	-		-

SENIOR STAFF AND ADDRESSES (AS AT 30 JUNE 1997)

CSIRO Corporate Centre - Canberra

Limestone Ave, CAMPBELL, ACT 2612 Tel: (06) 276 6766

Chief Executive

Dr Malcolm McIntosh

Deputy Chief Executives

Dr Colin Adam Dr Bob Frater, AO Dr Chris Mallett Dr John Radcliffe, OAM

Corporate Executive Office

Corporate Secretary Dr Ted Cain Government Business and International Scientific Liaison

Principal Secretary Dr Beth Heyde

Manager Education Programs Mr Ross Kingsland

Manager, Ministerial and Government Business Ms Marie Keir

Director National Awareness Mr Julian Cribb

Corporate General Managers

Finance Mr Bob Garrett Human Resources Mr Peter O'Keefe Information Technology Services Mr Jonathan Potter

Property Mr George Harley

Publishing

Mr Paul Reekie

Risk Assessment and Audit Mr Peter O'Callaghan

Strategic Planning and Evaluation Dr Andrew Pik

Divisions

Animal Health

Chief: Dr Mike Rickard Private Bag 24 GEELONG VIC 3220 Tel: (03) 5227 5000 Fax: (03) 5227 5555

Animal Production

Chief: Dr Oliver Mayo Locked Bag No 1, Delivery Centre BLACKTOWN NSW 2148 Tel: (02) 9840 2700 Fax: (02) 9840 2940

Atmospheric Research

Chief: Dr Graeme Pearman PMB 1 ASPENDALE VIC 3195 Tel: (03) 9239 4400 Fax: (03) 9239 4444

The Australia Telescope National Facility

Director: Prof Ron Ekers PO Box 76 EPPING NSW 2121 Tel: (02) 9372 4100 Fax: (02) 9372 4310

Biomolecular Engineering*

Chief: Dr Tom Spurling 343 Royal Parade PARKVILLE VIC 3052 Tel: (03) 9662 7211 Fax: (03) 9662 7221

Building, Construction and Engineering

Chief: Mr Larry Little PO Box 56 HIGHETT VIC 3190 Tel: (03) 9252 6000 Fax: (03) 9252 6244

Chemicals and Polymers*

Chief: Dr Tom Spurling Private Bag 10 CLAYTON SOUTH MDC VIC 3169 Tel: (03) 9545 2222 Fax: (03) 9545 2446

Coal and Energy Technology

Chief: Dr John Wright PO Box 136 NORTH RYDE NSW 2113 Tel: (02) 9490 8666 Fax: (02) 9490 8909

Entomology

Chief: Dr Paul Wellings GPO Box 1700, CANBERRA ACT 2601 Tel: (06) 246 4001 Fax: (06) 246 4000

Exploration and Mining

Chief: Dr Bruce Hobbs Private Bag WEMBLEY WA 6014 Tel: (08) 9387 0200 Fax: (08) 9387 8642

Food Science and Technology

Chief: Dr Michael Eyles PO Box 52 NORTH RYDE NSW 2113 Tel: (02) 9490 8333 Fax: (02) 9490 3107

Forestry and Forest Products

Chief: Dr Glen Kile PO Box E4008 KINGSTON ACT 2604 Tel: (06) 281 8211 Fax: (06) 281 8312

Horticulture*

Chief: Dr Jim Peacock, AC GPO Box 350 ADELAIDE SA 5001 Tel: (08) 8303 8600 Fax: (08) 8303 8601

Human Nutrition

Chief: Prof Richard Head PO Box 10041, Gouger Street ADELAIDE SA 5000 Tel: (08) 8303 8800 Fax: (08) 8303 8899

Land and Water

Chief: Dr Graham Harris PO Box 225 DICKSON ACT 2602 Tel: (06) 281 8480 Fax: (06) 281 8473

Manufacturing Technology*

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CORPORATE DEVELOPMENT

RESTRUCTURE

The restructuring of CSIRO is now substantially complete, with the establishment of strategic plans and budgets for 22 Sectors, and the reduction from 33 to 27 Divisions or Units at 30 June 1997. At various times during the year the following Divisional changes occurred:

DIVISIONAL CHANGES DURING 1996-97 Old Divisions/Units

Tropical Animal Production Tropical Crops and Pastures

Applied Physics Radiophysics

Information Technology Mathematics and Statistics Biometrics Units

Environmental Mechanics Soils Water Resources

Fisheries Oceanography

On 1 JULY 1997

Biomolecular Engineering Chemicals and Polymers

Manufacturing Technology Materials Science and Technology

Horticulture Plant Industry

New Divisions

Tropical Agriculture

Telecommunications and Industrial Physics

Mathematical and Information Sciences

Land and Water

Marine Research

Molecular Science

Manufacturing Science and Technology

Plant Industry

The new structure is shown in the Charts on pages 11-14.

EDUCATION PROGRAMS

CSIRO's Double Helix Science Club undertook a national survey of termite attacks on houses for the forestry industry and scientists. The data collected provided new information that will help the industry give advice to consumers. A new joining kit was developed for Club members and BHP increased its sponsorship of Double Helix to \$170 000 per year.

Two teaching units, Gene Technology and Forensic Frenzy, toured nationally, appearing at CSIRO Science Education Centres and elsewhere. A new school science theatre production, "Our Place in Space" was developed.

FINANCE

The CSIRO Executive agreed to the specification and development of a computer-based project information and reporting system that will be implemented in 1997-98. Related changes to the Organisation's accounting policies were finalised.

A revised assets management policy that focuses on improved capital budgeting and strategic asset management was completed and released. An expensesbased travel policy was fully implemented after a yearlong trial.

HUMAN RESOURCES

The Corporate Human Resources group has coordinated continuing development of CSIRO's employment conditions and arrangements to align them better with the needs of research. This is enabling CSIRO to attract, retain and develop the staff best able to deliver top class research outcomes.

Initiatives, which are in line with the employee relations strategies outlined by the Government, included a major review of remuneration and reward structures, increased emphasis on performance management and introduction of employee consultation processes that ensure all staff can be involved directly. The current Enterprise Agreement expired on 30 June 1997, and CSIRO is considering options for development of replacement arrangements.

INFORMATION TECHNOLOGY SERVICES

During the year, the Corporate Information Management unit was reviewed and subsequently merged with Information Technology Services. This resulted in a redistribution of funds to support research, and a smaller corporate group focusing on activities that support the library and information community across CSIRO.

A new strategy for the funding and operation of CSIRO's voice and data network was introduced, in which all network components were upgraded to a CSIRO standard. An ongoing replacement program was established.

There was a continuing emphasis on security enhancement for major corporate applications and a new method of funding corporate servers was developed.

Corporate systems have been assessed for Year 2000 compliance and a project to implement the necessary changes has commenced. A program has also been commenced to assess the impact on CSIRO of Year 2000 compliance by stakeholders and other associated organisations.

NATIONAL AWARENESS

A new unit was established in July 1996 to promote greater public awareness of CSIRO's research and its contribution to the nation. The National Awareness Program has its initial focus on providing more information to the media, and during the year significantly increased the output of corporate media releases about scientific achievements. A trial run of National Science Briefings for Federal politicians, on topical subjects related to national policies, was well received and is being developed into a continuing program for both Federal and State politicians; this initiative is supported by, and run in collaboration with, all the major scientific bodies in Australia.

PROPERTY

Capital works projects worth \$25 million were completed at Geelong, Belmont and Weribee (Victoria), Darwin (Northern Territory), Marmion (Western Australia), Yarralumla and Black Mountain (Australian Capital Territory), Kintore Avenue and Woodville North (South Australia). Major facilities at Clayton (Victoria) and Gungahlin (Australian Capital Territory) are nearing completion.

Rationalisation of sites continues with the disposal of properties worth \$24 million. The major sales were at North Ryde (\$16.8 million) and Badgery's Creek (\$3.5 million) in New South Wales, and Maribyrnong (\$2.6 million) in Victoria. The only acquisition was the purchase of the land component of the Syndal site in Victoria for \$1 million.

Negotiations over State initiatives at the Queensland Centre for Advanced Technology in Brisbane and at Bentley, Western Australia, are nearing completion.

RISK ASSESSMENT AND AUDIT

During 1996-97 seven Divisional risk assessments were completed and three at an Organisational level, the latter covering potential exposure in information technology security, intellectual property management, and equity holdings. Nine Divisional audits and seven specialist Organisation-wide audits were completed; the latter included the corporate payroll system, corporate property capital expenditure, commercial practice compliance and insurance.

SECURITY

The Security Implementation program continued with an Awareness program conducted for line management and training workshops run for CSIRO Security Officers.

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INTRODUCTION

Under a 1995 agreement with the then Ministers of Finance, and Industry, Science and Technology, CSIRO and the other Commonwealth science agencies agreed to trial six Performance Indicators as a means of demonstrating a commitment to continuous improvement.

The chosen indicators were: Shift of resources in accord with priority decisions; External funding; Customer satisfaction; Adoption of research results; Publications, reports and patents; and Training.

The first trial results were reported in the 1995-96 CSIRO Annual Report in the Corporate Development section. This year's Annual Report has been redesigned to report outcomes in the context of these six Indicators. The following sections are based on summaries of each Performance Indicator. A detailed Performance Indicator report is being prepared for senior management analysis and follow-up action.

The introduction to each section first describes the formal Performance Indicator and then, where appropriate, describes extra information collected for the Annual Report.

The context of the indicators in terms of CSIRO's mission is depicted below.



SHIFT OF RESOURCES ACCORDING TO PRIORITY DECISIONS (Performance Indicator 1)

This indicator measures CSIRO's shift of resources in line with changing priorities as determined in consultation with Government and CSIRO customers in the public and private sectors.

CSIRO undertakes a major assessment of research priorities on a triennial basis in line with the Organisation's Triennial Funding Agreement with Government. The assessment is undertaken in consultation with stakeholders in the public and private sectors and guides the subsequent broad allocation of resources between different research purposes. For the triennium 1994-95 to 1996-97 CSIRO's priority decisions were framed against a set of socio-economic objectives (SEOs) drawn from the Australian Standard Research Classification. In December 1993, the major priority decisions agreed by the CSIRO Board were as follows:

- resources for the Mineral Resources, Manufacturing, and Information and Communications SEOs to be increased; and
- appropriation funding to be maintained at the existing level for the three Environmental SEOs in total.

The trend in expenditure on each of these SEOs over the period is shown in Table 1. The figures differ from those published in last year's preliminary performance indicators report, reflecting a change in the measurement procedure to align total expenditure with CSIRO's accrual-based operating statement.

Comparing 1993-94 (the year before commencement of the triennium) with 1996-97 (the final year of the triennium) expenditure on the Manufacturing and Information and Communications SEOs has increased in line with the priority decisions in both absolute and proportional terms. The share of appropriation expenditure devoted to the three Environmental SEOs has remained steady at 22.2 per cent, with some movement between Environmental Aspects of Economic Development and Environmental Knowledge.

The observed trend in expenditure on the Mineral Resources SEO is associated with the pattern of expenditure of special funding received by CSIRO to facilitate development of technology for an Australian magnesium metal industry. Additional Commonwealth appropriation funds of \$20 million were supplemented by funds from the Queensland Government and industry sources. Expenditure associated with these funds peaked in 1993-94, and obscures the underlying trend.

Table 1: Total CSIRO Expenditure for Selected SEO Subdivisions, \$ million.

SEO Subdivision	1993-94	1994-95	1995-96	1996-97
Mineral Resources	79.3	73.4	72.3	68.5
Manufacturing	90.0	97.1	97.4	102.4
Information & Communications	26.2	25.9	32.9	34.1
Environmental Knowledge	67.5	60.9	68.1	82.3
Environmental Aspects of Economic Development	78.6	78.3	75.6	65.8
Environmental Policy and Management Frameworks	8.3	11.9	7.6	7.2
Total of Selected Subdivisions	349.9	347.5	354.0	360.4
CSIRO Total	695.0	680.2	693.5	693.8

EXTERNAL EARNINGS

(Performance Indicator 2)

This indicator is a measure of the demand for CSIRO's research and services consistent with its mission. The agreed target is for external earnings to be 30 per cent of total income derived from the provision of research and technology services and outputs.

External earnings derived from the provision of research and technology services or outputs for 1996-97 were 33.2 per cent (\$221.4 million) of total income, up from 32.6 per cent (\$201.8 million) in 1995-96 and from 29.6 per cent (\$206.7 million) in 1993-94.

Direct industry funding (excluding industry funding by way of levies through the rural research and development corporations) now accounts for some \$68 million or roughly one third of the total external income.

Note that these numbers are based on income, not expenditure. Expenditure details are provided in the Financial Statements in this Annual Report.

CUSTOMER SATISFACTION

(Performance Indicator 3)

This indicator is intended as a measure of CSIRO's responsiveness to customer needs and has been assessed primarily for those cases where there is a contractual arrangement. The data therefore tend to exclude, at least at this stage, satisfaction with, for example, the provision of scientific advice to aid Government policy making.

Formal post-contract surveys on customer satisfaction were conducted by 14 out of the 22 CSIRO Divisions in 1996-97; up from 10 out of the 32 Divisions existing in 1995-96. A response rate of 35 per cent was achieved, yielding 506 returns, mostly in connection with completed contracts. This is a considerable increase over last year when 281 returns were reported.

A high satisfaction level was again recorded, with individual surveys obtaining levels ranging from 80 per cent to 100 per cent. The main instances of dissatisfaction were again in contract preparation time and in timeliness of report delivery.

In addition to the formal surveys, other means of gauging customer satisfaction included repeat business, joint project management with clients, milestone achievement, reporting and payment, and formal project review by clients.

RESEARCH RESULTS

(based on Performance Indicator 4)

The Research Adoption indicator assesses the significance or impact of the work CSIRO does as opposed to the External Earnings indicator, which simply measures CSIRO's ability to generate revenue. The measure looks at examples of CSIRO-developed practices, instruments, products, and processes adopted by users in industry, Government and the community, or changes in user practice in response to policy advice provided by CSIRO.

However, for this Annual Report we have also included information on some of the major milestones or significant events in our research activities, to provide a fuller picture of our operations. Some stories appear in more than one Sector because they are equally relevant to each area.

The research is reported by Sectors, grouped into Alliances. Only a selection of outcomes is presented in this Report. A fuller list of Sector outcomes can be found on CSIRO's WWW site at http://www.csiro.au/news/ach9697/contents.htm.

This section concludes with a brief description of the CSIRO Medals awards for research achievement.

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Research awards
AGRIBUSINESS

Field Crops Sector

Harvest strategies to maximise grain legume yield and quality

Timing of the pulse harvest is crucial to maximise yield and quality. A recent Grain R&D Corporationsponsored study by CSIRO Entomology on the postmaturation and safe storage of field peas and lupins showed yield losses increased and seed quality deteriorated the longer the harvest was delayed. Yield loss due to pod drop and shatter increased as the plant and seed desiccated. Germination capacity decreased, the seed was bleached by weathering, and mouldiness increased. The extent of yield losses and quality changes varied between the different varieties of field peas and lupins, with up to 30 per cent yield improvement attained by higher moisture and earlier harvesting.

Disease resistance genes cloned

CSIRO Plant Industry scientists have cloned three disease resistance genes, two for rust resistance from flax and maize, and a third for cereal cyst nematode resistance in wheat. Plant transformation experiments have shown that genetic engineering for rust resistance will provide an added tool for controlling rust diseases.

The quest for whiter sugar

Purer, whiter sugar, produced following research by CSIRO Tropical Agriculture and Plant Industry scientists, will give Australia's \$2 billion sugar industry an internationally competitive edge. Low colour sugarcane varieties are being produced to reduce the browning of raw sugar — an advance that can save the sugar refining industry up to \$5 million per year in colour removal costs. Browning in sugar is due to the activity of an enzyme. The gene that gives rise to this enzyme has been isolated from sugarcane and efforts are underway to reduce the production of the enzyme and so reduce the browning.

Cotton decision support systems

entomoLOGIC, a PC-based decision support system for cotton management developed by CSIRO Plant Industry and Entomology scientists, is now widely available in the cotton industry, with over 400 registered users. While not all growers use the program to manage their crops, an increasing proportion of the innovative growers seeking a sustainable production system are now using entomoLOGIC exclusively for pest management decisions.

Feed wheats for the temperate high rainfall zone

CSIRO Plant Industry has released two varieties of wheat (Lawson and Paterson) that could transform the high-rainfall zone from grazing to mixed cropping. These varieties have also initiated a new Australian industry of feed wheat production. They are novel in Australia for being winter varieties, rather than spring, and for offering feed for winter grazing plus subsequent high yields of grain. In the first year of commercial release, demand by growers exhausted all the available seed supply.

INGARD cotton

CSIRO Plant Industry scientists have contributed to the delivery of the first commercial genetically engineered crop in Australia, through development of INGARD cotton. The National Registration Authority for Agricultural and Veterinary Chemicals approved planting of thirty thousand hectares in 1996-97. Despite a difficult growing season, the transgenic crops required significantly less pesticide than conventional cotton crops, averaging only 30 per cent as many applications. However, there was some variation in performance and yields across different regions. The INGARD varieties were released as part of a comprehensive, pre-emptive, resistance management plan designed to minimise the chances that *Heliothis* pests may evolve resistance to the genetically modified plants.

Food Processing Sector Malting enzyme master switch

CSIRO Plant Industry scientists have identified what they think is a master switch in barley grain called GAMyb that seems to control the production of all the "malting" enzymes. The scientists believe that it may be possible to genetically engineer GAMyb to produce increased levels of all malting enzymes during grain germination. The switch plays a major part in mediating a series of metabolic processes set in motion by gibberellin, a plant growth hormone that controls malting enzyme production in the grain.

Fat-reduced manufactured meat products

Hans Continental Smallgoods Pty Ltd has launched a range of reduced-fat smallgoods based on CSIRO Food Science and Technology research. The key technology, patented internationally, was licensed to the food ingredients company Applied Technical Products Ltd (ATP) and further developed for use in manufactured meat products following collaboration between ATP, CSIRO and Hans. The technology is unique in that the product is a replacer for solid fat, and it has allowed the fat content of smallgoods such as Strassburg to be reduced substantially with no loss of sensory quality.

Launch of "ZERO₂" advanced packaging technology

CSIRO Food Science and Technology has developed 'ZERO₂', a new component for food packaging that absorbs oxygen from within the package and so extends the shelf life of products susceptible to oxidation. It will be used in packaging foods such as processed meats and cheeses, nuts, pasta, prepared meals, beer and wine and will significantly enhance export opportunities for Australian produce. Southcorp Holdings is to fund R&D and commercial development.

Black tea may protect against skin cancer

Research at CSIRO Human Nutrition has shown that black tea appears to provide significant protection against the development of skin tumours caused by exposure to UV radiation resembling sunlight. It is possible that potential health benefits for humans associated with tea drinking may derive from black tea and not just green tea, as has been assumed in the past. Further studies are in progress to identify the active constituents which afford this protection.

Safety of fermented meats

In the aftermath of the major food poisoning outbreak in South Australia associated with fermented meat in 1995, the Division of Food Science and Technology studied the factors controlling the growth and survival of highly pathogenic *E. coli*. Fermented products receive no heat treatment, so must rely on other product or process parameters to ensure their microbial safety. Factors controlling the survival of bacteria in such products were identified and advice provided to the Australia New Zealand Food Authority, to aid in the development of an industry code of practice. The work was undertaken in consultation with industry to minimise the impact of the new requirements on the sensory attributes of the product.

Exporting food to Indonesia

The results of a study by the Division of Food Science and Technology of the market, culture and consumer trends in Indonesia were released to the food industry. The study included assessment of regulations and the distribution system. The outcomes emphasize the importance of understanding cross-cultural sensory perceptions and preferences when planning entrance or expansion strategies in this market, where the top 1 per cent of the population holds major buying power and has high expectations for quality of imported foods.

Forestry, Wood and Paper Industries Sector

Bushfire fighters need the right clothing

Scientists at CSIRO's Forestry and Forest Products and Worksafe Australia have recommended that firefighting uniforms be designed for the work task and not for protection in case of entrapment. Suppressing bushfires with hand tools generates heat from bodily exertion that is about three times more than the heat that firefighters absorb from fires. Heavy protective clothing stops this heat from escaping from the skin, causing a rapid increase in deep body temperature, which could lead to heat illness or heat stroke. The research has provided the basis for an international standard for 'wildland' firefighter clothing.

Videography and forest management

CSIRO Forestry and Forest Products has developed a method that uses digital photographs (airborne videographic remote sensing) to predict complexity in wildlife habitats. The new method can map the landscape into regions of different habitats. Ultimately the management of forest habitats for wildlife will depend on the availability of accurate maps of the diversity and extent of habitats over large areas and/or in difficult terrain.

Veneer from East Gippsland hardwoods

Tests have shown that East Gippsland hardwoods, normally used only for structural products, are suitable for making decorative sliced veneers. The trials, carried out by CSIRO Forestry and Forest Products in association with the Victorian timber and furniture industries and the Department of Industry, Science and Tourism, have now been followed by feasibility studies on the establishment of veneer slicing facilities in Victoria.

Transgenic eucalypts for plantation forestry

CSIRO Plant Industry scientists have developed a gene transfer system for the river red gum (*Eucalyptus camaldulensis*) and have used it to introduce an insecticidal gene active against beetle larvae, and a herbicide tolerance gene to the broad-spectrum herbicide, glufosinate ammonium. They are now trying to transfer the technology to species such as *E. nitens* and *E. globulus* that are more economically useful to pulp and paper industries in Australia.

New method for measuring microfibril angle in wood

A very rapid, automated instrument (SilviScan) for measuring microfibril angle has been developed by CSIRO Forestry and Forest Products. The cell walls of wood fibres are reinforced by long bundles of cellulose molecules, called microfibrils. These microfibrils are wound in a spiral or helix within the walls and the closer this helical angle (microfibril angle) is to the fibre axis, the stronger and stiffer is the fibre. Microfibril angle is one of several important fibre properties measured by SilviScan, which is being used in many wood quality research projects.

New coring device for eucalypts

CSIRO Forestry and Forest Products and Cyclone Hardware Pty Ltd have developed a new tree coring device that allows quicker and easier testing of wood quality. As Australia becomes more dependent on plantation wood, foresters need to understand how wood quality is affected by genetics and growing conditions. The only way to do that is to take a sample for analysis. The only other product available has been a Scandinavian hand corer designed for soft pines, which is almost impossible to use on hardwoods. A version suitable for sampling dry wood such as utility poles is under development.

Horticulture Sector

Genetically modified grapevine

Scientists at CSIRO Horticulture have achieved a scientific advance of international significance with Australia's first, and one of the world's first, genetically-modified grapevines. A marker gene has successfully been inserted into sultana, the most widely grown grape variety in Australia. This paves the way for major gains in both productivity and quality for the \$1.5 billion a year wine, grape and dried vine fruit industries. Working with the Cooperative Research Centre for Viticulture, CSIRO scientists are presently investigating genes that control sweetness, flavour and colour development in grapes.

Designer melons

Over the last decade, researchers at CSIRO Horticulture have been conducting a melon breeding program to produce new varieties. After collecting seeds from varieties around the world, evaluating them, and selecting the most promising, they set about crossing them to produce new melons which combine the best characteristics — sweetness, colour, size, small cavity size, rind texture and, equally important, resistance to diseases. The new melons are expected to capture market attention due to improved fruit quality, in particular their very sweet, juicy flesh. This will be important for Asian markets where sweetness is paramount.

Fruit fly treatment for exports

CSIRO Food Science and Technology scientists have completed a study for the Horticulture R&D Corporation on the in-transit cold-disinfestation of citrus fruit. All Australian citrus shipped to Japan requires quarantine treatment against fruit fly. The scientists have demonstrated that with current-generation refrigerated freight containers, it is possible to meet the very stringent Japanese protocol of keeping temperatures throughout the container below 1°C for 16 days. The study of temperature management included road transport of the container (with electric power supplied by a diesel-powered generator) and time off-power during transfer through the terminal and loading onto the vessel.

Mineral supplements for oranges

Albedo breakdown is a disorder of orange rinds that can affect up to 90 per cent of the fruit on some properties. A CSIRO Horticulture team linked occurrence of the problem to a localised calcium deficiency in fruit tissues. Outcomes have been the release of a spray formulation and a spray application regime, which in commercial trials reduced albedo breakdown incidence by 30 per cent. The potential benefit to Australia's citrus industry is \$1-2 million for each percentage of reduction.

Getting rid of pips

Scientists from CSIRO Horticulture have constructed two genes that inhibit seed formation. One has the potential to decrease seed numbers by 75 per cent. The other, resulting from a collaboration with the National Institute of Agrobiological Research in Japan, makes tobacco plants nip all of their seeds in the bud. These genes may lead to new kinds of fruit varieties with decreased seed numbers or entirely without seeds. The research is funded in part by the citrus industry and although some seedless citrus varieties already exist, the industry wants to see new seedless varieties that could expand the growing season and increase exports.

Hop industry mite

An introduced tropical mite may save the Tasmanian hop industry from the ravages of a major pest, the two-spotted mite. The tropical predatory mite *Phytosieulus persimilis* promises to be an effective and reliable method of biological control against the two-spotted mite, *Tetranychus urticae*. Introduced to Tasmanian hop gardens six years ago after research by CSIRO Entomology, the predatory mite now appears to have survived the rigours of southern winters and has built up sufficient numbers to be effective against the pest mite. This is a great boon for the hops industry since native predators were not controlling the pest mites effectively.

Meat, Dairy and Aquaculture Sector

Tick-resistant *Bos taurus* cattle release to market

Many generations of breeding observation and selection are behind the release of tick-resistant *Bos taurus* cattle by CSIRO Tropical Agriculture. The Division is currently seeking a commercial partner to multiply and market these animals. The availability of tickresistant British and European breeds will greatly enhance crossbreeding options throughout north Australia and enable better targeting of quality product to specific markets.

Prawn genetic studies yield good news for farmers

The prawn farming industry will receive great benefits from new developments in genetic studies conducted by CSIRO Tropical Agriculture. A molecular genetics project designed to look at the heritability of growth in prawns has found that growth is moderately heritable with large variation in wild stocks. This means that there are significant gains to be had in the future by introducing genetic improvement programs into prawn farming with potential for increases in growth of 10 per cent each year over a ten year time frame.

Comprehensive beef cattle genome map published

CSIRO Tropical Agriculture has recently released a map of the cattle genome that contains 1000 DNA variants and covers more than 95 per cent of the bovine genome. With this development, cattle are now the best mapped animal species in the world. The map is the product of a CSIRO-coordinated international collaboration involving 38 laboratories in 14 countries. The Division also manages a WWW site (http://spinal.tag.csiro.au) to provide access to the data. The availability of the map has been crucial to the discovery of the locations of genes contributing to economically important traits of cattle such as meat marbling, tenderness, and parasite resistance.

Improvements in livestock nutrition

New research and trials conducted by NSW Agriculture have shown a 25 per cent increase in live births resulting from the use of protected fat feed technology, developed by CSIRO Animal Production and Rumentek Industries Pty Ltd. The technology could make a huge difference to the productivity of the Australian beef and dairy herds and has considerable export potential. The new technology made its international debut at India's largest agricultural expo, Agrotech '96, in October.

Outsize prawns

Japanese King Prawns, which grow up to 25 per cent faster or larger than wild-caught prawns, have been developed by scientists in CSIRO Marine Research and Tropical Agriculture, working with a local prawn farmer. The advance has given Australia a chance to lead the world in the selective breeding of crustaceans for the burgeoning \$400 million a year aquaculture industry. Several breeding techniques were combined to produce these prawns, which have a very high value on the Japanese market.

Vaccine for healthy cattle

A new vaccine is expected to boost cattle health and welfare, promoting a more sustainable and profitable feedlot cattle industry in Australia, as well as opening up major export opportunities for Australia's pharmaceutical industry. The Division of Animal Health has developed a vaccine that can be used to protect cattle from bovine respiratory disease, which can cost \$50 million a year in production losses. The research was carried out with support from the Cattle and Beef Industry Cooperative Research Centre, and collaboration through an options agreement with Australian pharmaceutical company AusVac.

Screw worm

The Old World screw-worm fly is a major pest of livestock in the tropics of Asia and Papua New Guinea. It is not yet in Australia, but if it became established here, cattle production in the northern regions could become uneconomic. On 28 April, 1997 a new mass-rearing facility for sterile screw-worm fly, designed as a joint activity between the Australian and Malaysian Governments, was opened at Institut Haiwan Kluang, Johor, Malaysia. The project in Malaysia will help scientists in CSIRO Entomology determine how successful the "sterile insect release method" is in controlling and eradicating this pest.

Wool and Textiles Sector

Viruses deliver fertility control agents

Proof of the concept that viruses can be used to deliver fertility control agents was achieved in tests by the Division of Wildlife and Ecology on laboratory animals, as part of research into the sustainability of the livestock production system. Models have been developed for future testing of genetically engineered reproductive antigens in pest species, including the rabbit.

Fighting pox viruses: India and Australia collaborate

Scientists from the Division of Animal Health, Agriculture Western Australia and the Bureau of Resource Sciences are collaborating with scientists from BAIF Development Research Foundation, Pune, India, on research into capripox viruses. The potential for economic damage to Australia by an outbreak of sheep and goat pox or lumpy skin disease in cattle (capripox viruses) is considered to be second only to the threat of footand-mouth disease. The knowledge gained from this project, supported by the Australian Centre for International Agricultural Research, will enhance disease control in countries like India, where it is endemic, and boost Australia's preparedness to combat any outbreaks.

Protected feed fat to boost productivity

New research and trials conducted by NSW Agriculture have shown a 25 per cent increase in live births resulting from the use of protected fat feed technology, developed by CSIRO Animal Production and Rumentek Industries Pty Ltd. The technology could make a huge difference to the productivity of the Australian sheep flocks and has considerable export potential.

Automated wool sorting commercialised

Technology developed by the Division of Wool Technology and the International Wool Secretariat for the recognition and removal of stained or discoloured pieces of wool or textile material has been commercialised through the signing of an agreement with a European manufacturer. The first unit for wool has been installed in an Italian combing plant. This technology enables the efficient removal of contaminants from loose stock, without removing large quantities of non-contaminated material and is expected to provide very strong competition for older, less efficient technologies.

Success for high speed carding technology

A high speed carding technology, developed by the Division of Wool Technology, the International Wool Secretariat and Australian topmaker firm G H Michell, in collaboration with the French company Thibeau, is now successfully selling into the wool industry with seven units, each worth more than \$1 million, already purchased and negotiations for more in progress. The technology more than doubles the output of conventional worsted card technology while maintaining the quality of the woollen product.

Fibre modification technology enters commercialisation phase

The technology developed by the Division of Wool Technology and the International Wool Secretariat for wool fibre modification is reaching the final stages of licensing to an Australian topmaker for the commercial production of fibre and for global distribution of treated tops. A prototype commercial plant with 200 tonnes per annum capacity has now been commissioned and will be transferred to the licensee in the coming months. Two fibre streams will be produced, lightweight knitwear and silk-like woven wool fabrics.

Sportwool takes off

A research program involving elite athletes exercising at high workloads has identified unique benefits for *Sportwool* relative to its synthetic competitors in the hightech athletic sportswear area. *Sportwool* was developed by the Division of Wool Technology and the International Wool Secretariat. A licencee has been appointed to produce *Sportwool* fabric in Australia, and expressions of interest are currently being sought from major international sportswear manufacturers.

ENVIRONMENT AND NATURAL RESOURCES

Biodiversity Sector

Computer-based interactive key to rainforest trees of Australia

Since publication in 1993, more than 900 copies of the key to rainforest trees, developed by CSIRO Plant Industry, have been sold with very wide acceptance and praise. A distinguishing feature of the key is its focus on all trees within an ecological area rather than on the more traditional taxonomic family-by-family approach. The key has now been redeveloped and a more extensive version is due for publication in the second half of 1997.

Inventory of Australia's biodiversity

CSIRO Entomology has produced three major contributions towards improving our knowledge of Australia's biodiversity: (1) the *Checklist of the Lepidoptera of Australia* (book and CD-ROM) is Australia's first complete inventory of the fauna of moths and butterflies; (2) volume two of the three-volume monograph on mallee moths, Oecophorinae, has been published the 6000 species of mallee moths are important to the nutrient cycle in woodlands; and (3) *Click Beetles. Genera of the Australian Elateridae* gives a complete overview of this family, which contains species that are significant indicators of old-growth forests as well as species of economic importance.

Tourism research program launched

CSIRO has launched a program designed to give Australia's \$47 billion-a-year tourism industry a world lead in environmental sustainability. The multi-Divisional \$3 million Tourism Research Program will assist industry to reinvent the holiday resort in an environmentally sensitive way acceptable to Australians and overseas visitors. A key feature is the 25-year futures project, assessing the prospects and likely trends in tourism demand out to the year 2020.

Inland bores may threaten native species

A study carried out for Environment Australia by CSIRO Wildlife and Ecology has revealed that bores, dams and troughs are a potential threat to some species of native plants, animals and birds in arid and semiarid Australia. The introduced waters support grazing stock, which in turn affect plant composition and habitat for native animals and birds. Not all native species are threatened; some species are favoured by the changes. This research contributed to the decision by Environment Australia to close selected waters on Bookmark Biosphere Reserve and to monitor the impact of the closures.

Farms designed for conservation

In partnership with 11 farmers in the Wallatin catchment of the Western Australian wheatbelt, supported by a grant from Environment Australia, CSIRO Wildlife and Ecology developed and applied a method for designing farm landscapes, which meets both biodiversity conservation and agricultural objectives. In this catchment it was concluded that revegetation of an additional 4 per cent of the catchment was required to meet nature conservation objectives. This would take the total area under remnant vegetation from 7 to 11 per cent. The participating farmers will receive individual maps of the options for replanting on their properties.

Guide to marine pests

The first ever comprehensive guide to introduced marine species of Australia was published by the Centre for Research on Introduced Marine Pests (CRIMP) located in CSIRO Marine Research. CRIMP has also initiated a study of parasitic control agents for the northern Pacific seastar and European green crab, and is developing a risk analysis framework to minimise the likelihood of new introductions and the rate at which existing ones spread. CRIMP's research is critical to the future sustainability of both the shipping and mariculture industries.

Climate and Atmosphere Sector

Revised climate scenarios

The Division of Atmospheric Research has revised scenarios of climate change for the Australian region. Australia is likely to be between 0.3 and 1.4°C warmer by the year 2030. The temperature increase by 2070 is likely to be between 0.6 and 3.8°C. Southern Australia and inland areas are likely to warm more than northern parts of the country. Also described in the new scenarios are likely changes to rainfall, sea level and the incidence and severity of extreme events such as tropical cyclones and the occurrence of El Niño.

Ocean data help climate modelling

CSIRO Marine Research completed a six-year survey of the Southern Ocean between Tasmania and Antarctica, observing water properties and currents from the sea surface to the bottom. Researchers then combined this information with theoretical work to develop a model of the climate system that is more realistic in its representation of the uptake of heat and greenhouse gases by the ocean. This will permit better greenhouse scenarios for use by the Australian government in developing policy on climate change.

The impact of global change

Scientists in the Division of Wildlife and Ecology are further developing the capacity to analyse, interpret and adapt international and Australian studies and expertise on integrated impacts of global change. They are undertaking a series of global change impact studies in Australia for rangelands, temperate forest and wheat cropping systems, examining the impacts of fire on ecosystem dynamics and analysing the Australian terrestrial carbon cycle. Outcomes of this research will help underpin resource management strategies and assessment of adaptation and mitigation options.

CFCs in the atmosphere

A collaborative study by the Division of Atmospheric Research has determined the first complete atmospheric record of the CFC-12 replacement chemical, HFC-134a, showing its appearance in the global background atmosphere in about 1991, and a subsequent 100-fold increase in concentration in five years. Records of changing concentrations of CFC replacement chemicals provide useful information on the efficacy of measures through the Montreal Protocol aimed at protecting the ozone layer.

Drought forecasting

A CSIRO Tropical Agriculture study commissioned by the Bureau of Resource Sciences used historical rainfall records and simulation models of cropping systems to assess the severity of drought. Results showed that 30-60 per cent of the ten worst drought periods over the past 96 years could not have been predicted solely on the basis of rainfall records alone.

Carbon dioxide reduces impact of salinity

CSIRO Plant Industry scientists have found that wheat that has its growth rate cut 80 per cent by saline soil conditions is about six times more responsive to elevated carbon dioxide concentrations than nonstressed wheat. This phenomenon will diminish the impact of any worsening of salinity problems engendered by climatic change caused by increasing levels of greenhouse gases. A mechanism has been found to explain this finding.

Land and Water Sector Port Phillip Bay Study

CSIRO handed over its final report into the environmental health of Port Phillip Bay to the Premier of Victoria in mid-1997. The study was one of the largest multidisciplinary projects ever run by CSIRO and provides a model for future management of water catchments around Australia. The study showed the Bay, upon which the city of Melbourne is located, was in remarkably good condition, but also identified areas where problems could occur.

Stopping stormwater going down the drain

Instead of letting stormwater go down the drain, several city and state agencies are working towards recovery of this valuable resource, and CSIRO is contributing to the research. The work includes studies of directing stormwater underground for storage and later use, computer modelling of stormwater flows, plus social, economic, and management issues. In a recent report, CSIRO Land and Water made recommendations to the Council of Australian Governments about the ways in which the re-use of stormwater and treated sewage could fit into the nation's water reform agenda.

Charcoal in our soils

Carbon in soil organic matter is an essential component of fertile soil, but it is often found in the less useful form of charcoal. The charcoal results from tens of thousands of years of bushfires and makes the quality of Australia's soils even poorer than previously thought. Up to half the carbon in some Australian soils is present as charcoal, and the figure is even higher in cultivated soils. Tests have been developed by the Division of Soils (now part of CSIRO Land and Water) to indicate which carbon is inert charcoal, and which is in the form of fertile humus.

Predicting droughts

The recent drought in eastern Australia stimulated the national debate on what is agricultural drought, and what was the appropriate response by Governments. A study by CSIRO Tropical Agriculture, commissioned by the Bureau of Resource Sciences, used historical rainfall records with cropping systems simulation models to assess the severity of drought. Results showed that 30-60 per cent of the ten worst drought periods over the past 96 years could not have been predicted solely on the basis of rainfall records alone.

CFCs help to date groundwater

Chlorofluorocarbons (CFCs) are well known as ozonedestroying chemicals, but CSIRO Land and Water scientists are using them to date groundwater. CFCs are inert and have steadily built up in the atmosphere over the last 50 years. Rain picks up CFC molecules and takes them underground, where their concentration reflects the atmospheric concentration at the time the rain fell. In this way, scientists can tell the age and rate of depletion of water stores. This provides important information in assessing sustainability of groundwater use.

New soils found in oldest continent

A new catalogue of Australian soils, based on 14 000 soils and 30 years of national soil survey work by state and federal agencies, including the CSIRO Division of Soils (now part of CSIRO Land and Water) lists several entirely new soil types. Australia has perhaps the widest range of soils of any country in the world, and some of the newly catalogued soils are in the high-rainfall tropics. They receive more than 2000 millimetres of rain each year, are generally severely weathered, and hold few nutrients. Identifying these fragile soils and their properties allows us to manage them for continued stability and productivity.

Marine Sector

Ecological models for environmental management

As part of the Port Phillip Bay Environmental Study, scientists in CSIRO Marine Research developed integrated ecological models that combine complex circulation dynamics with models of ecological processes controlling water quality and the fate of nutrient inputs to coastal waters. These models are now used to assess the impacts of current and planned management activities in Port Phillip Bay, upon which the city of Melbourne is located.

Guide to marine pests

The first ever comprehensive guide to introduced marine species of Australia was published by the Centre for Research on Introduced Marine Pests (CRIMP) located in CSIRO Marine Research. CRIMP has also initiated a study of parasitic control agents for the northern Pacific seastar and European green crab, and is developing a risk analysis framework to minimise the likelihood of new introductions and the rate at which existing ones spread. CRIMP's research is critical to the future sustainability of both the shipping and mariculture industries.

Study of trawling effects helps manage the Great Barrier Reef

Most of the issues in the management of seabed habitats in the Great Barrier Reef (GBR) are related to the effects of prawn trawling. CSIRO Marine Research has completed a comprehensive five year study in conjunction with the Queensland Department of Primary Industries on the Far Northern Section of the GBR. The results show that the impacts of trawling may not be detectable in areas that are trawled sparsely or infrequently; however, the cumulative effect of frequent trawls over the same grounds may be substantial.

Recruitment of Southern Bluefin Tuna

Scientists in CSIRO Marine Research provided strong scientific evidence to the 1996 International Scientific Assessments of the Southern Bluefin Tuna (SBT) that in recent times recruitment to SBT stock has not collapsed and may have stabilised. Using a range of innovative techniques, including dart and archival tagging and aerial surveys, scientists developed an index of recruitment. This is a significant development as the current international management strategies for SBT are aimed at rebuilding the stock which is considered to be at historically low levels.

Gas pipeline routes through Torres Strait

CSIRO assisted the offshore gas industry to find potential pipeline routes through the Torres Strait Protected Zone in areas where the distribution and type of seabed habitat was previously unknown. The Protected Zone is comprised of many different habitats, which support valuable fishery resources such as prawns, lobsters and pearl shells, and are vulnerable to damage by trawling and dredging. CSIRO Marine Research scientists conducted surveys and produced maps of the distribution of inter-reefal seagrass, megabenthos habitats, sediments, and depth profiles to develop pipeline route options.

Macquarie Harbour study

CSIRO has made a major contribution to understanding the behaviour of copper in waters and sediments of Macquarie Harbour (Tasmania) as a consequence of discharges via the King River from the Mt Lyell copper smelting activities. Measurements by the Centre for Advanced Analytical Chemistry, at CSIRO Coal and Energy Technology, have led to the development of a copper budget for the system. Estimates were obtained for copper release from contaminated sediments of the King River delta; its bioavailability is reduced when it combines with dissolved organic matter. The results are being used to develop remediation strategies.

INFORMATION TECHNOLOGY, INFRASTRUCTURE AND SERVICES

Built Environment Sector

Software for energy efficient design

The National House Energy Rating Scheme (NatHERS) is a Department of Primary Industries and Energy initiative to encourage the design of environment friendly housing within Australia — houses are responsible for approximately 22 per cent of Australia's

carbon dioxide emissions and an energy efficient design can reduce energy consumption by up to 40 per cent. CSIRO Building, Construction and Engineering used thermal modelling expertise to develop user friendly software to support NatHERS. The software provides quick, comprehensive and effective assessment of designs, allowing architects to measure and compare energy consumption, leading to reduced heating and cooling costs for the occupant and a better environment for Australia.

Optimal route planning for roads

The Barton Highway, one of the main routes into Canberra, is in need of upgrade and expansion to meet increasing traffic loads. The New South Wales Road and Traffic Authority (RTA) has identified a by-pass of Murrumbateman as the most effective solution to the problem. CSIRO Building, Construction and Engineering has been commissioned to use its Align3D route optimisation software to identify the most cost effective route that meets the constraints defined by the RTA and the local community. The software has demonstrated improvements of 16 per cent on the existing alignment, reducing construction costs by up to \$20 million.

Stormwater re-use

Many state agencies are investigating ways to prevent stormwater going down the drain, viewing it as a valuable resource that should be recovered rather than disposed of. CSIRO Land and Water is responsible for coordinating multi-divisional research that includes directing stormwater underground for storage and reuse, computer modelling of stormwater flows and the economic, management and social issues associated with recycling. A report has been submitted to the Council of Australian Governments recommending ways in which stormwater re-use can be incorporated into the nation's water reform agenda.

Automated aircraft identification system

Airport owners worldwide currently use manual identification as the basis for billing airline operators for each aircraft landing. In conjunction with the Federal Airports Corporation and Telstra, CSIRO Manufacturing Technology has developed *Airscan*, a system that automatically detects and identifies the registration and ownership details of an aircraft as it lands. The system provides fast and accurate automatic billing, can be linked to flight information display systems to update arrivals details, and results in substantial operating savings for airport owners.

Evaluating embodied energy

It is estimated that the embodied energy required to construct an office building in Australia is equivalent to the energy required to heat and cool it over 30 to 40 years. CSIRO Building, Construction and Engineering has collaborated with the Royal Melbourne Institute of Technology and Cedar Enterprise to develop software that can identify the embodied energy of a design from three dimensional CAD drawings. The software includes a database of embodied energy values for construction materials, enabling architects to measure and compare the environmental impact of their designs.

Information Technology and Telecommunications Sector

Design software for satellite antennas

CSIRO Telecommunications and Industrial Physics has developed a software package for analysing antennas for microwave communications, particularly those on board satellites, where different complex designs operate concurrently on a single platform. CSIRO's software can provide a thorough design analysis and has special capabilities not currently available in any existing commercial package. The resulting accuracy of performance predictions means that satellite antennas can be expected to satisfy stringent design criteria when first constructed, avoiding re-engineering and minimising the time between design and delivery. A major US satellite manufacturer is installing the software package as its standard tool for antenna design.

ATM network - quality of service guaranteed

CSIRO Telecommunications and Industrial Physics has deployed an experimental high speed ATM (asynchronous transfer mode) network. ATM is the enabling technology for merging the separate communications technologies used in public networks for telephones, data, computers, entertainment distribution and in-home services. The resulting multimedia applications can select the quality of service for the individual video, audio etc streams that provide the best compromise between cost and performance. To understand the complexities of designing both applications and networks, CSIRO is researching these issues through an experimental network. The Division has successfully demonstrated prototype applications, including hierarchical video coding to exploit selectable quality of service, using high quality MPEG2 video transmission over ATM, and a news on demand service developed in collaboration with CSIRO Mathematical and Information Sciences.

The Navy organises its spare parts in APLCRATES

New software called APLCRATES (Assembly Part Lists Creation, Re-assessment and Tracking Expert System) was developed for the Royal Australian Navy (RAN) by IT solutions firm IBM Global Services Australia and CSIRO Mathematical and Information Sciences. APLCRATES calculates spare part allowances by assembling the necessary data and applying the acquired expertise in its knowledge base to balance various factors. It helps work out how many and what types of spare parts should be carried on Navy vessels. The system helps optimise inventories, makes better use of resources, reduces training time from six months to a couple of weeks, and cuts supervisory time by 75 per cent. The Navy is now using the system fully and plans to broaden its scope and applicability.

VISOR helps visualise ore bodies

Scientists in CSIRO Mathematical and Information Sciences have developed a software system that speeds up the ore grade estimation process and addresses the interpretation of underground ore body structures. The system, called VISOR (VISualisation of ORe-grade data sets) helps geoscientists understand the spatial correlation of borehole assay data, which is crucial to the development of accurate three-dimensional ore grade models. VISOR was a demonstrator project of the Advanced Computational Systems Cooperative Research Centre (ACSys) of which CSIRO is a core research participant. Snowden Associates was one of the project's industrial partners. The project is an example of modern interactive data visualisation techniques applied to a situation where existing software was inadequate.

Finding film segments with FRANK

FRANK, the Film Researchers Archival Navigation Kit, was developed by CSIRO Mathematical and Information Sciences in a project funded by Research Data Network/Advanced Computational Systems Cooperative Research Centres. A trial at ABC TV Archives saw 14 episodes of current affairs program 'Four Corners' digitised and made available to ABC researchers. This provided valuable feedback on the system and led to a new facility that allows cataloguers to create summaries of videos interactively. In further work on FRANK, a connection over Telstra's Experimental Broadband Network was used to test remote access, with a user in Sydney accessing a video server in Canberra.

Measurement Standards Sector

National Measurement Laboratory a National Facility

The Minister for Science and Technology, The Hon. Peter McGauran, has identified the National Measurement Laboratory as a National Facility within CSIRO. This follows the recommendation to this effect made by the Committee of Inquiry into Standards and Conformance in Australia (The Kean Committee). As a National Facility, the National Measurement Laboratory will have much greater visibility and a clearer identity both within the national measurement system and internationally. The National Measurement Laboratory maintains and disseminates national standards of measurement to Australian industry and the community, and is responsible for maintaining the international credibility for Australia's measurement standards.

Trapped ion frequency standards

Telecommunications and satellite positioning technologies require great accuracy from time and frequency standards and the National Measurement Laboratory is making a major contribution to international research in this area. One of the National Measurement Laboratory's trapped ion standards, NML-IT-2, has the best performance demonstrated by any passive atomic frequency standard, and the researchers aim to improve the absolute accuracy of the standards far beyond the present level.

International measurement standards research

A new iodine stabilised laser has been developed in the National Measurement Laboratory in collaboration with the International Bureau of Weights and Measures, Paris. The laser produces green light at a wavelength of 543 nanometres, and was developed as a basis for a new international standard of length.

The Avogadro Project

The Avogadro Project is an international collaborative project to establish a new and absolute definition of the kilogram in terms of the Avogadro constant. This requires a precise series of measurements to be carried out on a 1 kilogram sphere of single crystal silicon. The National Measurement Laboratory is the world leader in fabricating and characterising accurate silicon spheres and is contributing to the project by producing a number of such spheres and characterising their density by the year 2000.

International comparisons

A comparison has been conducted between the National Measurement Laboratory's cryogenic radiometer and the cryogenic radiometer at the International Bureau of Weights and Measures, Paris. This is the first time such a comparison has been conducted, and agreement has been established to 0.02 per cent, which represents an improvement in accuracy of nearly two orders of magnitude over traditional radiometer power measurements.

Indonesian project

The Division of Telecommunications and Industrial Physics, through the National Measurement Laboratory and in collaboration with the National Association of Testing Authorities, was successful in its bid for a World Bank funded project to work with the Indonesian national laboratory (KIM-LIPI) and accreditation agency (Komisi Metrologi) to develop Indonesia's measurement standards and laboratory accreditation service.

Asia-Pacific activities

Australia, through the National Measurement Laboratory, has continued to maintain the Secretariat and provide the Regional Coordinator for the Asia Pacific Metrology Programme (APMP) during its term of 1994-1998. NML has been active in four other projects in the Asia Pacific, in Indonesia, the Philippines and Vietnam. All are directed at improving the national measurement standards and measurement capability in these countries to the point where the national laboratories involved can participate in international comparisons, and gain international recognition and acceptance.

Radio Astronomy Sector CSIRO leads international hunt for 'hidden' galaxies

CSIRO's Australia Telescope National Facility is leading an international search for undetected galaxies and, to carry out two unprecedented surveys of the sky for them, has equipped the Parkes telescope with the equivalent of a wide-angle lens. This equipment, the CSIRO-designed-and-built 'multibeam receiver system', was officially commissioned on 21 March 1997 by the Minister for Science, The Hon. Peter McGauran. The multibeam project team involves CSIRO, three Australian universities and four overseas observatories.

Closest galaxy found full of holes

Astronomers working with CSIRO's Australia Telescope National Facility have made the most detailed pictures ever of the gas in our two nearest neighbouring galaxies, the Large and Small Magellanic Clouds, and have found that these galaxies may be literally blowing themselves apart with giant explosions. Surprisingly, the neutral hydrogen gas of both galaxies is full of large 'bubbles', holes blown in the gas, perhaps by groups of exploding stars. The Clouds are the first external galaxies in which this gas structure has been seen in such detail.

Fastest water masers found

Observers using the Parkes telescope have found strong radio spots ('masers') within a galaxy that appear to vary in strength about a hundred times more rapidly than any other known masers of this kind. The masers had previously been known to vary over about a month, but when observed with a new instrument on the Parkes telescope some of the strongest maser spectral lines varied in strength in only minutes. The variability is extraordinary because it implies that the masers are very small. The mechanism for the changes is as yet undetermined.

Radio 'twinkling' reveals smallest quasar

Researchers studying the quasar PKS 0405-385 with the Australia Telescope Compact Array have found that its radiation appears to vary in strength by up to 50 per cent in an hour, more than ten times faster than any other similar source. But to twinkle like this, the quasar must be extremely small. This poses a problem: how can the quasar produce its energy, sustainably, in such a small volume? To help solve this mystery, the quasar will now be observed with space-based instruments.

Eclipsing pulsar reveals more tricks

Observers have discovered a new phenomenon in a unique stellar system first found with the Parkes telescope. The system comprises the pulsar B1259-63 and an unusual massive companion star, the first of its kind found partnered with a pulsar. The pulsar orbits the bigger star in a highly eccentric orbit which at closest approach (periastron) brings it swooping through the 'wind' of material that streams from the star. Only two periastrons have occurred since the system was discovered. Parkes telescope observations of the first in 1994, showed the pulsar's pulse rate had been slowed by the encounter. In the 1997 periastron, observers using the Australia Telescope Compact Array found highly variable radio emissions, of a sort not normally associated with binary pulsars. Parkes observations showed linearly polarised radiation becoming circularly polarised, a phenomenon never seen before.

Australia Telescope extends its capabilities

The contract has been signed and work started for the upgrade of the Australia Telescope Compact Array under the Government's Major National Research Facilities (MNRF) program.

Service Sector

Automated melanoma diagnosis system

The Skin Polarprobe[™] was launched at the 4th World Conference on Melanoma held in Sydney in June 1997. It was designed by Australian company Polartechnics Limited, in collaboration with CSIRO Mathematical and Information Sciences, and the Sydney Melanoma Unit, Royal Prince Alfred Hospital. This instrument incorporates expert knowledge in a vision system, which analyses the fine detail in a skin lesion to assess the likelihood that it is a melanoma. CSIRO developed the image analysis algorithms used in the system. The system will undergo clinical trials at several specialist centres, before more widespread release.

Making sense of tourism data

Statisticians from CSIRO Mathematical and Information Sciences performed data analyses for the Bureau of Tourism Research to assess the impact of a change in data gathering contractor after June 1994. They analysed domestic travel to New South Wales, Victoria and Queensland from July 1984 to September 1995, and concluded that, at the time of the change, there had been a substantial shift in the figures for tourism originating from Melbourne and Sydney to all three States. They were able to determine the underlying trends in tourism, adjusting for this shift under the assumption that it was due to the change in data gathering contractor.

Old cars can kill

A study commissioned by Rodney Vaughan and Associates and performed by Rodney Vaughan and Associates and CSIRO Mathematical and Information Sciences, showed that people travelling in old cars were three times more likely to die in crashes than if they were in newer models. The study required the synthesis of a database of crashes together with the results of surveys of the distances travelled each year by different sorts of vehicle.

Automated road crack detection

A new machine vision system, developed by a team from the Divisions of Manufacturing Technology, Telecommunications and Industrial Physics, and Mathematical and Information Sciences, has the potential to save millions of dollars in the maintenance of roads in New South Wales. The New South Wales Roads and Traffic Authority commissioned CSIRO to develop the RoadCrack automated road crack detection system, which is able to measure and quantify the type, severity and extent of cracks from a vehicle moving at 80 kilometres per hour. Road cracks are a major predictor of damage to roads and current detection methods are manual, slow and subjective. A world commercialisation strategy for the system is currently underway.

SQIS

CSIRO Telecommunications and Industrial Physics has a range of technologies currently under development that have significant applications in telecommunications, multimedia, security, surveillance and access control, industrial inspection, medicine and weather prediction. The Division has developed a range of digital imaging processing tools including image data browsing, realtime face recognition and verification, and still image and video compression. Earlier this year CSIRO's real-time face recognition technology SQIS (System for Quick Image Search) was successfully tested as part of a cooperative automatic passport verification system at Brisbane airport.

Image compression

Passports Australia is now using technology developed by CSIRO Telecommunications and Industrial Physics to compress all its passport face images. They selected CSIRO's technology after rigorous comparisons with commercially available JPEG and fractal compression algorithms because it exhibits superior quality at very high compression ratios.

MANUFACTURING

Chemicals and Plastics Sector

Product development using engineered resins

CSIRO Chemicals and Polymers and Du Pont have extended their strategic alliance to the year 2003 to continue the development of processes leading to polymers tailored for specific end uses, with application in such fields as automotive products, electronics and coatings. The work has already led to the development of a new range of automotive coatings that are cleaner, 'greener' and more durable than current paints, and the use of a CSIRO polymer in a printing ink which Du Pont believes will be used world wide by the end of 1998.

Exporting money

CSIRO Chemicals and Polymers and the Reserve Bank of Australia (RBA) have developed a substantial armoury of banknote security technologies. Australia now exports commemorative and general circulation notes to a growing number of countries through a joint venture company "Securency", recently formed between RBA and UCB (Union Chemie Belge, UK). UCB has decided to invest \$43 million to build a plant at Craigieburn Victoria, to produce specialty films, including the substrate for banknotes.

Termite biology and control

CSIRO Entomology has assessed several physical barriers and bait systems to control termite attack. The research group has achieved a world first by demonstrating effective colony elimination of *Coptotermes acinaciformes, C. lacteus and Nasutitermes exitiosus* in the field using Hexaflumuron bait.

New food packaging R&D project launched

CSIRO Food Science and Technology has developed 'ZERO₂', a new component for food packaging that absorbs oxygen from within the package and so extends the shelf life of products susceptible to oxidation. It will be used in packaging foods such as processed meats and cheeses, nuts, pasta, prepared meals, beer and wine and will significantly enhance export opportunities for Australian produce. Southcorp Holdings is to fund R&D and commercial development.

PLASCON to destroy ozone depleting substances

CSIRO Manufacturing Technology and SRL Plasma Ltd have developed PLASCON waste conversion technology to destroy Australia's stock of ozone depleting halons at the DASCEM Halon Bank Decanting, Conversion and Destruction Facility. Through this facility Australia leads the world in the destruction of halons. This will yield not only environmental and social benefits, but will also open up export opportunities.

Acne treatment reaches commercial trials

The best compound currently available for dealing with acne is a substance known as isolutrol. Originally found in shark bile, the compound was isolated and patented by McFarlane Laboratories in 1986. CSIRO Chemicals and Polymers then developed a process to produce the compound synthetically so that market needs could be met. The process is undergoing trials in India for its commercial viability. McFarlane is negotiating non-exclusive supply agreements with a number of the world's leading cosmetic companies.

Fumigants

Research by CSIRO Entomology on alternative grain fumigants (carbonyl sulphide, carbon disulphide and ethyl formate) has progressed to the stage where regulatory approval has been obtained for trials on farm bins. The trials have included milling and baking studies at the Bread Research Institute. Background work to this project has included development of analytical procedures for detecting very low level fumigant residues.

Integrated Manufactured Products Sector

Australian scientists create a nanomachine

Research started by CSIRO some ten years ago and continued within the Cooperative Research Centre for Molecular Engineering and Technology has resulted in the world's first working nanomachine, a selfassembled biosensor. The biosensor can be used with a wide range of recognition molecules, each designed specifically to detect a minute quantity of a target substance. This outstanding scientific achievement, announced in the journal *Nature* in April 1997, has generated intense interest in Australia and overseas. It is planned to use the technology as the basis for a new manufacturing industry in Australia. While current intended markets for this disposable product include diagnostics for human health care, the environment, agriculture and defence, its full potential has yet to be tested and many areas remain for future evaluation and exploitation. The technology is protected by a suite of patents.

X-ray breakthrough

CSIRO scientists have achieved a world-first with a new method for taking X-ray pictures that give sharper images of soft tissue and reduce the X-ray dosage received by patients. The work, by the Division of Materials Science and Technology, received international attention through its appearance on the cover of the journal *Nature*. The technology should help give doctors the means for early detection of breast and lung cancers and will help them target treatments more precisely, using better, safer and cheaper radiography. It will also be useful in a wide range of industrial inspection processes.

Ultrasonic metering of liquids

CSIRO Telecommunications and Industrial Physics has developed an electro-acoustic measuring system that enables very accurate and stable measurement of small liquid flow rates using ultrasound. Ultrasonic devices for commercial and domestic metering of liquids are of great interest to meter manufacturers and the utilities because they are small, have no moving parts and are compatible with the remote meter reading technologies that are being developed. To date it has been difficult to measure small flows reliably using ultrasound; this problem has now been solved.

Light metal design and prototyping service

The Division of Manufacturing Technology and the Cooperative Research Centre for Casting and Solidification

Technology (CAST) established the Design and Prototyping Service (D&PS) for industry. The D&PS conducts casting and tooling design optimisation, functional prototype manufacture, and cast tooling for prototyping in production casting equipment. Achievements include the re-design of a high-pressure die cast meter component to reduce total part cost by 50 per cent and minimise distortion; and optimisation of the design of a major die cast zinc component, which enabled Nokia Mobile Phones to save \$60 000.

Multi-million dollar export of airborne remote sensing equipment

Sydney based small-to-medium enterprise, Integrated Spectronics Pty Ltd, and the Division of Materials Science and Technology have collaborated to develop the world's most sensitive airborne remote sensing equipment. Integrated Spectronics recently delivered equipment to an American company for use on a US Department of Energy mission to the Central Asian republic of Kazhakstan to map contaminated nuclear test sites and waste dumps.

Software goes commercial

Compumod launched CSIRO's award winning software *Fastflo* onto the commercial market in Australia and New Zealand in November 1996. *Fastflo* is a specialist software package for solving partial differential equations. These equations underpin countless scientific and industrial applications, particularly in computational fluid dynamics, such as predicting airflow around automobiles, the design of pumps, and the control of molten metal flows. CSIRO Mathematical and Information Sciences announced an international distributor for *Fastflo* in mid-1997, and substantial international sales are expected.

Pharmaceutical and Human Health Sector

New drug delivery technology

New drug delivery methods suitable for use with many existing and future pharmaceuticals as well as for targeted delivery of gene therapeutics have been developed by CSIRO Biomolecular Engineering. Drugs are chemically bound to a structure that mimics the naturally occurring dietary fats, the triglycerides. This modification can be engineered to alter the route of delivery of the drug, to change its distribution in the body or to give the drug slow release characteristics. The technology has attracted significant support from the Australian pharmaceutical industry, particularly F H Faulding & Co Ltd.

Influenza drug in clinical trials

Zanamivir, the influenza drug resulting from CSIRO Biomolecular Engineering research in collaboration with Monash University and the Australian National University, and developed with the support of the Australian company Biota, is in the final stages of clinical trials. The trials are being conducted by Glaxo Wellcome, which is commercialising the drug, initially in Australia and later during the northern hemisphere winter. If successful, the drug could be in clinical use within two years. An effective anti-influenza drug is likely to have a billion dollar market, even in ordinary epidemic years.

Genetically engineered antibodies

CSIRO Biomolecular Engineering has engineered a novel form of antibody with improved prospects for treating tumours. Antibodies have a long history as therapeutic and diagnostic reagents, representing over 30 per cent of the \$10 billion clinical diagnostic market. Imaging reagents, comprising radio-labelled antibodies, are the forerunners of cancer therapeutic compounds that will incorporate cell destroying radioisotopes. The latest discovery by scientists at the Division is a unique, genetically engineered trimeric antibody fragment. These trimers, because of their increased target binding properties and decreased clearance rates, offer many advantages over conventional antibodies for tumour targeting and penetration.

Research targets prostate cancer

Scientists from CSIRO Biomolecular Engineering and Sydney's Prince of Wales hospital have made significant advances in the diagnosis and treatment of incurable prostate cancer, the second largest cause of male cancer deaths in Australia. CSIRO has developed technologies to enhance the uptake of DNA into cells seven to ten times more effectively than existing commercial reagents. A viral delivery system to 'taxi' therapeutic genes into tumour cells and a way of controlling genes so that they only work in cancer cells and not healthy cells have also been discovered.

Anti-ageing compound commercialised

Carnosine, a small naturally occurring molecule, has been shown by scientists at CSIRO Biomolecular Engineering to inhibit the ageing process and to rejuvenate ageing cells in tissue cultures of human cells. The discovery has been commercialised by an Australian cosmetic company who have incorporated carnosine (Beta Alistine) in a range of skin-care products. The use of carnosine in cancer treatment is also being investigated.

MINERALS AND ENERGY

Coal and Energy Sector Increased coal recovery

Mine monitoring technologies developed by CSIRO Exploration and Mining have resulted in increased recovery in the South Bulli Colliery in New South Wales, which is mining under the stored waters of the Cataract Reservoir. Analysis of the deformation and stability during the removal of nine panels of coal in the mine, and comparison with deformation modelling, allowed a review of pillar design, which when implemented, increased coal recovery by 5 per cent.

Coal preparation facility opens

In a major initiative to aid the transfer of technology to industry, CSIRO Coal and Energy Technology has opened a coal preparation R&D facility on Coal Operations Australia Ltd's (COAL) Catherine Hill Bay site, near Newcastle, New South Wales. The facility houses pilot-scale rigs capable of testing tonne quantities of coal, providing comparative information on the performance of commercial equipment, and refining technologies and processes.

Improving fabric filters

Fabric filters, which collect the flyash from the flue gas of several Australian coal-fired power stations, contribute to the industry being among the world's best environmental performers. Site test-work, undertaken by CSIRO Coal and Energy Technologyto optimise the performance of filters, has been highly successful. Improved operational procedures, involving longer periods of flyash collection and more effective filter cleaning, are allowing the bags in shaker-cleaned filters to operate for up to 50 000 hours before needing to be replaced. This compares with only 20-30 000 hours previously and results in a major saving in operating costs estimated at \$2 million a year.

Fluidised-bed research

The Division of Minerals has designed and commissioned a large cold fluidised-bed for the Cooperative Research Centre for New Technologies for Power Generation from Low Rank Coals. It will be used to provide data on the physical operations within a fluidised-bed, enabling existing computer models to be refined and developed and provide data to aid in the scaling-up of the process. Fluidised bed boilers could increase the energy output from low rank (brown) coals significantly with accompanying reductions in greenhouse emissions.

New fuel cells

Ceramic Fuels Cells Ltd, in which CSIRO Materials Science and Technology is a partner, is well on the way to developing a 20 kilowatt demonstration cell by mid 1998. The company has operated a 1.5 kilowatt model and a 3-5 kilowatt model has been constructed and successfully tested. Fuel cells offer cleaner power generation with efficiencies of up to 60 per cent and the option of power production at small, medium and large scale. They can operate with a variety of fuels, including gas, coal gas and hydrogen.

Supercapacitors

CSIRO Coal and Energy Technology has developed technology to use very high surface area carbons, high conductivity electrolytes and other materials to produce a high power, high energy density supercapacitor. With industry partner cap-XX, the technology is being commercialised with many of the supercapacitors being tested by leading edge companies in Australia and overseas. Supercapacitors are ideal for quick-charge portable devices, including tools, as back-up uninterruptable power supplies for computers, as energy storage devices for photovoltaic cells and as secondary energy storage for electric and hybrid vehicles.

Mineral Exploration and Mining Sector ARIES-1 satellite

Mining companies will be able to explore more effectively for minerals with the advent of a powerful new spaceborne prospecting tool — the ARIES-1 satellite. The satellite's instrument will provide the capability for both mineral mapping and environmental monitoring and is designed to monitor forests, wetlands, coastal areas, agriculture and rehabilitation projects. The ARIES-1 project has been jointly developed by CSIRO, the Australian Centre for Remote Sensing (ACRES) and Auspace Ltd.

New developments in gold exploration

Sophisticated techniques developed by CSIRO Exploration and Mining have helped discover potentially major new gold deposits in the Gawler Craton of South Australia. The calcrete geochemistry techniques were originally developed for exploration in Western Australia's Eastern Goldfields, but have now been successfully applied to similar terrain in South Australia. The techniques are grounded on a new understanding of how ancient gold bodies have weathered over millions of years, and how minute surface traces of gold may indicate the presence of large ore bodies deep below the surface.

Capping uranium mine wastes

CSIRO Exploration and Mining is well advanced with development of a highly efficient technique for safely locking away extremely soft uranium mine tailings, allowing early environmental rehabilitation of mine sites. A high tensile geotextile mat is laid over the tailings, before placement of capping sand and rock. The mat has greatly increased the bearing capacity of the tailings, the key to prompt rehabilitation. The technique also has potential for significant savings in mine management costs.

Wear resistant disc cutters for excavating hard rock

A breakthrough in the design of tungsten carbide disc cutters is being hailed as a major step towards more economical hard rock mining. Disc cutters are the only feasible alternative to explosives, but they wear rapidly in moderately abrasive rock. The new design lasted twenty times longer during tests by Pasminco Ltd in very hard and abrasive rock in Broken Hill. The design was developed by CSIRO Manufacturing Technology in collaboration with the Cooperative Research Centre for Mining Technology and Equipment and Pasminco Ltd.

Cyanide-eating bacteria

Scientists in CSIRO Land and Water have isolated cyanide-eating bacteria that could help in environmental clean-ups. The bacteria have been found living in the inhospitable environment of ore leach pads, processing ponds and tailings dams of Queensland gold mines, where cyanide is used as a gold extractant. The bacteria could be seen as either a problem or a benefit, depending on where they live: mining companies could improve cyanide recovery rates by reducing bacteria levels; alternatively, the bacteria could be encouraged to thrive in tailings dams.

Under-sea mineral deposits found

CSIRO Exploration and Mining scientists aboard the *RV Franklin* have discovered mineral deposits in the Bismarck Sea, off Papua New Guinea. Two highly active under-sea hot springs have been found where gold, silver and other metals are being deposited on the sea floor. The discoveries provide scientists with a 'natural laboratory' for studying new mineral deposits as they form. The information gained will give explorers new insights into how ore deposits form and how they can be located in similar geological environments on land.

Mineral Processing and Metal Production Sector

Australia to become a major world supplier of magnesium

Work commenced a decade ago at the Division of Minerals, aimed at providing technology for establishing an Australian magnesium industry, has borne fruit. The process from this research was developed by CSIRO and Queensland Metals Corporation through the Australian Magnesium Research and Development Project. Now Queensland Metals Corporation and Normandy Mining, assisted by Ford Motor Corporation, are demonstrating the process by constructing and operating a large demonstration plant as part of a commercial and technical feasibility study for a commercial magnesium plant that would be capable of meeting more than a quarter of the world's current demand.

New generation QEM*SEM

A new generation QEM*SEM is now available and two have already been sold, one to a major Australian mining company and the other in South Africa. CSIRO's QEM*SEM technology (Quantitative Evaluation of Materials by Scanning Electron Microscopy) can significantly increase mineral recovery rates and reduce plant capital and operating costs.

Savings for gold industry

Research by the Division of Minerals may lead to savings of up to \$100 million per annum for the gold mining industry in Western Australia's goldfields. Most of the savings will come from better management of the highly saline ground water used in the gold cyanide leaching process. CSIRO has developed strategies for minimising processing costs through modelling the relationships between the buffering capacity of the saline ground water, the lime demand and the cyanide species. Savings of over \$3 million have already been identified for two gold producers.

Advances in slurry thickening technology

Recent work by the Division of Minerals with Worsley Alumina has demonstrated the benefits of applying computational fluid dynamics (CFD) to thickeners used in mineral processing. CFD modelling provided a clearer understanding of the flow patterns and flocculant performance in Worsley's thickeners and was used as a basis for testing feedwell modifications. When the feedwell redesign was implemented together with optimisation of flocculant mixing with the feedstream, the residue handling capacity of an existing thickener doubled. This reduced expansion capital requirements by millions of dollars, while the increase in soda recovery substantially reduced operating costs.

From coal to iron ore to sugar cane

IRONSCAN 1500, developed by the Division of Minerals with the support of Hamersley Iron Pty Ltd, has been in service for 12 months at the Mt. Tom Price iron ore mine, Western Australia. The first overseas sale of the instrument has also been made. The analyser is designed for monitoring the level of aluminium, manganese and potassium in iron ore on a moving conveyor belt. The technique was originally developed for monitoring ash in coal. It has been extended again in the CANESCAN 1500 soil monitor developed with the support of Tully Sugar Ltd and the Bureau of Sugar Experiment Stations. Soil in feedstock is estimated to cost Australian mills around \$30 million annually due to wear of mill equipment and increased sugar losses.

On-line particle size analysis

A new method has been developed by the Division of Minerals for determining particle size distribution of slurries. The method, based on ultrasonic velocity spectrometry combined with gamma-ray transmission, is capable of analysing highly concentrated samples without dilution. CSIRO is presently designing an industrial gauge for installation in industrial slurry streams.

Petroleum Sector Understanding marine

environmental impacts

The research capacity of CSIRO Marine Research was significantly increased by completion of a \$3.6 million development that includes large experimental ecosystems called mesocosms. Experiments in mesocosms will improve our ability to predict and manage human impacts on the marine environment. The facility will be an important part of high priority research concerning the marine disposal of drilling fluids.

Wellbore stability

The aim of the wellbore stability effort in the Division of Petroleum Resources is to provide the Australian petroleum industry with the capability to reduce the occurrence and costs associated with well instability related problems. State-of-the-art technologies on drilling fluid-shale interaction, strength testing of shales, and borehole collapse tests on hollow cylinder samples with novel mud circulation provision, have been developed. The expertise has been applied successfully in the design of advanced wells on the North West Shelf, for wells that are 3 kilometres deep and that extend laterally for more than 8 kilometres. This capability places the Division as arguably one of the world's leaders in the field.

Hydrodynamic mapping

Methodology for assessing fault seal integrity, using well pressure data, has been jointly developed by the Divisions of Petroleum Resources and Land and Water. The method has been successfully applied to a study area in the Timor Sea, where fault breach has led to the leakage of several hydrocarbon traps. The sealing integrity of faults and caprock is one of the major variables in defining exploration risk and hydrocarbon reserves in a petroleum basin. The pilot study has led to a collaborative agreement between CSIRO and the Australian Geological Survey Organisation, and a consortium of ten petroleum companies has been set up to study the hydrodynamics and fault seal integrity on the North West Shelf of Australia.

Assessing maturity with FAMM

A novel technique for assessing the maturity of petroleum source rocks has been developed by the Division of Petroleum Resources. Termed FAMM (fluorescence alteration of multiple macerals) the analysis method has been designed to overcome many of the problems inherent to other maturity assessment techniques, such as vitrinite reflectance and bulk geochemical methods. FAMM has been employed in maturity studies in the North West Shelf/Timor Sea areas, including the Carnarvon and Bonaparte Basins, to establish thermal histories of the studied sections, in order to improve hydrocarbon generation/expulsion models.

RESEARCH AWARDS

The Chairman's Medal

The 1996 Chairman's Medal and CSIRO Medals were presented on 20 November, 1996 by Professor Adrienne Clarke, AO, then Chairman of the Board.

The winners of the Chairman's Medal were Professor Graham Harris and the Port Phillip Bay Environmental Study Technical Group and Management Team — Dr Graeme Batley, Dr Chris Crossland, Dr David Fox, Mr Douglas Hall, Dr John Hunter, Dr Peter Jernakoff, Mr Robert Molloy, Dr Alexander Murray, Mr Brian Newell, Dr John Parslow, Dr Graham Skyring, Dr Stephen Walker and Dr Trevor Ward — who designed, managed and completed the largest and most integrated piece of coastal marine research ever carried out in Australia.

CSIRO Medals

The CSIRO Medals for 1996 for CSIRO staff were awarded to:

- Dr Dave Abel, Mr Ross Ackland, Mr Mark Cameron, Mr David Campbell, Mr Hong Lei, Mr Ross Payne, Mr Robert Power, Mr Lloyd Simons, Ms Dione Smith, Dr John Smith, Mr Barry Steele, Mr Tai Tran, Mr Gavin Walker and Dr Sue-Ken Yap, for their development of interactive Spatial Information Systems;
- Dr Michael Dallwitz, for his development of the DELTA taxonomic computer programs.

The CSIRO External Medal was won by Mr Kevin Kenneally and Ms Daphne Choules Edinger from the Western Australian Department of Conservation and Land Management, and Mr Tim Willing from the Broome Botanical Society, for research leading to the publication of the book *Broome and Beyond: Plants and People of the Dampier Peninsula, Kimberley, Western Australia.*



Chairman's Medal:

From left to right are Dr Graham Skyring, Dr Peter Jernakoff, Mr Brian Newell, Dr David Fox, Dr Stephen Walker, Professor Adrienne Clarke (Chairman), Dr Graeme Batley, Professor Graham Harris, Dr Alexander Murray, Dr John Parslow, Mr Douglas Hall and Mr Robert Molloy. Absent are Dr Chris Crossland, Dr John Hunter and Dr Trevor Ward. Photo: Maria Basaglia.



CSIRO Medallists:

From left to right are Professor Adrienne Clarke (Chairman), Mr Kevin Kenneally, Ms Daphne Choules Edinger, Mr Tim Willing, Dr Malcolm McIntosh (Chief Executive), Dr Michael Dallwitz and Dr Dave Abel. Photo: Maria Basaglia.

PUBLICATIONS

(based on Performance Indicator 5)

This indicator is used primarily to assess CSIRO's contribution to, and hence ability to access, the world's knowledge base. Australia produces only some 2 per cent of the world's science and technology, so the ability to access the other 98 per cent and evaluate it for local use is crucial. Quantity is measured and reported annually; the quality of publications, via citation analysis, is assessed and reported triennially.

The performance indicator covers scientific publications, reports and patents. This Annual Report also provides information on some more general corporate publications.

Scientific and technical publications

Total publication output appeared to have been relatively steady over the last ten years at approximately 3100 a year, as reported through the CSIRO Index up to 1995-96. However, a change in the method of data collection for the Index in 1996-97 appears to suggest substantial under-reporting of conference papers and technical reports in past years and perhaps some under-reporting of journal articles. The revised figures show total publication output jumping to 4249 (a 35 per cent increase).

An independent study of CSIRO publications in journals referenced in the Science Citation Index (SCI) of the Institute for Scientific Information for the period 1981

Year	Journal Articles	Conference Papers	Technical Reports	Books & Chapters	Total		
1986-87	1855	889	308	332	3384		
1987-88	1877	707	348	203	3135		
1988-89	1756	823	226	209	3014		
1989-90	1705	805	269	184	2963		
1990-91	1643	949	212	199	3003		
1991-92	1534	910	331	216	2991		
1992-93	1655	970	414	211	3250		
1993-94	1582	1016	214	216	3028		
1994-95	1799	891	186	213	3089		
1995-96	1984	805	148	179	3116		
1996-97	2149	1630	295	175	4249		

CSIRO Publications by Document type 1986 to 1996

to 1995 (representing some 75 per cent of total CSIRO journal publications) revealed the same steady trend in publication numbers. The study also revealed that the quality or impact of those CSIRO publications as measured by citation analysis is strong and has improved over the same period. The strength lies particularly in agricultural sciences, earth sciences, applied sciences, engineering and some parts of biological sciences. This trend towards higher impact for CSIRO's publications runs counter to the trend for Australian science overall.

A full report on this bibliometric analysis of CSIRO publications in SCI journals will be published by the Research School of Social Sciences of the Australian National University in September 1997.

Client reports

CSIRO produced a total of 5076 client reports for 1996-97 compared to 4760 in 1995-96. There are wide variations within CSIRO. The majority of the client reports (3407) were produced by just two Divisions, reflecting the service (testing) nature of part of their operations. Another five Divisions produced over 100 reports each.

Patents

CSIRO patents data have been collected for the last five years by IPM Pty Ltd, CSIRO's patent database managers. Due to the complex nature of 'families' of patent applications, an indicator of patents activity is used. The indicator used here is patent applications under the Patent Cooperation Treaty (PCT). Publication occurs within six months of a patent application under the PCT.

International patent applications filed by CSIRO are relatively steady over the last five years at around 50 a year. As expected, some of these applications are allowed to lapse over time. The decision to maintain a patent takes into account legal advice, market conditions, and identification and wishes of commercial partners. However, once published, they remain a published document.

CSIRO PCT Applications for All Cases 1992 to 1997

Financial Years	Number of PCT Applications
1992-93	52
1993-94	48
1994-95	60
1995-96	55
1996-97	46

General public and industry publications

CSIRO Publishing successfully completed its first full year of commercial operation. Revenue grew to \$6.3 million in three main publishing categories:

- Journals;
- Education and general books, magazines and multimedia CDs; and
- Academic and reference books, and reference CDs.

Efforts to improve distribution of CSIRO publications in North America and Europe were instrumental in achieving sales increases.

The highlight of the year was the release of the *Australia State of the Environment* book and CD, to critical acclaim and positive sales results.

A review of *Rural Research* magazine was completed, with new initiatives to improve technology transfer to the Agribusiness sectors to take effect during the second half of 1997.

Building Innovation is a bimonthly CSIRO magazine produced by CSIRO Building, Construction and Engineering, and distributed to 14 500 readers. It is designed to increase awareness and encourage adoption of innovative technologies and practices that can advance and support Australia's construction industry. In a survey sent to all readers of the publication in 1996, 97 per cent of respondents claimed it had increased their awareness of innovation within the industry, 87 per cent said it had increased their awareness of CSIRO and 45 per cent believed there was a high chance of their adopting some of the innovations described within the next two years.

TRAINING

(based on Performance Indicator 6)

This performance indicator is a measure of the number of students jointly supervised by CSIRO and university staff, and the number of students fully or partially sponsored by CSIRO (not including CSIRO employees). It is a measure of CSIRO's contribution to developing the skill base in Australia.

For this Annual Report, we have expanded the performance report to include information on training of CSIRO staff.

Training by CSIRO staff

In 1996-97 CSIRO and university staff jointly supervised a total of 919 postgraduate students, including 705 PhD students and 214 Masters or Honours students. Over 30 per cent of these students were supervised through the Organisation's involvement in the Cooperative Research Centre program. The corresponding figures for 1994 (the last year of the previous triennium) were 509 PhD students and 183 Masters or Honours students.

In 1996-97 CSIRO provided full scholarships to 30 PhD and 3 Masters or Honours students and partial scholarships to a further 61 PhD and 9 Masters or Honours students. Overall, this was 42 students less than in 1996, due almost entirely to a drop in the number of partial scholarships. In addition, CSIRO is also involved in student lectures and seminars, undergraduate and TAFE courses, short courses, summer schools, apprenticeships and vacation student programs.

Training of CSIRO staff

A revised approach to training and development of CSIRO staff has been instituted, with increasing emphasis on coordinated devolution of responsibilities to Divisions. A Steering Committee has been set up to advise on priorities for corporate training activities and a framework for integrating Divisional initiatives.

Two further courses in the Research Management series were held and the individually tailored Leadership Development Program continued. Two courses were held in the new Project Leadership Program. A total of 128 staff participated in these courses during the year.

A link was established with Deakin University and the Association of Professional Engineers, Scientists and Managers, Australia (APESMA) to provide accreditation of internal courses and status towards the University's Graduate Certificate, Diploma and Masters courses on technology management.

CSIRO participated for the first time as a member of The Leadership Consortium, a group of organisations who collaborate to develop and promote leadership within their own businesses. A group of six Chiefs of merging Divisions worked together to share experiences and develop guidelines for mergers.

Three courses, entitled "Achievement Through Teams: Leadership in R&D", were completed as part of the joint venture with the Business/Higher Education Round Table. The courses were aimed at leaders of R&D projects that involve collaboration between the university, private and public sectors; 51 people from various organisations took part.

CSIRO Annual Report 1996-1	С	2	S	1	R	0	Α	n	n	u	a	1	R	е	p	0	r	t	1	9	9	6		1	9	9	7
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APPENDIX 1.

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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:

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- 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 pages 1-3 and 19-24);
- any determinations made by the Minister under subparagraph 9(1)(a)(iv) of the *Act* during the year (see below);
- any directions or guidelines given by the Minister under section 13 of the *Act* during the year (see below);
- any policies notified by the Minister under section 14 of the *Act* during the year (see below);
- financial statements for the reporting year in a form in accordance with the Minister for Finance's Guidelines for Financial Statements of Commonwealth Authorities (see pages 80-104); and
- the Auditor-General's report on these statements (see page 78).

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

APPENDIX 2.

Index of compliance with reporting guidelines

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APPENDIX 3.

Functions and powers of CSIRO

Functions of the Organisation

- (1) The functions of the Organisation are:
 - (a) to carry out scientific research for any of the following purposes:
 - (i) assisting Australian industry;
 - (ii) furthering the interests of the Australian community;
 - (iii) contributing to the achievement of Australian national objectives or the performance of the national and international responsibilities of the Commonwealth;
 - (iv) any other purpose determined by the Minister;
 - (b) to encourage or facilitate the application or utilisation of the results of such research;
 - (ba) to encourage or facilitate the application or utilisation of the results of any other scientific research;
 - (bb) to carry out services, and make available facilities, in relation to science;
 - (c) to act as a means of liaison between Australia and other countries in matters connected with scientific research;
 - (d) to train, and to assist in the training of, research workers in the field of science and to cooperate with tertiary education institutions in relation to education in that field;

- (e) to establish and award fellowships and studentships for research, and to make grants in aid of research, for a purpose referred to in paragraph (a);
- (f) to recognise associations of persons engaged in industry for the purpose of carrying out industrial scientific research and to cooperate with, and make grants to, such associations;
- (g) to establish, develop and maintain standards of measurement of physical quantities, and in relation to those standards:
 - (i) to promote their use;
 - to promote, and participate in, the development of calibration with respect to them; and
 - (iii) to take any other action with respect to them that the Chief Executive determines;
- (h) to collect, interpret and disseminate information relating to scientific and technical matters; and
 - to publish scientific and technical reports, periodicals and papers.
- (2) The Organisation shall:
 - (a) treat the functions referred to in paragraphs (1) (a) and (b) as its primary functions; and
 - (b) treat the other functions referred to in subsection (1) as its secondary functions.

Powers of the Organisation

- The Organisation has power to do all things necessary or convenient to be done for or in connection with the performance of its functions and, in particular, may:
 - (a) arrange for scientific research or other work to be undertaken, on behalf of the Organisation, by any person or body;
 - (b) join in the formation of a partnership or company;
 - (c) make available to a person, on such conditions and on payment of such fees or royalties, or otherwise, as the Chief Executive determines, a discovery, invention or improvement to the property of the Organisation;
 - (d) pay to officers, or to persons undertaking work on behalf of the Organisation, such bonuses as the Chief Executive, with the approval of the Minister, determines in respect of discoveries or inventions made by them; and
 - (e) charge such fees, and agree to such conditions, as the Chief Executive determines for research and other services carried out or facilities made available by the Organisation at the request of any person.
- (2) The Organisation shall not, without the written approval of the Minister, hold a controlling interest in a company.
- (3) An approval under sub-section (2):
 - (a) may be of general application or may relate to a particular company or proposed company; and

- (b) may be given subject to conditions or restrictions set out in the instrument of approval;
- (4) Where the Organisation commences to hold a controlling interest in a company, the Minister shall:
 - (a) cause to be prepared a statement setting out particulars of, and the reasons for, the holding of that controlling interest; and
 - (b) cause a copy of the statement to be laid before each House of the Parliament within 15 sitting days of that House after:
 - (i) the Organisation commenced to hold that controlling interest; or
 - (ii) if the Minister is of the opinion that the disclosure of the holding of the controlling interest would affect adversely the commercial interests of the Organisation, the Minister ceases to be of that opinion.
- (5) Nothing is invalid on the ground that the Organisation has failed to comply with subsection (2).
- (6) Where the Organisation holds a controlling interest in a company, the Organisation shall ensure that the company does not do any act or thing that, if done by the Organisation, would not be within the functions of the Organisation.

APPENDIX 4.

Legal requirements

Freedom of information

The *Freedom of Information Act* 1982 (the Act) provides the public with a general right of access to documents held by CSIRO and Commonwealth Agencies. This general right is limited only by exceptions needed to protect essential public interests or the privacy and business affairs of those who give information to the Commonwealth.

In the year to 30 June 1997, CSIRO received 24 requests under the Act.

Section 8 statement

Section 8 of the Act requires agencies to publish certain information concerning their functions and documents.

The following information is presented by CSIRO in accordance with the requirements of that section.

CSIRO's function and powers

Refer to Appendix 3 of this Annual Report

Consultative procedures

Valuable input from industry and other users and stakeholders into the identification of strategic research needs and the formulation of policy and administration is obtained through formal advisory and consultative committees as well as through receipt of representations from industry, scientific and employee groups. Membership of Sector Advisory Committees is listed in Appendix 7.

Categories of documents

CSIRO holds the following categories of documents:

(1) Corporate records: containing information of corporate and residual value such as financial

management and administration, buildings and property, personnel and industrial relations and scientific and industrial research.

- (2) Work group records: these are records generated within a work group such as research records and materials created in the course of scientific and technical investigations including:
 - raw data;
 - project databases;
 - observational and experimental data; and
 - field and laboratory notebooks.
- (3) Personal records.

The following CSIRO documents are customarily made available to the public free of charge: policy circulars; information circulars; staff circulars; *CoResearch* (staff newspaper); film catalogues; list of saleable publications; information service leaflets issued by Divisions on a wide range of technical subjects attracting frequent enquiries from the general public; conditions of CSIRO post-doctoral awards; press releases; information on careers in CSIRO; and school project material.

The following CSIRO documents are available for purchase by the public by contacting CSIRO, Limestone Avenue, Campbell, ACT 2612 — Scientific and technical publications including magazines, journals and books as well as CSIRO administrative manuals. A list of these manuals is available from the Freedom of Information (FOI) Coordinator.

Archives and disposal arrangements for documents

CSIRO maintains an archives collection in Canberra which has records dating from the establishment in 1916 of the Advisory Council for Science and Industry, the original predecessor of CSIRO. Certain Australian Archives Regional Officers also hold quantities of CSIRO records. The disposal arrangements for CSIRO records are made in accordance with the provisions of the *Archives Act* 1983. Access to records over 30 years old is provided in accordance with that Act.

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.

FOI procedures and initial contact points

A central FOI 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 2612 or PO Box 225 DICKSON ACT 2602 Tel: (02) 6276 6123

In accordance with the *Freedom of Information Act* 1982, formal requests to CSIRO should be addressed to the Chief Executive of CSIRO.

Privacy

The *Privacy Act* 1988 (the Act) came into operation on 1 January 1989. The Act applies to both the Commonwealth and ACT Governments, and requires Departments and agencies to comply with certain Information Privacy Principles (IPPs). They govern:

- methods used to collect personal information;
- storage and security of personal information;
- notice of the existence of record systems;
- access by individuals to their own information; and
- use of personal information and its disclosure to third parties.

The Act allows the Privacy Commissioner to investigate,

and report on, an act or practice which may be an interference with the privacy of an individual.

During 1996-97 the Privacy Commissioner did not undertake any investigations under s.36 of the *Privacy Act* 1988 in relation to CSIRO.

Privacy procedures and initial contact points

A central Privacy Coordinator manages CSIRO's privacy responsibilities.

Initial enquiries should be made to:

Privacy Coordinator CSIRO Limestone Avenue CAMPBELL ACT 2612 or PO Box 225 DICKSON ACT 2602 Tel: (02) 6276 6123.

The Administrative Decisions (Judicial Review) Act

The *Administrative Decisions (Judicial Review)* Act 1977 (the AD(JR) Act) enables a person aggrieved by certain classes of administrative decisions or actions taken by Commonwealth agencies including CSIRO to challenge these decisions in the Federal Court.

Section 13 of the AD(JR) Act gives a person aggrieved by a decision the right to obtain a statement of the reasons for the decision. This right exists independently of the right to apply for a review of a decision.

The statement of reasons is to be in writing, and is to set out the findings on material questions of fact, referring to the evidence or the material on which those findings were based, and giving the reasons for the decision.

In the year to 30 June 1997, CSIRO received four requests for statements of reason under the AD(JR) Act.

APPENDIX 5.

Trust Funds

William McIlrath Fellowship Trust Fund

This trust was created in 1953, when Mr William McIlrath donated a cheque for £50 000 to CSIRO, to be held in trust and the income used for the appointment of a Senior Research Fellow in Animal Husbandry. In 1995 approval was gained to vary the trust to appoint a postgraduate student in the field of Animal Husbandry at the McMaster Laboratory in Prospect.

In 1996 a postgraduate scholarship was advertised for research on the control of parasitic infections of livestock. Ms Jennifer MacDiarmid was appointed for three years to conduct research on cloning, gene expression and analysis of immune responses in sheep to excretory/sectory antigens from an important nematode parasite.

Sir Ian McLennan Achievement for Industry Award Fund

Established in 1985, the Sir Ian McLennan Achievement for Industry Award recognises outstanding contributions by CSIRO scientists to national development. The winning scientist receives a medal and a grant of up to \$15 000 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.

No award was given during the year.

FD McMaster Bequest Trust Fund

The late Sir Frederick McMaster, a prominent New South Wales 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. From this fund, seven Fellowships were awarded in 1996-97, totalling \$142 411. They were given to support eminent overseas scientists selected to work for a period in CSIRO Divisions.

Five Research Fellowships and two Visiting Fellowships were awarded. For the former, the Fellow is actively involved in a CSIRO research project for three to 12 months. For the latter, the Fellow undertakes to review and make recommendations on a specific area of research, or a program of public lectures and high level discussions on research policy and management, or other activities approved by the selection committee.

The Ken and Yasuko Myer Plant Science Research Fund

In June 1994, the Division of Plant Industry received a gift of \$1 million from the estate of the late Kenneth Myer to establish a trust fund for plant science research. The Board of Trustees includes representatives from the Myer family, industry and CSIRO. Both Mr Myer and his wife Yasuko were strong supporters of the work done by CSIRO through the Division of Plant Industry.

The current research project will continue the screening of genes that delay flowering. This could lead to new ways of understanding and managing flowering.

The David Rivett Memorial Fund

The David Rivett Memorial Fund was established in 1961 to commemorate the life and work of the late Sir David Rivett, formerly Chief Executive Officer and subsequently Chairman of CSIR. The Fund is used to finance a public lecture by a suitably distinguished overseas scientist on current and significant new research.

The fourteenth David Rivett Memorial Lecture was delivered by Mr Victor McElheny, Director, Knight Science Journalism Fellowships at the Massachussetts Institute of Technology, in Melbourne in 1996. The topic was 'The demand side economy of science journalism'.
Science and Industry Endowment Fund

The Fund was established under the *Science and Industry Endowment Act* 1926. The Trustee of the Fund is the CSIRO Chief Executive.

The operation of the Fund was reviewed and no grants were made during 1996-97. Following the review, grants will again be offered in 1997-98.

APPENDIX 6.

CSIRO research

During 1996-97 Sector Research Plans were developed for the 1997-98 to 1999-2000 funding triennium. The components of each Sector Plan are listed below.

More information about Sectors is on CSIRO's WWW site (at http://www.csiro.au/csiro/structure/index.html).

Agribusiness

Field Crops

- High-Value Food Products
- Feed Grains and Industrial Raw Materials
- Gene Technologies for Breaking Yield Barriers
- Post-Harvest Technologies
- Genetic Engineering for Pest and Disease Management
- Integrated Biological Management Strategies
- Crop Water and Nutrient Use
- Strategic Cropping Options
- Sustainable Resource Management

Food Processing

- Biotechnology for Food Quality
- Food Ingredients
- Food Processing Technology
- Value-Added Processing for Meat Industries
- Cheese and Cultured Foods
- Packaging and Transport Technologies
- Basis of Consumer Food Preference
- Strategies to Ensure Food Safety
- Health Potential of Processed Food

Forestry, Wood and Paper Industries

- Industrial Plantations
- New Plantations (Farm Forestry)
- Native Forests
- Harvesting, Roading and Transport
- Solid Wood
- Composites
- Pulp and Paper
- Recycling
- Furniture and Other Appearance Products

Horticulture

- Crop Improvement
- Crop Management
- Postharvest Quality
- Crop Protection
- Water, Nutrients and Sustainability

Meat, Dairy and Aquaculture

- National Animal Disease Advice and Control
- Animal Health and Trade
- Aquaculture
- Livestock Improvement
- Intensive Livestock Pigs and Poultry
- Nutrition for Cattle and Sheep
- Pasture Improvement
- Pesticide Reduction and Parasite Control
- Sustainable Resource Management
- Biological Control
- Pre-Processing and Consumer Issues
- Dairy Production
- Manufactured Inputs
- Biometrics

Wool and Textiles

- Product Innovation
- Colouration and Finishing
- Fibre Structure and Function
- Topmaking and Spinning
- Wool Scouring and Environment
- Leather Research

- Quality Control and Instrumentation
- Parasite Control
- Wool Genetic Improvement
- Quality and Productivity Through Nutrition
- Resource Management for Wool Producers
- Market Access and Protection

Environment And Natural Resources

Biodiversity

- Knowing our Biodiversity
- The Functional Role of Biodiversity
- Using Biodiversity
- Sustainable Tourism
- Conserving and Monitoring Biodiversity
- Integrating Biodiversity with Resource Management
- Managing Environmental Pests, Weeds and Diseases

Climate and Atmosphere

- Air Quality
- Atmospheric Composition
- Climate Processes
- Climate Modelling
- Climate Impact

Land and Water

- Catchment Management, Assessment and Monitoring
- Sediment, Nutrient and Pollutant Transport in Catchments
- Surface Water Management
- Groundwater Management
- Land Resource Inventory and Evaluation
- Land Degradation Processes, Management and Restoration
- Land and Water Contamination
- Remediation
- Waste Utilisation
- Integrated Resource Use and Society

Marine

- Multi-Use of EEZ
- Marine Living Resources: Northern

- Marine Living Resources: Southern
- Marine Living Resources: International
- Conservation Management
- Products and Biotechnology
- Estuarine and Coastal
- ORV Franklin

Information Technology, Infrastructure and Services

Built Environment

- Energy Conservation and Improved Indoor Air Quality
- Management and Re-Use of Urban Waters
- Water Treatment Processes
- Waste Minimisation and Recycling Technologies in Construction
- Condition Monitoring and Rehabilitation
- Construction Elements with Enhanced Service Lives
- Sustainable Use of Timber
- Performance Criteria for the Built Environment
- Advanced Construction Systems Delivery
- Infrastructure Optimisation
- Integrated Design Technologies
- Intelligent Transport Systems

Information Technology and Telecommunications

- Wireless Access
- Millimetre-Wave Communications
- Mobile Communications Networks
- Antennas
- Interactive Media System and Environments
- Spatial Information Infrastructures, Systems and Services
- Electronic Documents and Commerce
- Software Engineering Initiative
- Advanced Telecommunications Networks and Services

Measurement Standards

- National Measurement System
- Standards Research and Development

- CSIRO Annual Report 1996-1997
- International Metrology
- Asia-Pacific Activities

Radio Astronomy

- National Facility Operation
- Astrophysics
- Engineering Development

Services

- Health Services
- Security Systems
- Decision Support for Service Process Improvement

Manufacturing

Chemicals and Plastics

- Polymers and Composites
- Engineered Packaging, Membranes and Inorganic Materials
- Specialty Designer Chemicals
- Crop Protection Products
- Chemical Processing, Cleaner Production and Disposal

Integrated Manufactured Products

- Light Metals Automotive
- Shipbuilding and Aerospace
- Industrial Instruments
- Medical Instruments
- Scientific Instruments
- Electric Motors
- Forging and Casting
- Non-Ferrous Materials
- Joining Technologies
- Ceramics and Composites
- Automation
- Manufacturing Systems
- Micromanufacturing

Pharmaceuticals and Human Health

- Antivirals
- Cancer
- Cardiovascular Disease
- Diabetes
- Tissue Growth and Repair
- Generic Pharma Discovery
- Diagnostics
- Biomaterials

Minerals and Energy

Coal and Energy

- Coal Exploration and Mining
- Environmental Impacts of Mining
- Coal Preparation
- Clean Utilisation Technologies
- Fuel Cells and Gas
- Renewables and Energy Storage

Mineral Exploration and Mining

- Ore Deposit Formation
- Mineral Mapping Technologies
- Exploration Geology and Geochemistry in the Regolith
- Exploration Geophysics
- Mine-Scale Geophysics
- Mine Design and Operations
- Mining Equipment and Automation
- New Mining Methods
- Environmental Impacts of Mining
- Water Issues for Mining
- Occupational Health and Safety

Mineral Processing and Metal Production

- Alumina Production
- Non-Ferrous Mineral Processing
- Iron Ore Processing
- Industrial Minerals
- Base Metal Hydrometallurgy

- Light Metal Production
- Base Metal Pyrometallurgy
- Ferrous Metal Pyrometallurgy
- Precious Metal Processing
- Environment, Health and Safety Systems
- Process Design and Optimisation
- Process Mineralogy
- Materials and Equipment

Petroleum

- Environment and Safety
- Exploration and Appraisal
- Drilling and Completions
- Development and Production
- Facilities
- Coal Seam Methane
- Capability Gaps

APPENDIX 7.

Sector Advisory Committees, as at 30 June 1997

(Updated information is on WWW at http:// www.csiro.au./csiro/structure/sac.htm)

To ensure the continuing effectiveness of research and development for each Sector, CSIRO has appointed Sector Advisory Committees with members representing its stakeholders and customers.

These Committees assist in the planning of research portfolios for each Sector, providing valuable information about the strategic research needs of industry and society. The Committees also help in the uptake of research results by industry.

Agribusiness

Field Crops Sector

Chairman

Mr Trevor Flugge Chairman Australian Wheat Board

Members

Mr Harry Bonanno Chairman Australian Cane Growers Council Ltd

Dr Tony Gregson Director Grains R&D Corporation

Mr John Grellman Board Member Cotton Seed Distributors Ltd

Mr Richard Haire Chief Executive Officer Queensland Cotton

Mr Mike Hedditch Executive Director Rice Growers Association of Australia

Mr Chris Henderson Farmer, seed producer, feed grain supplier

Dr Chris Hudson Goodman Fielder Ltd

Prof John Lovett Managing Director Grains R&D Corporation

Prof Don Marshall Dept of Crop Science University of Sydney

Mr Baillieu Myer Myer Foundation

Food Processing Sector

Chairman

Vacant at 30/6/97

Members

Mr Simon Brooke-Taylor National Food Authority

Prof Ken Buckle Dept Food Science & Technology University of New South Wales

Dr Bryan Cox General Manager R&D Goodman Fielder Ingredients Ltd

Dr Paul Donnelly Managing Director Dairy R&D Corporation

Dr Roger MacBean R&D Technical Manager QUF Industries Ltd

Mr Hans Sidler General Manager National Food Buying Woolworths Supermarkets

Dr Robert Young General Development Manager Unifoods

Mr Peter Wallace Chief Executive Officer National Heart Foundation

Dr Peter White Executive Director, Rural Industries Export Development Unit Queensland Department of Primary Industries

Forestry, Wood and Paper Industries Sector

Chairman

Mr Angus Pollock Australian Paper

Members

Mr Ron Adams Bunnings Forest Products Dr Gary Bacon Executive Director, Forestry Queensland Department of Primary Industries Fisheries and Forestry

Dr Ian Bevege Principal Adviser Australian Centre for International Agricultural Research

Mr Ian Dench AMCOR Research & Technology Centre

Mr Geoff Gorrie Executive Director, Agriculture & Forests Department of Primary Industries & Energy

Mr Peter Law General Manager Engineering Boral Timber Industries Ltd

Mr Richard Rawson Executive Director Forests Service Department of Natural Resources and Environment Victoria

Mr Mark Thomas Chief Executive Greening Australia

Horticulture Sector

Chairman

Mr David Pullar David Pullar & Associates

Members

Mr Tony Biggs Editor *Good Fruit & Vegetables* Rural Publishers Ltd

Mr Bob Calder Assistant Secretary, Agribusiness Branch Department of Primary Industries & Energy

Mr Brian Carroll Chairman Ausveg Board

Dr Edwina Cornish Managing Director Florigene Pty Ltd Mr Phillip Laffer Director of Viticulture & Winemaking Orlando-Wyndham Pty Ltd

Mr Peter Pokorny National Merchandising Manager, Produce Woolworths Ltd

Mr Paul Ziebarth Member Queensland Fruit & Vegetable Growers Board

Meat, Dairy and Aquaculture Sector

Chairman

Dr John Keniry Chairman Ridley Corporation Limited

Members

Dr Ted Christie Barrister & environmental lawyer

Mr Robin Hart Chairman Kerwee Pastoral Company

Mr John Landy Chairman Meat Research Corporation

Ms Wendy Miller Veterinarian & beef producer

Dr Gardner Murray Chief Veterinary Officer Department of Primary Industries & Energy

Mr Wayne Sanderson Executive Director R&D Technical Services Murray/Goulburn Co-op Co Ltd

Mr Ervin Vidor Director & Chairman Sea Farms Ltd

Mr Shane Walsh Beef producer Mr Tony Wharton Chief Executive Officer Q-Meat

Wool and Textiles Sector

Chairman

Ms Margaret Moroney Margaret Moroney Pty Ltd

Members

Mr John Blood Textile & garment consultant

Mr Ray Chapman Managing Director COOGI Australia Pty Ltd

Mr Bill Cook Manager, Financial Analysis Wooltech

Mr Trevor Dawson Managing Director Rocklea Spinning Mills Pty Ltd

Dr Brian Fisher Executive Director Australian Bureau of Agricultural & Resource Economics

Mr Guy Fitzhardinge Livestock Producer

Mr John Grant Technical Director International Wool Secretariat Australia

Mr John Menzies Managing Director Austanners

Mr Andrew Vizard Veterinary Clinical Centre University of Melbourne

Mr David Ward Managing Director Australian Wool Testing Authority Ltd

Environment and Natural Resources

Biodiversity Sector

Chairman

Dr Robyn Kruk Director NSW National Parks & Wildlife Service

Members

Mr Jim Downey Director Australian Conservation Foundation

Mr Malcolm Forbes Assistant Secretary, Sustainable Water Branch Biodiversity Group, Environment Australia

Mr Des Griffin Executive Director Australian Museum

Mr Colin Griffiths First Assistant Secretary, Biodiversity Group Environment Australia

Professor Pauline Ladiges Head, School of Botany University of Melbourne

Prof Henry Nix Centre for Resource & Environmental Studies Australian National University

Ms Pamela Sayers National Policy Manager Tourism Council of Australia

Climate and Atmosphere Sector

Chairman

Mr Oleg Morozow Manager Environmental Affairs Santos Ltd

Members

Mr Ian Carruthers Assistant Secretary Air Pollution & Climate Change Branch Environment Australia Mr Stephen Corbett Director NSW Environmental Health Unit

Mr Tom Fenwick Acting Director General Queensland Department of Natural Resources

Dr Doug Gauntlett Deputy Director (Research & Systems) Bureau of Meteorology

Mr Mark McKenzie Engineeering & Environment National Roads & Motorists Association

Mr Michael Rae Manager Sustainable Development World Wide Fund for Nature

Dr Peter Scaife Chief Environmental Scientist BHP Research Laboratories

Dr Ros Taplin Director Climatic Impacts Centre Macquarie University

Land and Water Sector

Chairman

Dr Wendy Craik Executive Director National Farmers Federation

Members

Dr Joe Baker Chairman National Landcare Advisory Committee

Mr Don Blackmore Chief Executive Murray Darling Basin Commission

Andrew Campbell Assistant Secretary, Sustainable Landscapes Branch Environment Australia

Mr Geoff Gorrie Executive Director, Agriculture & Forests Group Department of Primary Industries & Energy Dr John Langford Executive Director Water Services Association

Dr Phil Price Executive Director Land & Water Resources R&D Corp

Dr Graeme Robertson Chief Executive Officer Agriculture WA

Ms Kathryn Tayles General Manager Environmental Policy CRA Ltd

Marine Sector

Chairman

Prof Graeme Kelleher Vice Chair, IUCN Commission on National Parks & Protected Areas

Members

Dr Peter Bridgewater Head Biodiversity Group Environment Australia

Mr Ron Eagle Deputy Director General NSW Public Works

Ms Mary Howard Assistant Secretary, Fisheries Branch Department of Primary Industries & Energy

Mr Ted Loveday President Queensland Commercial Fishermens Organisation

Prof Helene Marsh Tropical Environment Studies & Geography James Cook University

Dr Russell Reichelt Director Australian Institute of Marine Studies

Mr Richard Stevens Managing Director Australian Fisheries Management Authority

Information Technology, Infrastructure and Services

Built Environment Sector

Chairman

Dr Jack Wynhoven Chief Executive Connell Wagner

Members

Mr Alan Castleman Chairman Western Metals Ltd

Mr Alan Evans First Assistant Secretary, Industry Division A Department of Industry, Science & Tourism

Mr Ian Johnston Chief Executive Officer Government Property Office (WA)

Mr John Morgan Managing Director Melbourne Water

Dr Michael Sargent Chief Executive Officer ACTEW Corporation Ltd

Mr Bill Service Director Saltcoats Consulting Pty Limited

Mr David Thomson Director Technology Roads & Traffic Authority (NSW)

Ms Yvonne von Hartel Senior Partner Robert Peck von Hartel Trethowan

Mr Lionel Wonneberger Managing Director Thomson Radar Australia Corporation

Information Technology and Telecommunications Sector

Chairman

Mr Mel Ward Consultant

Members

Dr Roger Buckeridge Consultant

Ms Lyndsay Cattermole Managing Director Aspect Computing Pty Ltd

Mr Rob Cook Chief Executive CITR Pty Ltd

Mr David Laidlaw General Manager Solutions Development ISSC Australia

Mr Andy Macdonald Secretary/Chief Government Information Officer Office of Government Information Technology

Mr Val Mickan Managing Director Silicon Graphics Pty Ltd

Mr Peter Rule Director Strategic Development Ericsson Australia Pty Ltd

Dr Ockert van Zyl Executive Director Telecommunications-Manufacturing Siemens Ltd

Measurement Standards Sector

Chairman

Mr Bruce Kean, AM

Members

Mr John Birch, AM Executive Director National Standards Commission

Mr Alan Brecht Assistant Secretary Defence Quality Assurance Department of Defence Mr Rex Christensen General Manager Technical Regulation Branch Australian Telecommunications Authority

Professor Lawrence Cram School of Physics University of Sydney

Ms Margaret Fanning Assistant Secretary, Business Environment Branch Department of Industry, Science & Tourism

Mr John Gilmour Chief Executive National Association of Testing Authorities Australia

Mr John Hulbert Executive Director Joint Accreditation System of Australia and New Zealand

Mr Ian Monro Principal Consultant Testing & Measurement Testing & Certification Australia

Mr Chris Nesbitt-Hawes General Manager Operations & Service Australian Defence Industries Ltd

Mr Ross Wraight Chief Executive Standards Australia

Radio Astronomy Sector

Chairman

Dr Rachel Webster School of Physics University of Melbourne

Members

Dr Jacqueline Bergeron European Southern Observatory, Germany

Dr Brian Boyle Director Anglo-Australian Observatory

Dr Dennis Cooper Chief CSIRO Telecommunications & Industrial Physics

Dr Bob Frater Deputy Chief Executive CSIRO Professor Hirashi Hirabayashi Deep Space Communication & Research Institute of Space & Astronautical Science, Japan

Professor Don Melrose Director Research Centre for Theoretical Astrophysics University of Sydney

Professor Jeremy Mould Director Mount Stromlo Space Observatory

Dr John O'Sullivan Director of Technology News Ltd

Dr Marcus Price Officer in Charge Australia Telescope National Facility

Dr Peter Scaife Chief Environmental Scientist BHP Research Laboratories

Professor John Storey School of Physics University of New South Wales

Professor Jack Welch Director, Hat Creek Observatory University of California, USA

Service Sector

Chairman

Mr Peter O'Grady Quality consultant

Members

Mr Garry Campbell Director Information Services Coles Myer Ltd

Ms Carmel Cray Managing Director Logica

Ms Judith King Executive Director Australian Coalition of Service Industries Mr Michael Mannington Director ID Tours

Mr Roger Nairn National Australia Bank

Mr Seong Who Choo Senior Manager R&D National Roads & Motorists Association

Dr Victor Skladnev Managing Director Polartechnics Limited

Manufacturing

Chemicals & Plastics Sector

Chairman

Mr Alan Seale General Manager Technology ICI Australia

Members

Dr Doreen Clark Analchem Bioassay

Ms Bev Clarke First Assistant Secretary Engineering, Construction & Resource Processing Industries Division Department of Industry, Science & Tourism

Mr Claude Gauchat Executive Director Avcare

Mr Leo Hyde R&D Manager Du Pont Australia Ltd

Mr Roger Karge Managing Director Innovative Technology & Licensing Australia (Chemicals)

Mr Michael MacKellar Chief Executive Officer Plastics & Chemicals Industries Association Prof Ian Rae Deputy Vice Chancellor Victoria University of Technology

Mr Greg Rappo General Manager Chemicals & Agricultural Products Division Abbott Laboratories

Mr Doug Rathbone Chief Executive Officer Nufarm Pty Ltd

Integrated Manufactured Products Sector

Chairman

Dr Don Williams AO Company Director

Members

Mr Peter Coates, CBE Chairman Ceramic Fuel Cells Ltd

Mrs Patricia Crook Managing Director Dynek Pty Ltd

Mr Frank Cunningham Manager Business Development BHP Research Laboratories

Mr Keith Daniel Chief Executive Officer AMBRI Pty Ltd

Mr Vince Evans Technical Service Manager Federation of Automotive Products Manufacturers

Mr Mike Holthuyzen First Assistant Secretary Industry Division B Department of Industry, Science & Tourism

Mr Roger James Industry Specialist - Aviation & Aerospace Manufacturing Technology Unit Business Victoria Mr Ross McNeil General Manager ANI Technology

Mr Antony Simpson Company Director

Mr Robert Trenberth Consultant Ernst & Young

Dr Katherine Woodthorpe Associate IT Services

Pharmaceuticals & Human Health Sector

Chairman

Prof John Funder Director Baker Medical Research Institute

Members

Ms Dallas Ariotti Health economist

Mr Pat Clear Chief Executive Officer Australian Pharmaceutical Manufacturers Association Inc

Dr Bill Coote Secretary General Australian Medical Association Ltd

Ms Patricia Kelly Assistant Secretary, Purchasing, Pharmaceutical and Environmental Industries Branch Department of Industry, Science & Tourism

Dr Graham Mitchell Foursight Associates Pty Limited

Mr Graham Thurston Secretary Australian Diagnostic Manufacturers Association

Minerals and Energy

Coal & Energy Sector

Chairman

Mr John Hannah Group General Manager/Executive VP BHP Coal Ltd

Members

Ms Margaret Beardow Assistant Director, Policy Analysis & Research Electricity Supply Association of Australia

Mr Noshir Bharucha Director Energy Innovation Section Department of Primary Industries & Energy

Mr Robyn Bryant Assistant Secretary, Coal Development Branch Department of Primary Industries & Energy

Mr George Edwards Executive Chairman Advance Coal Ltd

Mr Ross Graham Director Australian Coal Research Ltd

Prof Don Nicklin Consultant

Mr Keith Orchison Executive Director Electricity Supply Association of Australia

Mr Terry O'Reilly Coal & Allied Ltd

Mr Bruce Robertson Consulting Mining Engineer Shell Coal Australia Ltd

Ms Jane Robertson Executive Director NSW Minerals Council

Dr John Sligar Consultant

Dr Jim Smitham Manager Research - Mineral & Petroleum Programs BHP Research Mr George Webb Research Manager Australian Gas Association

Dr John Zillman Director Bureau of Meteorology

Mineral Exploration & Mining Sector

Chairman

Mr Dick Carter Executive General Manager BHP Minerals

Members

Mr Alan Broome Chairman AUSTMINE-ACIRL

Mr Dick Davies Chief Executive Officer Australian Mineral Industries Research Association

Mr Ed Eshuys Director Resources Great Central Mines

Dr Ross Farden Consultant

Dr Ron Kay Group Executive - Environment CRA Ltd

Mr Rob Rawson First Assistant Secretary, Coal & Mineral Industries Division Department of Primary Industries & Energy

Mr Robert Rigo Technical Services Manager Mount Edon Gold Mines

Dr Vivienne Snowden Principal Snowden Associates

Dr Volker Tillman Consultant Dr Tom Whiting Manager Exploration - Australia & SW Pacific BHP Minerals

Mr Mark Woffenden General Manager Mine Planning & Technology Hamersley Iron Pty Ltd

Mineral Processing & Metal Production Sector

Chairman

Mr Ian Lawrence Manager Technology Western Mining Corporation

Members

Mr Don Banfield Asssistant Secretary, Minerals Branch Department of Primary Industries & Energy

Dr Robin Batterham Vice President Research & Technology CRA Ltd

Mr Keith Crocker Assistant Secretary, Resource Processing Industries Branch Department of Industry, Science & Tourism

Mr Dick Davies Chief Executive Officer Australian Mineral Industries Research Association

Mr David Debney Technical Manager WA Operations Alcoa of Australia Ltd

Mr Mike Eager Managing Director Aberfoyle Limited

Mr Ian Hartnell General Manager Queensland Metals Corp

Dr Robert Hobbs General Manager Corporate Research BHP Co Ltd

Dr Bruce Kelley General Manager CRA-Advanced Technology Development Mr Jim Mitchell General Manager Technical Services North Limited

Petroleum Sector

Chairman

Mr Agu Kantsler General Manager New Ventures Woodside Offshore Petroleum Pty Ltd

Members

Mr Frank Aquino Well Construction Manager Woodside Offshore Petroleum Pty Ltd

Mr Charles Balnaves Group Manager Petroleum Engineering BHP Petroleum Pty Ltd

Dr Peter Goode General Manager Petroleum Department Santos Ltd

Dr Rodney Halyburton Manager Petroleum Technology BHP Petroleum Pty Ltd

Mrs Eve Howell Deputy Managing Director Apache Energy Ltd

Mr John McPherson Senior Geological Adviser Mobil Exploration & Producing Australia Pty Ltd

Mr Rob Male Alliance Contract Manager Woodside Offshore Petroleum Pty Ltd

Mr Michael Sayers Geophysicist West Australian Petroleum Pty Ltd

Dr Robert Willink General Manager - Oil & Gas Exploration Boral Energy Resources Ltd

APPENDIX 8.

Cooperative Research Centres Program

The Cooperative Research Centres (CRC) Program supports collaborative research between industry, Commonwealth and State Government instrumentalities, universities and other research providers such as CSIRO.

CSIRO is involved in 52 of the 62 CRCs established under the CRC Program to 30 June 1997. CSIRO is also a participant in one of the new proposals approved during the 1996 selection round of CRCs, Sustainable Rice Production, and in nine approved proposals from first round (1991) CRCs for renewal of funding. These latest CRCs will begin their contract periods after July 1997.

Cooperative Research Centres in which CSIRO is a participant

Manufacturing Technology

- Alloy and Solidification Technology
- Industrial Plant Biopolymers
- Intelligent Manufacturing Systems and Technologies
- International Food Manufacturing and Packaging Science
- Materials Welding and Joining
- Molecular Engineering and Technology: Sensing and Diagnostic Technologies
- Polymer Blends

Information and Communications Technology

- Advanced Computational Systems
- Australian Photonics
- Intelligent Decision Systems
- Research Data Network
- Robust and Adaptive Systems

Mining and Energy

- AJ Parker CRC for Hydrometallurgy
- Australian Geodynamics
- Australian Mineral Exploration Technologies

- Australian Petroleum
- Black Coal Utilisation
- GK Williams CRC for Extractive Metallurgy
- Landscape Evolution and Mineral Exploration
- Mining Technology and Equipment
- New Technologies for Power Generation from Low Rank Coal

Agriculture and Rural Based Manufacturing

- Aquaculture
- Cattle and Beef Industry (Meat Quality)
- Food Industry Innovation
- Hardwood Fibre and Paper Science
- Legumes in Mediterranean Agriculture
- Plant Science
- Premium Quality Wool
- Quality Wheat Products and Processes
- Sustainable Cotton Production
- Sustainable Sugar Production
- Temperate Hardwood Forestry
- Tropical Pest Management
- Tropical Plant Pathology
- Viticulture
- Weed Management Systems

Environment

- Antarctic and Southern Ocean Environment
- Biological Control of Vertebrate Pest Populations
- Catchment Hydrology
- Freshwater Ecology
- Soil and Land Management
- Southern Hemisphere Meteorology
- Sustainable Development of Tropical Savannas
- Tropical Rainforest Ecology and Management
- Waste Management and Pollution Control
- Water Quality and Treatment

Medical Science and Technology

- Cardiac Technology
- Cellular Growth Factors
- Diagnostic Technologies
- Eye Research and Technology
- Tissue Growth and Repair
- Vaccine Technology



INDEPENDENT AUDIT REPORT

To the Minister for Industry, Science and Tourism

Scope

I have audited the financial statements of the Commonwealth Scientific and Industrial Research Organisation for the year ended 30 June 1997. The financial statements comprise:

- Statement by Board Members
- Operating Statement
- Statement of Assets and Liabilities
- Statement of Cash Flows
- Schedule of Commitments
- Schedule of Contingencies, and
- Notes to and forming part of the Financial Statements.

The members of the Board are responsible for the preparation and presentation of the financial statements and the information they contain. I have conducted an independent audit of the financial statements in order to express an opinion on them to the Minister for Industry, Science and Tourism. The audit has been conducted in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards, to provide reasonable assurance as to whether the financial statements are free of material misstatement.

Audit procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial statements, and the evaluation of accounting policies and significant accounting estimates.

These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial statements are presented fairly in accordance with Australian Accounting Standards, other mandatory professional reporting requirements (Urgent Issues Group Consensus Views) and statutory requirements so as to present a view of the entity which is consistent with my understanding of its financial position, the results of its operations and its cash flows.

The audit opinion expressed in this report has been formed on the above basis.

Audit Opinion

In accordance with sub-section 51(1) of the Science and Industry Research Act 1949, I now report that the financial statements are in agreement with the accounts and records of the Organisation, and in my opinion:

- (i) the statements are based on proper accounts and records;
- (ii) the statements present fairly in accordance with applicable Accounting Standards and other mandatory professional reporting requirements the financial position of the Organisation as at 30 June 1997 and the results of its operations and its cash flows for the year then ended;
- (iii) 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, and;

(iv) the statements are in accordance with the *Guidelines for Financial Statements of Commonwealth Authorities*. Australian National Audit Office

D S Lennie Executive Director For the Auditor-General Canberra 12 September 1997

Address all mail to GPO Box 707 CANBERRA ACT 2601 Centenary House 19 National Circuit BARTON ACT 2600 Phone (02) 203 7300 Fax: (02) 203 7777





BOARD MEMBERS' STATEMENT

In our opinion, the attached financial statements of the Commonwealth Scientific and Industrial Research Organisation for the year ended 30 June 1997 present fairly the information required by the Minister for Finance Guidelines for Financial Statements of Commonwealth Authorities.

Signed at Canberra this 12th day of September 1997 in accordance with a resolution of the Board Members.

J. C. ... Allen

D C K Allen Chairman

uccui Intol

M K McIntosh Chief Executive and Board Member

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OPERATING STATEMENT For the year ended 30 June 1997

		1997	1996
	Notes	\$'000	\$'000
NET COST OF SERVICES			
Operating expenses			
Business Units			
Animal Health and Australian Animal Health Laboratory		22 434	25 873
Animal Production		21 661	22 809
Atmospheric Research		13 446	12 805
Australia Telescope National Facility		11 129	15 735
Building Construction & Engineering		26 938	27 237
Coal & Energy Technology		20 105	19 950
CSIRO Office Of Space Science and Applications (COSSA)		3 469	3 003
CSIRO Publishing		5 858	6 146
Entomology		28 552	28 292
Environmental Projects Office		1 754	2 973
Exploration & Mining		29 658	29 200
Food Science & Technology		22 139	21 810
Forestry & Forest Products		30 100	26 770
Human Nutrition		9 433	7 763
Land & Water		44 434	48 057
Magnesium Project		2 266	7 605
Marine Research		34 143	30 764
Manufacturing Science & Technology		39 698	36 498
Mathematical & Information Sciences		26 143	24 316
Mediterranean Agricultural Research		229	188
Minerals		33 381	30 469
Molecular Science		33 702	31 517
ORV Franklin National Facility		5 163	4 /98
Petroleum Resources		9 264	8 641
Plant Industry		46 077	43 159
Telecommunications & Industrial Physics		45 782	45 665
Tropical Agriculture		32 100	30 365
Wildlife & Ecology		22 619	22 255
Wool Technology	2(1)	26 514	25 /01
Corporate Activities	2 (b)	45 611	53 089
Total operating expenses	2(2)	693 802	693 451
Total operating expenses	L(a)	0)9002	0) 5 1) 1
Operating revenues from independent sources			
Revenue from research activities and user charges		209 232	210 544
Other revenue	3	35 436	31 449
Total operating revenues from independent sources		244 668	241 993
		110.101	/ = = / = 0
Net cost of services		449 134	451 458
REVENUES FROM GOVERNMENT			
Parliamentary appropriations received	4	444 502	417 597
Surplus (deficit) of revenues from Government			
over net cost of services		(4 632)	(33 861)
Accumulated surpluses at			
beginning of reporting period		618 065	651 926
Accumulated surpluses at			
end of reporting period		613 433	618 065
r			

STATEMENT OF ASSETS AND LIABILITIES As at 30 June 1997

		1997	1996
	Notes	\$'000	\$'000
DEBT			
Loans	5		10 220
Leases	6	18 998	19 292
Total debt		18 998	29 512
PROVISIONS AND PAYABLES			
Employees	7	135 639	130 146
Suppliers	8	22 033	18 169
Other	9	142 422	134 767
Total provisions and payables		300 094	283 082
Total liabilities		319 092	312 594
EQUITY			
Reserves		252 407	252 407
Accumulated surpluses		613 433	618 065
Total equity	10	865 840	870 472
Total liabilities and equity		1 184 932	1 183 066
FINANCIAL ASSETS			
Cash	11	44 341	12 507
Receivables	12	38 438	23 484
Investments	13	84 975	109 324
Total financial assets		167 754	145 315
NON-FINANCIAL ASSETS			
Land and buildings	14	844 736	854 227
Plant and equipment	15	158 242	167 509
Other	16	14 200	16 015
Total non-financial assets		1 017 178	1 037 751
Total assets		1 184 932	1 183 066
Current liabilities		140 294	132 027
Non-current liabilities		178 798	180 567
Current assets		86 550	81 893
Non-current assets		1 098 382	1 101 173

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STATEMENT OF CASH FLOWS For the year ended 30 June 1997

		1221	1220
	Notes	\$'000	\$'000
OPERATING ACTIVITIES			
Cash received		111 400	(1
Appropriations		444 502	417 597
Sales of goods and services		240 989	4 608
Other		5 162	3 826
		602 762	662 115
		092 /05	002 115
Cash used		40(10((12 (02
Employees		400 180	415 495
Interest and other financing costs		511	517
		621 /02	625 200
		021 402	033 300
Net cash provided by operating activities	17	71 361	26 815
INVESTING ACTIVITIES			
Cash received			
Proceeds from sale of property, plant and equipment		22 325	22 248
Proceeds from sale of equity instruments		1 309	- 10
		23 634	22 248
Cash used			
Purchase of property, plant and equipment		76 360	72 499
Net cash used by investing activities		(52 726)	(50 251)
FINANCING ACTIVITIES			
Cash used			
Repayment of debt		10 514	597
Net cash used by financing activities		(10 514)	(597)
Net increase in cash held		8 121	(24 033)
Cash at 1 July		120 166	144 199
Cash at 30 June		128 287	120 166
For the purpose of the Statement of Cash Flows, cash is represented by:			
Cash at bank and on hand	11	30 114	2 670
Cash at bank - trust monies	9	12 836	7 674
Deposits - at call	11	1 391	65
Managed funds	11 & 13	-	31 985
K&D Syndicate deposits - under contract	13	83 946	77 772
		128 287	120 166

SCHEDULE OF COMMITMENTS As at 30 June 1997

	1997	1996
	\$'000	\$'000
BY TYPE Capital commitments		
Land and buildings Plant and equipment	5 666 10 097	30 016 182
Total capital commitments	15 763	30 198
Other commitments Operating leases Research and development commitments Other commitments	10 822 271 268 595	14 732 263 017 297
Total other commitments	282 685	278 046
Total commitments payable	298 448	308 244
Commitments receivable Research and development commitments Other receivables	251 915 9 622	241 746
Total commitments receivable	261 537	241 746
Net commitments	36 911	66 498
BY MATURITY		
One year or less From one to two years From two to five years Over five years	25 729 4 271 4 613 2 298	51 109 5 185 5 936 4 268
Net commitments	36 911	66 498

SCHEDULE OF CONTINGENCIES As at 30 June 1997

	1997	1996
	\$'000	\$'000
CONTINGENT LOSSES		
Performance guarantees	1 427	-
Estimated legal claims arising from employment, motor vehicle		
accidents and contractual disputes.	383	819
These matters are being fully defended		
	1 810	819

SCHEDULE OF UNQUANTIFIABLE CONTINGENCIES As at 30 June 1997

The Commonwealth of Australia and CSIRO are defendants in legal proceedings brought by 36 plaintiffs in relation to the premature escape of Rabbit Calicivirus Disease in 1995. The defendants have denied legal liability and will respond to the legal proceedings accordingly. At this stage, there is insufficient information to assess CSIRO's potential financial exposure, if any, to such claims.

In addition, CSIRO is the defendant in legal proceedings brought by Charter Pacific Corporation Limited in relation to the exploitation of CSIRO's Exelgram technology and a Deed of Settlement entered into between the parties in September 1994. The proceedings are being vigorously contested by CSIRO and CSIRO has filed a counter claim against Charter Pacific Corporation Limited.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

	NOTE	PAGE
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Finance Lease Liabilities	6	92
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Equity	10	93
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NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Economic Dependency : CSIRO receives approximately two thirds of its funding from Commonwealth Parliamentary appropriations and it has no borrowing powers under its *Science and Industry Research Act* 1949.

Note 1 Summary of significant accounting policies

1.1 Basis of accounting

The financial statements are a general purpose financial report.

As required by sub-section 57(1)(a) of the *Science and Industry Research Act* 1949, the financial statements are prepared in accordance with the Guidelines for Financial Statements of Commonwealth Authorities issued by the Minister for Finance in July 1997 (the 'Guidelines') which require that the financial statements are prepared:

- in compliance with the Australian Accounting Standards and the Accounting Guidance Releases issued by the Australian Accounting Research Foundation, and
- having regard to Statements of Accounting Concepts and the Urgent Issues Group Consensus Views.

The financial statements have been prepared on an accrual basis and are in accordance with the historical cost convention, except for certain assets which, as noted, are at valuation. Except where stated, no allowance is made for the effect of changing prices on the results or on the financial position.

1.2 Rounding

Amounts are rounded to the nearest \$1000 except in relation to:

- remuneration of Board Members;
- remuneration of Officers; and
- remuneration of auditors.

1.3 Principles of consolidation

As at 30 June 1997, CSIRO's in-kind contributions provided approximately 43 per cent of the total resources of both Biomolecular Research Institute Limited and Ceramic Fuel Cells Limited. These contributions have been accounted for in CSIRO's Operating Statement (Note 18). CSIRO does not have the capacity to control the Boards or financial and operating policies of the companies. Having considered this matter and their immaterial effect on CSIRO's financial statements, CSIRO has, in accordance with Australian Accounting Standard AAS24, elected not to consolidate these accounts.

1.4 Taxation

In accordance with section 53 of the *Science and Industry Research Act*, CSIRO is exempt from all forms of taxation except fringe benefits tax.

Foreign currency transactions

Transactions denominated in a foreign currency are converted to Australian currency at the rates of exchange prevailing at the date of the transactions. At balance date, amounts receivable and payable in foreign currency are translated at the exchange rate prevailing at that date and any exchange differences are brought to account in the Operating Statement.

Hedges

1.5

All non-specific hedge transactions are recorded at the spot rate at the date of the transaction. Hedges outstanding at balance date are translated at the rates of exchange ruling on that date and any exchange gains or losses are brought to account in the Operating Statement.

Where hedge transactions are designed to hedge the purchase or sale of goods or services, exchange differences arising up to the date of purchase or sale, together with any costs or gains arising at the time of entering into the hedge, are included in the measurement of the purchase or sale.

1.6 Insurance

As part of its risk management strategy CSIRO has in place insurance cover for a range of risks including industrial special risks, professional indemnity, public and product liability, directors and officers liability/company reimbursement, travel and motor vehicles. The insurance cover is designed to protect CSIRO from losses in excess of normal self insurance.

1.7 Segments reporting

CSIRO principally operates in the field of scientific and industrial research and development in Australia with a small overseas presence related to specific Australian research objectives. It is therefore considered that for segment reporting, it operates in one industry (scientific research and development) and one geographical location.

1.8 Revenue recognition

Parliamentary appropriations are recognised as revenue in the year of receipt in accordance with the Guidelines for Financial Statements of Commonwealth Authorities.

Revenue from contract research activities is recognised in the Operating Statement when work is performed, the balances of research activities in progress are accounted as either research work in progress or contract research moneys received in advance in the Statement of Assets and Liabilities.

A surplus is recognised on completion of each research activity. However, where a deficit is anticipated over the life of the research activity then it is brought to account when first recognised.

Other revenue, including licensing fees and royalties from the sale of products or technologies developed under agreements, is brought to account when received. While this basis of accounting constitutes a departure from an accrual basis, the effect is not material to the financial statements.

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1.9 Consumable stores

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

1.10 Leases

A distinction is made between finance leases, which effectively transfer from the lessor to the lessee substantially all the risks and benefits incidental to ownership of leased assets, and operating leases, under which the lessor effectively retains all such risks and benefits.

Where a non-current asset is acquired by means of a finance lease, the asset is capitalised at the present value of minimum lease payments at the inception of the lease and a liability for lease payments recognised at the same amount. Lease payments are allocated between the principal component and the interest expense. Leased assets are amortised over the period of the lease.

Operating lease payments are charged to the Operating Statement on a basis which is representative of the pattern of benefits derived from the leased assets.

1.11 Bad and doubtful debts

Bad debts are written off in the year in which they are identified. A provision is raised for doubtful debts based on a review of all outstanding receivables at year end.

1.12 Investments

Equities

Investments are brought to account at the lower of cost or Board valuation, which is not in excess of the recoverable amount. The Board considers the nature of the underlying net assets with particular regard to any deferred expenditure on research, development and intellectual property (Note 1.13).

Controlled Entities

There are no controlled entities

Associated Companies

Investments in associated companies are carried at lower of cost or Board valuation, which is not in excess of the recoverable amount. An associated company is one in which CSIRO exercises significant influence over the company and the investment is long-term.

Other Companies

Investments in other companies are carried at lower of cost or Board valuation, which is not in excess of the recoverable amount.

Managed Funds

Managed funds comprise government, semi-government and bank endorsed securities which are valued at market values at balance date.

С	S	1	R	0	А	1	n	n	u	a	1	R	е	p	0	r	t	1	9	9	6	1	9	9	7	
-				-									-		-		-			-	-		-	-		

1.13 Research and development expenditure and intellectual property

All research and development costs, including costs associated with protecting intellectual property (eg. patents and trademarks) are expensed as incurred, except where benefits are expected beyond any reasonable doubt, to equal or exceed those costs.

1.14 Cooperative Research Centres

The activities attributable to the interests of CSIRO in Cooperative Research Centres have been expensed consistent with Note 1.13. CSIRO's interests in Cooperative Research Centres are disclosed in Note 23.

1.15 Property

The Guidelines require that property be revalued in accordance with the 'deprival' method of valuation.

All land, buildings and leasehold improvements were revalued in June 1996 using methods which comply with the Guidelines.

Land which will continue to be used for research activity was valued by CSIRO's registered valuer, GJ Harley, AAVLE at "existing use value" and the valuation adopted as Board Members' valuation. Existing use contemplates the continued use of the asset for the same application as at the date of valuation, having regard to the asset's capacity to continue contributing to the value of the entity but ignoring alternative uses.

Land designated for possible sale was valued by registered external valuers, Paul McBurnie FVLE(Val), AVLE(Econ), and Ross Stevens AVLE(Val), at market value and the valuation adopted as Board Members' valuation.

Buildings and leasehold improvements, which will continue to be used for research activity, were valued at depreciated replacement costs using external building price indices to arrive at current replacement costs less accumulated depreciation having regard to the age and condition of the buildings.

Building valuations include plant, fixtures and fittings, which form an integral part of the building.

Interest costs on borrowings specifically financing assets under construction are capitalised up to the date of completion of each asset to the extent those costs are recoverable.

1.16 Plant and equipment

All plant and equipment is valued at historical cost. The capitalisation threshold limit is \$3000. The \$3000 threshold was selected because it facilitated efficient asset management and reporting without materially affecting asset values recognised. Assets costing less than the threshold limit are expensed in the year of purchase. Computer software, scientific glassware, experimental prototype equipment, and library monographs and serials are not capitalised as non-current assets owing to either their uncertain useful lives or the uncertainty of benefits to be derived from their development.

Property, plant and equipment which are purchased from contract research funds and where their sale proceeds are refunded to the contributors under the terms of the agreements, are expensed during the year of purchase. Separate records for these assets are maintained (Note 20).

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1.17 Depreciation and amortisation

Depreciation is calculated on a straight line basis so as to write off the net cost or revalued amount of each item of building, plant and equipment over its expected useful life.

The cost of improvements to or on leasehold properties is amortised over the unexpired period of the lease or the estimated useful life of the improvement, whichever is the shorter.

Profits and losses on disposal of property, plant and equipment are taken to account in determining the operating results for the year.

1.18 Liability for employee entitlements

The liability for employee entitlements encompasses provisions for annual leave and long service leave. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken by employees is less than the annual entitlement for sick leave.

The provision for annual leave reflects the value of total annual leave entitlements of all employees at 30 June 1997 and is recognised at its nominal value.

The liability for long service leave is recognised and measured at the present value of the estimated future cash flows to be made in respect of all employees at 30 June 1997. In determining the present value of the liability, attrition rates and pay increases through promotion and inflation have been taken into account.

1.19 Superannuation

CSIRO discharges its liability for employee superannuation by contributing to the Commonwealth Superannuation (CSS) and the Public Sector (PSS) superannuation schemes, which provide retirement, death and disability benefits to employees. Contributions to the schemes are at rates calculated to cover existing and emerging obligations. Current contribution rates are 20.5 per cent of salary (CSS) and 8 per cent of salary (PSS). In addition either 3 per cent (CSS and PSS members) or 6 per cent (other employees) is contributed for employer productivity benefits. These contribution rates are determined by regular actuarial review.

1.20 Workers' compensation

CSIRO's workers' compensation liability is covered by the premium paid to the Commission for the Safety, Rehabilitation and Compensation of Commonwealth Employees (COMCARE) and no additional provision for liability is required.

1.21 Cash

For the purpose of the Statement of Cash Flows, cash includes cash at bank and on hand, deposits at call, trust monies, R&D Syndication deposits under contract and managed funds which include investments in money market instruments which are readily convertible to cash.

1.22 Comparative figures

Where necessary, comparative figures have been adjusted to conform to changes in presentation in these financial statements.

		1997	1996
		\$'000	\$'000
Note 2	(a) Operating expenses		
	Goods and services expenses: Employee expenses		
	Remuneration for services provided Separation and redundancy	401 759 11 002	401 745 7 805
		412 761	409 550
	Suppliers expenses		
	Supply of goods and services Operating lease rental	214 413 2 682	219 279 2 941
		217 095	222 220
	Depreciation and amortisation		
	Depreciation and amortisation of property, plant and equipment Amortisation of finance leased assets	62 591 553	61 132 477
		63 144	61 609
	Net foreign exchange losses		46
	Write-down of financial assets		
	Provision for doubtful debts written back Bad debts written off	(159) 200	(965) 274
		41	(691)
	Interest and Other expenses:		
	Finance lease charges	511	517
	Increase in provision for refit of research vessels	250	200
		761	717
	Total operating expenses	693 802	693 451
	(b) Corporate activities – operating expenses		
	Corporate Business	2 285	(Comparative
	Corporate Executive Office	5 952	figures not
	Corporate Finance	2 226	available
	Corporate Human Resources	3 655	due to
	Corporate Property	1 813	restructure
	Corporate Training	1 298	of the
	Executive	/ 195	Corporate
	Information Technology Services	13 42/	Groups)
	KISK ASSESSITIETIL & AUDIL Strategie Diagoning	1 300	
	Other	500 5 844	
		4= (11	E2 000
		45 011	22 099

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		1007	1006
		\$1000	\$1000
		\$ 000	\$ 000
Note 3	Other revenue from independent sources		
	Department of Primary Industries and Energy's contribution to the operation		
	of the Australian Animal Health Laboratory National Facility	6 047	5 775
	Dividends	-	(()
	Interest Powalties and license feet	2 110	4 608
	Royalities and license lees	5 141 7 116	2 200
	Fees for provision of services	10 588	0 703
	Reptal proceeds	10 000	970.
	Net foreign exchange gains	1/5/	1)4;
	Net rains from disposal of assets	-17	
	land and buildings	856	518
	plant and equipment	916	1.880
	Net gains from sale of shares	673	1 000
	Miscellaneous	205	209
	Total other revenue from independent sources	35 436	31 449
Note 4	Revenue from Government		
	Parliamentary appropriations received		
	Appropriation Acts Nos 1 and 3 1006/07	417 102	301 007
	Appropriation Acts Nos. 2 and 4 1996/97	27 400	25 600
	Appropriation Acts 105. 2 and 4, 1770/77	27 400	29000
	Total revenue from Government	444 502	417 597
Note 5	Loans		
	Loan from the Commonwealth		10 220
	The loan of \$10 220 000 from the Commonwealth was the drawdown of an approved loan of \$10 million and an inflation component of \$220 000 for the North Ryde re-development project. It was repaid in full in November 1996. Interest totalling \$333 978 (1996 \$873 368) has been capitalised on the North Ryde re-development project.		
Note 6	Finance lease liabilities		
	Lease liabilities recognised in the Statement of Assets and Liabilities		
	Current	377	385
	Non-Current	18 621	18 904
	Total finance lease liabilities	18 998	19 292
	Finance lease liabilities at the reporting date and related finance charges are payable as follows:		
	within one year	888	936
	within one to two years	930	935
	within two to five years	2838	2 781
	more than five years	20 291	21 081
	Minimum lease charges	24 947	25 733
	Future finance charges	(5 949)	(6 441)
	Total lease liabilities	18 998	19 292
		10 //0	., .).

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		N	otes	1997	1996
				\$'000	\$'000
Note 7	Liabilities to employees				
	Accrued wages and salaries Provision for recreation leave Provision for long service leave			4 408 46 707 84 524	3 029 45 427 81 690
	Total liabilities to employees			135 639	130 146
Note 8	Liabilities to suppliers				
	Trade creditors Operating lease rentals			19 387 2 646	18 169 -
	Total liabilities to suppliers			22 033	18 169
Note 9	Other liabilities				
	Research revenue received in adva	ince		44 278	46 928
	R & D Syndicates		19	84 096	77 922
	Trust monies		11	12 836	7 674
	Other creditors			1 212	2 243
	Total other liabilities			142 422	134 767

Note 10 Equity - Movement summary 1996/97

A Description	ccumulated Surpluses \$'000	Asset Revaluation Reserve \$'000	Asset Realisation Reserve \$'000	Total Reserves \$'000	Total Equity \$'000
Balance at 1.7.96	618 065	245 682	6 725	252 407	870 472
Surplus/(deficit)	(4 632)	-		-	(4 632)
Transfers to/from reserves		(9 028)	9 028	_	
Balance at 30.6.97	613 433	236 654	15 753	252 407	865 840

Note 11	Cash			
	Cash at bank and on hand		30 114	2 670
	Cash at bank - trust monies	9	12 836	7 674
	Deposits - at call		1 391	65
	Managed funds - at call			2 098
	Total cash		44 341	12 507

		Notes	1997 \$'000	1996 \$'000
Note 12	Receivables			
	Goods and services Property sales Other		21 858 11 447 5 460	23 866
	Provision for doubtful debts		38 765 (327)	23 970 (486)
	Total receivables		38 438	23 484
	Receivables include receivables overdue by:			
	Less than 30 days Between 30 and 60 days Between 60 and 90 days Greater than 90 days Total receivables overdue		2 778 1 451 533 634 5 396	5 035 1 669 570 1 434 8 708
Note 12	Terresterents			
Note 15	Managed funds - Bank endorsed bills and government securities R & D Syndicate deposits - under contract	19	83 946	29 887 77 772
	Shares - at valuation	% CSIRO interest	83 940	10/ 059
	Associated companies Bio-Coal Briquette Pty Ltd Dunlena Pty Ltd Gene Shears Pty Ltd Gropep Pty Ltd Preston Group Ltd	47.0 34.7 35.1 8.3	- 5 501 101 784	88 5 501 101 784
	Provision for diminution in value		1 391 (1 391)	1 479 (1 479)
				-
	Shares - at cost Listed companies Unlisted companies Debentures and unsecured notes		1 018 8 3	1 655 7 3
			1 029	1 665
	Total investments		84 975	109 324

CSIRO has shares in a listed company, Queensland Metals Corporation NL. As at 30 June 1997 the market value was \$1 986 747 (1996 \$2 339 672).

C	S	1	R	0	A	n	n	u	a	1	F	2	е	p	0	r	t	1	9	9	6	1	9	9	7

		1997	1996
		\$'000	\$'000
Note 14	Land and buildings		
	Land		
	At cost	978	
	At June 1996 valuation	182 804	198 648
		183 782	198 648
	Buildings		
	At cost	32 854	-
	At June 1996 valuation	565 119	568 220
		597 973	568 220
	Accumulated depreciation	(23 095)	-
		57/ 878	568 220
	Capital works in progress - at cost	16 595	18 165
	out and a program a cost	504 (P2	50(005
		591 473	586 385
	Leasehold improvements		
	At cost	3 294	
	At June 1996 valuation	48 751	49 142
		52 045	49 142
	Accumulated amortisation	(2 085)	
		49 960	49 142
		1, ,00	1/ 112
	Buildings under finance lease		
	Buildings - at valuation	20 052	20 052
	Accumulated amortisation	(531)	- 12
		19 521	20 052
	Total land and buildings	844 736	854 227
	To the state of th	S.X / 50	c), ==,

Land includes ACT land totalling \$110 000 (1996 \$110 000). Negotiations are continuing between CSIRO and the ACT Government to formalise lease arrangements.

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	Total plant and equipment	158 242	167 509
		174	187
	Plant and equipment under finance lease - at cost Accumulated amortisation	233 (59)	252 (65)
		16 803	18 536
	Research vessels - at cost Accumulated depreciation Provision for refit	32 205 (14 652) (750)	32 080 (13 044) (500)
		141 265	148 786
	Plant and equipment - at cost Accumulated depreciation	396 016 (254 751)	390 809 (242 023)
Note 15	Plant and equipment		
		\$'000	\$'000
		1997	1996

(a) Analysis of property, plant and equipment

Movement summary 1996/97 for all assets irrespective of valuation basis.

Description	Land \$'000	Buildings \$'000	Total Land & Buildings \$'000	Plant and Equipment \$'000	Total \$'000
Gross value as at 1.7.96	198 648	655 579	854 227	423 141	1 277 368
Additions Disposals	4 551 (19 417)	34 188 (3 102)	38 739 (22 519)	37 082 (31 769)	75 821 (54 288)
Gross value at 30.6.97	183 782	686 665	870 447	428 454	1 298 901
Accumulated depreciation/ amortisation as at 1.7.96	-	- 23	1 - 1 - 1	255 632	255 632
Depreciation/amortisation Adjustment for disposals	-	25 838 (127)	25 838 (127)	37 556 (22 976)	63 394 (23 103)
Accumulated depreciation/ amortisation as at 30.6.97	_	25 711	25 711	270 212	295 923
Net book value as at 30.6.97	183 782	660 954	844 736	158 242	1 002 978
Net book value as at 1.7.96	198 648	655 579	854 227	167 509	1 021 736

C	S	1	R	0	Α	n	n	u	a	1	R	e	p	0	r	t	1	9	9	6	1	9	9	7

Note 15 Plant and equipment (cont'd)

(b) Total property, plant and equipment classified by title, specific uses and zoning

			Plant and	Total	Total
Description	Land	Buildings	Equipment	1997	1996
	\$'000	\$'000	\$'000	\$'000	\$'000
Freehold	162 314	346 030		508 344	490 503
Commonwealth Crown Leases	18 235	98 332	-	116 567	121 218
Leasehold	-	52 046		52 046	49 142
National Facilities	1 450	152 987	75 073	229 510	224 235
Deed of Grant		623		623	623
Finance Lease	1 783	20 052	233	22 068	22 086
Capital Work in Progress	-	16 595	-	16 595	18 165
	183 782	686 665	75 306	945 753	925 972
Plant and Equipment	-	-	353 148	353 148	351 396
	183 782	686 665	428 454	1 298 901	1 277 368
Accumulated depreciation/ amortisation	-	(25 711)	(270 212)	(295 923)	(255 632)
Total property, plant and equipment	183 782	660 954	158 242	1 002 978	1 021 736

Freehold	Held in Fee Simple - however, the majority of freehold properties are zoned "Public Purpose Commonwealth" which restrict sale potential.
Commonwealth Crown Leases	Represents ACT sites that are held on 99 year leases with a restricted purpose clause "Scientific Research Purposes".
Leasehold	Property covered by various lease arrangements with Universities, State Governments and other entities.
National Facilities	Represents AAHL, AT and the Oceanographic Research Vessel "Franklin" managed by CSIRO on behalf of the Commonwealth.
Deed of Grant	Covers property which reverts to the State Government when vacated by CSIRO.
Finance Leases	Represents land and buildings subject to finance lease arrangements with State Governments.
Capital Works in Progress	Relates to building works currently under construction.

The specialised nature of CSIRO's buildings and the zoning restrictions on land use, and the consequent low levels of demand for such properties, mean that the market values of the properties may be significantly lower than the "existing use value" to CSIRO.

For example, during the financial year two of CSIRO's properties (i.e. land and buildings) at Maribymong and Lower Plenty had a total "existing use" net book value of \$5 076 103 prior to identification for sale. The properties were sold in 1996/97 for \$2 906 000.

(c) National Facilities

The Australian Animal Health Laboratory (AAHL), the Australia Telescope (AT) and the Oceanographic Research Vessel "Franklin" have been established by the Commonwealth Government as National Facilities to satisfy an identified national research need. The term 'National Facility' denotes substantial instrumentation, equipment and costs of such magnitude that the expense can only be justified on the basis of shared use by researchers from several organisations. The primary criteria require that the Facilities are specifically designated for national use and that they are made available to scientists according to the merit of their proposals. These Facilities are controlled and administered by CSIRO on behalf of the Commonwealth Government.

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Note 15 (c) National Facilities (cont'd)

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Details of National Facilities included in the above totals of Land and Buildings and Plant and Equipment are as follows:

	AAHL \$'000	AT \$'000	"Franklin" \$'000	1997 \$'000	1996 \$'000
Land	1 450	-	-	1 450	1 450
Buildings Accumulated depreciation	152 987 (4 330)	Ξ	1.	152 987 (4 330)	151 292 _
	148 657	-		148 657	151 292
Plant and Equipment Accumulated depreciation Provision for refit	8 337 (6 098) –	51 291 (10 834) -	15 445 (8 928) (500)	75 073 (25 860) (500)	71 493 (23 477) (400)
	2 239	40 457	6 017	48 713	47 616
Net book value as at 30 June	152 346	40 457	6 017	198 820	200 358

The operating expenses for the above named National Facilities for the financial year amounted to \$29 401 661 (1996 \$35 716 119) and they have been included in CSIRO's Operating Statement.

Note 10	Other non-infancial assets																									
	Prepaid property rentals	1 262	970																							
	Other prepayments	809	1 946																							
	Property held for resale - at acquisition cost	1 011	1 288																							
	Research work in progress - at cost	11 118	11 811																							
	Total other non - financial assets	14 200	16 015																							
Note 17	Statement of Cash Flows - Cash Flow Reconciliation																									
	Net Cost of Services	(449 134)	(451 458)																							
	Revenues from Government	444 502	417 597																							
	Operating surplus/(deficit)	(4 632)	(33 861)																							
	Depreciation and amortisation of property, plant and equipment	63 144	61 608																							
	Increase/(decrease) in provision for refit	250	200																							
	(Profit)/Loss on disposal of property, plant and equipment	(1 772)	(2 397)																							
	(Profit)/Loss on disposal of shares	(673)	_																							
	(Increase)/decrease in receivables	(3 506)	1 072																							
	Increase/(decrease) in employee liabilities	5 493	(2 768)																							
	Increase/(decrease) in liability to suppliers	3 864	2 963																							
	(Increase)/decrease in other liabilities	7 655	(610)																							
	(Increase)/decrease in other non - financial assets	1 538	608																							
	Net cash provided/(used) by operating activities	71 361	26 815																							
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Note 18 Related entities (Note 1.3)

During the financial year CSIRO has provided in-kind contributions in the form of scientific staff and accommodation valued under the agreement at \$3 238 409 (1996 \$3 262 985) to Biomolecular Research Institute Limited (BRI) and \$2 158 426 (1996 \$2 135 266) to Ceramic Fuel Cells Limited (CFC). The contributions have been in accordance with formal agreements between CSIRO and the related entities and have been accounted for in CSIRO's Operating Statement.

BRI is principally a research and development company involved in the development of pharmaceutical and biological products and CFC's principal activity is the research and development of ceramic fuel cell technology.

Note 19 Research and Development Syndicates

CSIRO has entered into several agreements whereby the Research and Development Syndicates have provided funds in respect of Research and Development projects.

The funds provided by the Syndicates and held in interest bearing deposits are subject to these agreements and have been fully drawn upon in accordance with the terms of those agreements to meet CSIRO's research contract obligations. The balances of deposits are held as security to meet CSIRO's obligations to purchase the intellectual property held by each Syndicate, at the guaranteed option price, should the investors elect to sell.

Note 20 Resources provided to CSIRO free of charge and not included in the Statement of Assets and Liabilities

	Land \$'000	Buildings \$'000	Plant and equipment \$'000	Total 1997 \$'000	Total 1996 \$'000
At valuation or cost	7 927	950	42 008	50 885	89 539
Accumulated depreciation	-	(70)	(34 39/)	(34 407)	(33 847)
	7 927	880	7 611	16 418	55 692

CSIRO has free use of the above resources at little or no cost in accordance with contract research agreements with contributors. They are assets controlled and accounted for in the contributors' books and any proceeds from their disposal are refundable to the contributors. The above assets have either been purchased out of contract research monies and expensed in the year of purchase in accordance with the accounting policy Note 1.16 or provided to CSIRO at little or no cost whilst control of the assets remains with the contributors. The fair value of the in-kind contributions of these assets could not be reliably determined and therefore could not be brought to account in the Operating Statement.

Note 21 Monies held in trust

Monies held in trust which are not included in the Statement of Assets and Liabilities and are represented by cash at bank and the following investments in equities, bank bills and term deposits :

Investments		
Advance Bank	115	107
Commonwealth Bank of Australia	2 591	2 521
St George Bank	105	110
M F Cash Management Fund	939	1 027
	3 750	3 765
Cash at bank	23	103
	3 773	3 868

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		1997 \$'000	1996 \$'000
Note 21	Monies held in trust (cont'd)		
	(a) The components of trust funds are as follows:		
	William McIlrath Trust Fund	254	270
	David Rivett Memorial Lecture Fund	95	96
	FD McMaster Bequest	2 377	2 361
	Sir Ian McLennan Achievement for Industry Award	108	114
	The Ken and Yasuko Myer Plant Science Research Fund	939	1 027
		3 773	3 868

William McIIrath Trust Fund - Established to appoint and fund postgraduate students in Animal Husbandry at the McMaster Laboratory, Prospect.

David Rivett Memorial Lecture Fund – Established to bring eminent overseas scientists to present the David Rivett Memorial Lecture.

FD McMaster Bequest - Established to award fellowships for research in agriculture or veterinary science in CSIRO Divisions.

Sir Ian McLennan Achievement for Industry Award – Established to award outstanding contributions by CSIRO scientists to national development.

The Ken and Yasuko Myer Plant Science Research Fund – Established to fund plant science research.

(b) Movements of trust funds summary

Expenditure	(152)	(15)	(135)	(31)	(6)	(339)	(421)
Interest and dividends	64	7	151	15	5	242	291
Receipts during year	-	2	-	-	-	2	2
Balance at 1 July	1 027	114	2 361	270	96	3 868	3 996
/ \$	Myer \$'000	McLennan \$'000	McMaster \$'000	McIIrath \$'000	Rivett \$'000	1997 \$'000	1996 \$'000

1997 1996 \$ \$

tal

Total

Note 22 Remuneration of auditors

Remuneration to the Auditor-General for:

Auditing the financial statements for the reporting period260 000280 000Auditing the Cooperative Research Centres-3 000260 000283 000

Note 23 Cooperative Research Centres (CRCs)

The Cooperative Research Centres Program, launched in May 1990 by the Commonwealth, was established to assist two or more collaborators to carry out research contributing to the development of internationally competitive industry sectors. The Program supports long-term, high-quality research, improved links between research and application, and stimulation of education and training.

During the financial year, CSIRO's total 'in kind' and cash contributions valued in accordance with the agreements, is estimated at \$73 million. As the CRC agreements include a 12 month termination clause this amount approximates CSIRO's forward commitment for 1997/98.

At 30 June 1997 CSIRO is a participant in 52 CRCs and CSIRO's interest in each is listed as follows:

Names of Cooperative Research Centres

CSIRO's Equity Interest (%) (excluding Commonwealth contributions)

AGRICULTURE AND RURAL BASED MANUFACTURING	
Aquaculture	11
Cattle and Beef Industry (Meat Quality)	30
Food Industry Innovation	16
Hardwood Fibre and Paper Science	45
Legumes in Mediterranean Agriculture	18
Plant Science	64
Premium Quality Wool	42
Quality Wheat Products and Processes	24
Sustainable Cotton Production	28
Sustainable Sugar Production	19
Temperate Hardwood Forestry	48
Tropical Pest Management	34
Tropical Plant Pathology	27
Viticulture	21
Weed Management Systems	31
ENVIRONMENT	
ENVIRONMENT	16
Antarctic and Southern Ocean Environment	10
Biological Control of Venedrate Populations	00
Catchment Hydrology	29
Freshwater Ecology	15
Southeast Hernischers Meteorology	45
Southern Hemisphere Meleorology	4/
Sustainable Development of Tropical Savannas	11
Weste Management and Dellution Control	5/
Waste Management and Pollution Control	8 12
water Quality and Treatment	15
INFORMATION AND COMMUNICATION TECHNOLOGY	
Advanced Computational Systems	35
Australian Photonics	4
Distributed Systems Technology	3
Research Data Network	9
Robust and Adaptive Systems	20
MANUEACTURING TECHNOLOGY	
MANUFACTURING TECHNOLOGY	45
Alloy and Solidincation Technology	45
Industrial Plant Biopolymers	2/
Intelligent Manufacturing Systems and Technologies	15
International Food Manufacturing and Packaging Science	14
Materials welding and Joining	44
Molecular Engineering and Technology: Sensing and Diagnostic Technologies	43
Polymer blends	28
MEDICAL SCIENCE AND TECHNOLOGY	
Cardiac Technology	22
Cellular Growth Factors	19
Diagnostic Technologies	18

C S	R	0	A	n	n	ц	a	1	R	e	D	0	r	t	1	9	9	6	1	9	9	7

Note 23 Cooperative Research Centres (CRCs) (cont'd)

MEDICAL SCIENCE AND TECHNOLOGY (cont'd)	
Eye Research and Technology	21
Tissue Growth and Repair	35
Vaccine Technology	26
MUNING AND ENERGY	
MINING AND ENERGY	
A J Parker CRC for Hydrometallurgy	50
Australian Geodynamics	34
Australia Mineral Exploration Technologies	43
Australian Petroleum	61
Black Coal Utilisation	9
G K Williams CRC for Extractive Metallurgy	39
Landscape Evolution and Mineral Exploration	45
Mining Technology and Equipment	73
New Technologies for Power Generation from Low Rank Coal	10

CSIRO's equity interest is the proportion, which CSIRO contributes overall to each of the CRCs.

Note 24 Remuneration of Board Members

Remuneration and superannuation benefits received or due and receivable by full-time and part-time Board Members were:

	1997 \$	1996 \$
Board Members' remuneration Payments to superannuation funds for Board Members	440 588 49 131	641 224 64 313
	489 719	705 537

The number of Board Members whose total remuneration fell within the following bands were :

	\$				1997 Number	1996 Number
Nil	-	10 000			5	3
10 001	-	20 000			1	5
20 001	-	30 000			6	1
40 001	-	50 000			-	1
110 001	-	120 000			-	1
330 000	-	340 000			. 1	
430 001	-	440 000*			7.1	1

* Includes termination payment to the former Chief Executive.

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Note 25 Meetings of Board Members and Audit Committee

During the financial year, six Board Meetings and five Audit Committee Meetings were held. The number of meetings attended by each of the Board and Audit Committee member was as follows:

	Board Member	rs' Meetings	Audit Committee Meetings		
	No. eligible to attend	No. attended	No. eligible to attend	No. attended	
D C K Allen (Appointed 6.11.96)	4	4	2	1	
A E Clarke (Chairman, completed term 4.12.9	96) 3	3	3	2	
K W Davern	6	6	-	11111	
R Higgins (Appointed 7.4.97)	2	1		2000-02	
M K McIntosh	6	6	_		
M J O'Kane (Appointed 28.5.97)	1	1	-		
S M Richards	6	6	5	5	
A E de N Rogers (Appointed 28.5.97)	1	1	_		
D S Shears (Resigned 18.8.96)	-	-	-	-	
N C Stokes (Completed term 30.11.96)	2	2	3	3	
EGCTan	6	6			
G Taylor (Resigned 6.4.97)	4	3			
E J Woods	6	6	2	2	

The members of the Audit Committee are Dr S M Richards (Chairman), Dr E J Woods (appointed on 20 December 1996), Mr N C Stokes (completed term on 30 November 1996) and Ms E Alexander (independent adviser and non Board Member). Ms E Alexander attended all the Audit Committee Meetings.

The Chairman of the Board is an ex officio member of the Audit Committee and the Chief Executive is invited to attend all meetings of the Audit Committee.

Note 26 Remuneration of Officers

	1997	1996
	\$	\$
Remuneration received or due and receivable by Officers	1 207 338	2 015 560

The number of Officers included in these figures are shown below in the relevant income bands :

	\$				1997 Number	1996 Number
110 001	_	120 000				1
160 001	-	170 000				2
170 001	_	180 000				1
180 001	-	190 000			1	-
200 001	_	210 000			1	1
210 001	-	220 000			_	1
220 001	-	230 000				1
230 001	-	240 000			2	_
310 001	_	320 000*			-	1
330 001	-	340 000			1	-
430 001	-	440 000*			-	1

* Includes termination payment.

The Officers' remuneration includes the Chief Executive and the Deputy Chief Executives concerned with, or taking part in, the management of CSIRO during 1996-97.

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Note 27 Related party disclosures

Board Members - The Board Members of CSIRO during the financial year were:

D C K Allen (Chairman, appointed 5 December 1996) A E Clarke (Completed term, 4 December 1996) K W Davern R Higgins M K McIntosh M J O'Kane S M Richards

A E de N Rogers D S Shears (Resigned, 18 August 1996) N C Stokes (Completed term, 30 November 1996) E G C Tan G Taylor (Resigned, 6 April 1997) E J Woods

Remuneration - Information on remuneration of Board Members is disclosed in Note 24.

Board Members' interests in contracts

Since 1 July 1996 no Board Member of CSIRO has received or become entitled to receive a benefit, other than a benefit included in the aggregate amount of remuneration received or due and receivable shown in Note 24 by reason of a contract made by CSIRO with the Board Member or with a firm of which the Board Member is a member or with a company in which the Board Member has a substantial financial interest.

Other transactions of Board Members' - related entities

Professor A E Clarke, is a Director of Western Mining Corporation Limited, Australian Mutual Provident Fund Society, Woolworths Limited, Tridan Limited (Group) and Plant Cell Biology Research Centre and a Board Member of a Cooperative Research Centre. These companies and the CRC have a number of contractual relationships with CSIRO in the field of research and development. The contracts are based on normal commercial terms and conditions.

Mr R Higgins is the secretary of the Department of Industry, Science and Tourism (DIST). During the financial year a number of grants and consultancy contracts were entered into between DIST, on behalf of the Commonwealth of Australia, and CSIRO. The contracts are based on normal terms and conditions for such arrangements. Mr R Higgins is also a Board Member of Austrade, which had commercial arrangements with CSIRO during the financial year. These arrangements relate to overseas' joint ventures in Detroit and Santiago.

Dr M K McIntosh is also a Director of an associated company of CSIRO, Gene Shears Pty Ltd. It has a number of contractual relationships with CSIRO in the field of research and development. The contracts are based on normal commercial terms and conditions.

Professor M J O'Kane is the Vice Chancellor of the University of Adelaide. CSIRO has a number of buildings on the University campus which are occupied by a number of CSIRO Divisions to do research. There are some collaborative research and development work being conducted by the University and CSIRO. In addition, she is a Director of FH Faulding Limited and MFP Australia. These entities have a number of contractual relationships with CSIRO in the field of research and development and they are based on normal commercial terms and conditions.

Dr S M Richards is the Chairman of Aberfoyle Limited and the Chairman of the Australian Nuclear Science and Technology Organisation (ANSTO). Aberfoyle Limited through its subsidiary, Aberfoyle Resources Limited, contributes to several research projects for which CSIRO is the sole or joint contractor. ANSTO has a number of contractual relationships with CSIRO in the field of research and development. All contracts are based on normal commercial terms and conditions.

Mr A E de N Rogers is Chairman of Uniquest Limited, a Director of the Ports Corporation of Queensland and a member of the Senate of the University of Queensland. These entities have a number of contractual relationships with CSIRO in the field of research and development. The University of Queensland is also a participant in a number of Cooperative Research Centres in which CSIRO is a participant. All contracts are based on normal commercial terms and conditions.

Mr N C Stokes is a Director of Gene Shears Pty Ltd, an associated company of CSIRO. It has a substantial contractual relationship with CSIRO and the contracts are based on normal commercial terms and conditions.

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