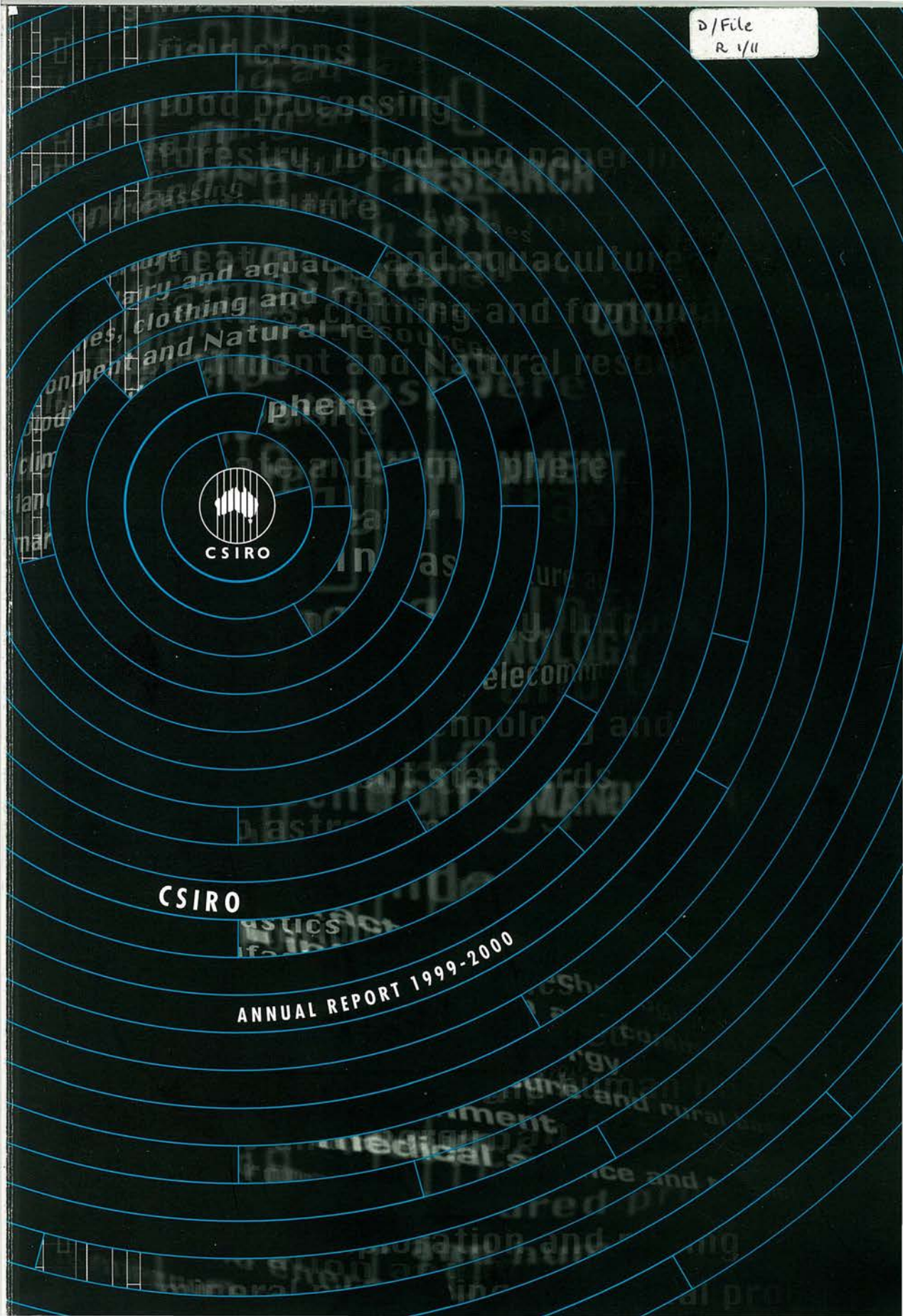


# CSIRO

## ANNUAL REPORT 1999-2000

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 over 6 000 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 and the *Commonwealth Authorities and Companies Act* 1997.

## CSIRO'S VISION

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


# ANNUAL REPORT 1999 - 2000

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Senator The Honourable Nick Minchin

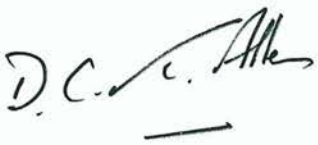
Minister for Industry, Science and Resources

Parliament House

CANBERRA ACT 2600

We have pleasure in submitting to you, for presentation to Parliament, the fifty-second Annual Report of the Commonwealth Scientific and Industrial Research Organisation. This report has been prepared in compliance with the requirements of the *Science and Industry Research Act* 1949 and the *Commonwealth Authorities and Companies Act* 1997.

We commend the Organisation's achievements to you.



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

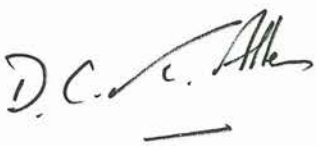
Colin M Adam
*(Acting Chief Executive)*

September 2000

# BOARD RESOLUTION

The 1999-00 CSIRO Annual Report has been prepared in accordance with the Finance Minister's Orders and approved for presentation to the Minister for Industry, Science and Resources.

Signed this 13th day of September 2000 in accordance with a resolution of the Board Members.



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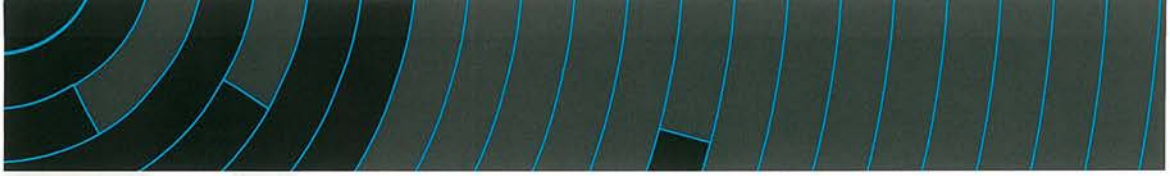


# FOREWORD

## VALE MALCOLM MCINTOSH

The Board noted with great sadness the passing of Chief Executive Dr Malcolm McIntosh, AC, on 7 February 2000 and recorded its sincere appreciation for Dr McIntosh's outstanding leadership of CSIRO over the last four years. It noted his contribution to Australian science and technology extended far beyond CSIRO and would have a profound and long-lasting effect right across Australia well into the 21st century.

Dr McIntosh took up his appointment as Chief Executive of CSIRO early in 1996 and presided over a major organisational restructure aimed at 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 new matrix structure retained Divisions as the business units of CSIRO but grouped the research portfolio into 22 Sectors, each representing an industry group, market or natural resource. Dr McIntosh's strong leadership ensured that the radical new structure was adopted with speed and very few problems.

Dr McIntosh believed strongly in the importance of Australia becoming a more scientifically aware society, and in scientists sharing their insights and discoveries with the community at all levels.

In his all too short time at CSIRO, Dr McIntosh won enormous respect and affection from staff at all levels, and from those with whom he worked. He has left us with a challenge to maintain and take forward his high standards.

A Board sub-committee has been established to identify a successor to Dr McIntosh and it is expected that interviews will take place in July.

## RESEARCH AND COMMERCIALISATION

### RESEARCH ACHIEVEMENTS

Customers are lining up to use our MIEX® process (jointly developed with industry) to remove natural organic matter from water. While natural organic matter is harmless in itself, it can make it difficult to treat the water to drinking standards. This increases the amounts of chemicals needed to treat the water and can create harmful by-products. The first MIEX® treatment plant will open in Western Australia in 2001.

Patented CSIRO technology is the basis for the new world standard for high-performance wireless local area networks. The technology has been licensed to an Australian start-up company which has received substantial funding from the USA and which will launch its first product in September 2000.

Our research for the mining industry has helped the discovery of a rich new gold deposit in Western Australia (with an estimated worth of over one billion dollars) and improved mine safety by developing a collision prevention warning system for use on large mine trucks.

In agribusiness, one of our major achievements was to issue, after ten years of research, a National Guideline of prescriptions and tools for growing environmentally sustainable tree plantations irrigated with municipal effluent. The emphasis is on protecting rivers, soil and groundwater from degradation while producing valuable forest products.

Another long-term project is also showing good returns. The positive impact of rabbit calicivirus disease continues to be seen in some of Australia's driest areas with remarkable regeneration of grasses and shrubs, and continued reduction in rabbit numbers.

In environmental research, a computer modelling technique developed to minimise the impact of agricultural pesticides on rivers, lakes and groundwater is attracting world interest. The Pesticide Impact Ranking Index model helps farmers and regulators to reduce the chances of a chemical pesticide ending up in the local water supply.

The CSIRO Board approved the sale of equity in two companies, The Preston Group and Poly U, and reinvested the proceeds of some $11 million into new CSIRO research. The incorporation of research outcomes into new company structures, with appropriate external capital, is expected to grow significantly in Australia.

## BOOST TO LIVESTOCK RESEARCH

A Review Group headed by Mr John Blood conducted a major review of CSIRO's livestock research infrastructure in early 2000. CSIRO has accepted the recommendations from the Report, with the result that we will strengthen significantly our research on behalf of Australia's $12 billion livestock sector through the formation of a new Division of Livestock Industries on 1 July 2000. It will comprise the current Divisions of Animal Health and Animal Production and relevant parts of the Division of Tropical Agriculture.

We will in addition make a major new commitment to biotechnology at the Institute of Molecular Bioscience in Brisbane and revitalise rural and regional laboratories at Armidale (New South Wales), Rockhampton (Queensland), and Geelong (Victoria). The Prospect site of the Division of Animal Production in New South Wales will be progressively closed over the next two years.

## RURAL SUSTAINABILITY

The excellent work done by Tropical Agriculture in sustainable agricultural systems research has been a model for the Organisation in considering the dynamics of production and environmental systems. This part of Tropical Agriculture will be merged with the Division of Wildlife and Ecology to form a new Division responsible for wildlife and ecological systems integration with agricultural production systems to provide a stronger research base for rural sustainability.

## GENE TECHNOLOGY

We have reviewed the directions and conduct of our gene technology research and revised our Gene Technology Position Statement issued in 1999. The revised Statement appears in Appendix 8 of this Report.

## GETTING CLOSER TO INDUSTRY

CSIRO is always looking for new ways to develop and promote new technologies in Australia. We are particularly proud of two recent innovative ways of collaborating with the automotive industry to boost Australia's technology and skill base and the automotive industry's international reputation. Both projects centre on the development of new energy efficient, low cost hybrid electric/petrol cars. Both were funded from the Chief Executive's Special Projects Fund.

The ECOmmodore is a unique full-sized concept vehicle that dramatically reduces fuel consumption and exhaust emissions.
*Photo: Holden Ltd*

aXcessaustralia, a second generation hybrid vehicle, displaying power controller units under the bonnet.
*Photo: Manufacturing, Science and Technology*

The ECOmmodore sedan, which Holden unveiled in May 2000, is the result of a joint development venture by Holden and CSIRO. The prototype is the first hybrid electric/petrol driven car in the world to feature the cost-effective combination of supercapacitors and lead acid batteries.

To help promote Australian technology to the world, the ECOmmodore provided VIP transport on the first Australian leg of the Olympic torch relay from Uluru.

The second hybrid car has been designed by a consortium of normally disparate, often overlooked parts of the automotive world – over 100 component makers, designers and CSIRO. The aXcessaustralia Low Emission Vehicle is a mechanism to show off Australian industry's innovative ability to the world.

The original aXcessaustralia car, unveiled in 1998, helped Australian component manufacturers achieve more than $730 million in new export business. The redesigned aXcessaustralia car (completed in June 2000) contains several advanced CSIRO developments that reduce fuel consumption by half and urban pollution emissions by 90 per cent.

### SECTOR ADVISORY COMMITTEES

During the year, the Chairs of our 22 Sector Advisory Committees made it clear they would like to become more involved in structured discussions of some of the broader issues facing CSIRO during the next decade. We welcome that engagement and we will foster that discourse.

A meeting of SAC Chairs held in April 2000 produced a number of suggestions on how CSIRO could improve its performance. They included increasing marketing effort and sharpening our commercial edge, explaining more clearly and widely to the community the value that CSIRO research provides for Australia, developing strong industry networks with special attention to small-and-medium-sized enterprises, becoming actively involved in issues of national importance such as salinity and focusing on communicating the excitement and value of science to young Australians.

### NATIONAL INNOVATION SUMMIT

CSIRO was actively involved in preparations for and in activities at the National Innovation Summit held in Melbourne in February 2000. CSIRO sponsored a special industry breakfast at the start of the event. We have a continuing role as a reference organisation for the work of the Implementation Group established to refine proposals and to develop action plans in response to recommendations from the Summit.

## MANAGEMENT

### PRIORITY SETTING

CSIRO's external earnings have again exceeded the Government's target of 30 per cent, coming in at 33.3 per cent for 1999-00. Almost half of this was sourced from the private sector (domestic and international) either directly or via the industry levy component of the Rural R&D Corporations.

External earnings are viewed by CSIRO as co-investment in R&D by our clients and partners, and hence, as a demonstration of their commitment to ensure the adoption and/or commercialisation of our research. Industry's record and stated intention towards co-investments is, therefore, one of the criteria that we apply in determining CSIRO's priorities. Public good requirements and strategic positioning considerations also

influence our decisions. The balance of our investments across sectors will, therefore, change in response to changing circumstances.

## ORGANISATIONAL PERFORMANCE MEASUREMENT

The CSIRO Executive and Board have endorsed a major CSIRO-wide project to enhance the quality and timeliness of information available for strategic and tactical management of the Organisation, including an initial benchmarking phase.

The framework that has been adopted for this task is Organisational Performance Measurement (OPM®). OPM is a commercially available product developed from research undertaken by CSIRO Mathematical and Information Sciences. It is being applied in nearly a dozen organisations and has been licensed to business schools and private consultants.

The objective is to identify performance measures that will be most useful to the Board, Executive, Chiefs, Sector Coordinators and General Managers in promoting, and implementing actions for, improved organisational performance and any future (re)positioning; and enable CSIRO to respond efficiently and effectively to external pressures for improved accountability and reporting – including demonstration of CSIRO's 'value' to Australia.

## OUTSOURCING OF INFORMATION TECHNOLOGY

In April 2000, the Federal Government's Office of Asset Sales and Information Technology Outsourcing (OASITO) began a project to look at IT outsourcing for the Group 9 Science Agencies. CSIRO is the lead agency in the group that also contains the Australian Nuclear Science and Technology Organisation (ANSTO), the Australian Institute of Marine Sciences (AIMS), the Bureau of Meteorology, Antarctic Division, and the Australian Geological Survey Organisation (AGSO).

The initial stage of the project is a scoping study that is being undertaken to determine the IT infrastructure that can be outsourced without compromising any of the agencies' abilities to fulfill their primary responsibilities. The draft scoping study report will be followed by a period of consultation with CSIRO management and staff and a preliminary assessment of the impact of the study recommendations. OASITO projects that the tender will be released to the market in the last quarter of the year.

We will establish an accountability project team to identify and monitor risks associated with the initiative.

## REVIEW OF CSIRO'S PROPERTY HOLDINGS

The recent Federal Government Review of CSIRO properties determined that we sell and lease back six properties. While proceeds from the sales will go directly to the Government, the sales will have no adverse financial impact on our research activities as CSIRO will receive funding for additional sale and rental costs. A sub-committee of the CSIRO Board will oversight the sale and leaseback arrangements and these will be structured to ensure that CSIRO retains appropriate management and organisational control so that the special needs and risks of research are covered.

As part of our overall estate management activities, we are continuing to build up relations with State Governments, ensuring support for the establishment of joint facilities. This is an integral part of our objective of maintaining top quality, contemporary research facilities.

## COMPUTER ISSUES ASSOCIATED WITH THE YEAR 2000

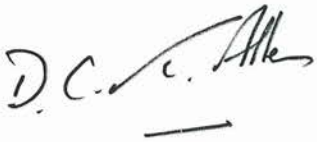
As a result of the very comprehensive planning processes introduced to address possible Year 2000 problems, CSIRO was Y2K ready with a full set of contingency plans. There were no significant Y2K incidents at CSIRO on 31 December 1999 or during January 2000. Some very minor problems were resolved within hours and business was not disrupted. Our total costs for the two year Y2K program were approximately $9.3 million.

## BOARD ACTIVITIES

Over the past couple of years, the Board has been putting in place a framework for its governance, due diligence and performance monitoring. A due diligence program has been implemented through the Board meeting agendas and from these, a Board self-assessment questionnaire and other inputs, the Board produced its first annual performance report in December 1999. This has been provided to the Minister.

The Board has established a Strategic Directions project to review important external factors that will impact on CSIRO during the next decade. This will form a basis for ongoing discussions with the Minister for Industry, Science and Resources as Australia moves into the knowledge economy with its increasing reliance on highly educated and motivated staff. Issues include our strategic relationships with Australian Universities with new State government funding initiatives, our changing R&D contractual relationship with international, as well as our traditional national companies, our engagement with providers of private capital, and a range of differing rewards and recognition for our staff.

There were no changes to the CSIRO Board this financial year, other than the replacement of Dr Malcolm McIntosh by Dr Colin Adam, Acting Chief Executive.



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

Colin M Adam
*(Acting Chief Executive)*

# ABOUT CSIRO

## ENABLING LEGISLATION

CSIRO is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act* 1949. The reporting, accountability and other rules for CSIRO's operation are set out in the *Commonwealth Authorities and Companies Act* 1997.

## FUNCTIONS

In summary, 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

In summary, 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 2.

## 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; and
- 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; and
- 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; and
- 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; and
- 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.

## RESPONSIBLE MINISTER

From 1 July 1999 to 30 June 2000, the Minister responsible for CSIRO was Senator the Honourable Nick Minchin, Minister for Industry, Science and Resources.

Under the *Science and Industry Research Act* 1949, 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 CSIRO 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 1999-00.

# CORPORATE GOVERNANCE

## ECONOMIC DEPENDENCY

CSIRO is economically dependent on the Commonwealth Government, requiring appropriation of money by Parliament to carry out the majority of its activities.

## ROLE OF THE CSIRO BOARD

The functions of the Board of CSIRO are contained in the *Science and Industry Research Act* 1949 ('*SIR Act*') and the *Commonwealth Authorities and Companies Act* 1997 ('*CAC Act*'). The *SIR Act* requires the Board to, amongst other duties:

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

The *CAC Act* requires the Board to comply with certain accountability and corporate governance principles, including:

- the maintenance of the Audit Committee;
- specific financial and reporting provisions;
- disclosure of Board Member's personal interests; and
- provision of indemnities and indemnity insurance in certain circumstances.

All the *CAC Act* requirements are currently being met.

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

The Board has a formal agenda for each meeting and receives regular papers from management on science, financial and business performance, and a range of specific issues relevant to the Organisation.

The Board has established a permanent Audit Committee and establishes other committees from time to time to assist in the execution of its duties and allow detailed consideration of complex issues.

The Audit Committee operates under written terms of reference (see page 18). All matters considered and determined by the Audit Committee are submitted to the Board for information and, where appropriate, ratification.

## BOARD MEMBERSHIP

Under the *SIR Act*, the CSIRO Board comprises the full-time Chief Executive, a part-time Chairman and up to eight other part-time members. All members, including the Chief Executive, are appointed by the Governor-General.

Each member brings complementary skills and experience to the Board. Details of the 1999-00 Board members, their qualifications and terms of appointment are shown at the end of this section. The Financial Statements contain details of remuneration of Board members and their attendance at Board and Audit Committee meetings.

## DISCLOSURE OF INTERESTS

Sections 10E and 10F of the *SIR Act* require written disclosure to the Minister of all direct or indirect pecuniary interests in any business or in any body corporate carrying on a business. Section 27F of the *CAC Act* provides for the disclosure of material personal interests in a matter that is being considered by the Board and prohibits participation, deliberation and decision making by any member on such matters, unless so resolved by the Board or entitled by the Minister: see s. 27J(3) *CAC Act*.

All of these requirements are currently being met.

## BOARD AND BOARD COMMITTEE MEMBERS' REMUNERATION

The Remuneration Tribunal determines part-time Board members' remuneration and allowances.

## AUDIT COMMITTEE

The Audit Committee, a formal sub-committee of the Board, meets at least four times a year. As at 30 June 2000, the Audit Committee comprised Mr D P Mercer (Chairman), Mr D C K Allen, Mr A E de N Rogers and Ms E Alexander (external advisor).

The Chief Executive and the Deputy Chief Executive responsible for Finance, together with the General Manager of CSIRO's Risk Assessment and Audit Unit, 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 corporate governance (particularly section 32 of the *CAC Act* 1997), 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.

## OTHER COMMITTEES

There is a Board Remuneration Sub-Committee, which meets from time to time. Other sub-committees are established to address specific issues but are not permanent committees.

## 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 Organisational high and significant risks and management's risk mitigation strategies through regular reports from the Risk Assessment and Audit Unit.

A risk management policy, and associated guidelines, was issued in July 1997.

It is the responsibility of the operational management of CSIRO to develop and implement risk mitigation strategies. In appropriate circumstances, insurance is used as a method to transfer the financial impact of risk.

## 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. A follow up review of fraud risk assessments conducted since April 1996 was undertaken during 2000. Also, a detailed Fraud Control Plan has been developed in line with the guidelines set out by the Commonwealth Law Enforcement Board. Consistent with the Fraud Control Plan, 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.

## INTERNAL CONTROL

The Board is responsible for ensuring an appropriate internal control framework is in place and operating. Through the Audit Committee it reviews management's policies, procedures framework and internal compliance.

## EXTERNAL AUDIT

Under the *CAC Act* the Auditor General is the external auditor for CSIRO. The Audit Committee reviews the Australian National Audit Office audit plan and meets with the external auditor prior to recommending to the Board that the financial statements be signed.

## INTERNAL AUDIT

The Risk Assessment and Audit Unit provides an independent review function in accordance with a formal charter endorsed by the Audit Committee.

The Audit Committee reviews the annual Risk Assessment and Internal Audit plan and receives regular reports on progress against that plan.

## YEAR 2000 COMPLIANCE

There were no significant Y2K incidents at CSIRO on 31 December 1999 or during January 2000. Minor problems were resolved within hours and business was not disrupted. Our costs for the two year Y2K program totaled approximately $9.3 million.

## THE CSIRO BOARD (1999-00)

CHAIRMAN

**Mr Charles Allen**
AO MA MSc FTSE
Company Director
5 December 1996
— 5 November 2001

**Mr Don Mercer**
BSc(Hons) MA(Econ)
Company Director
4 March 1998
— 3 March 2003

MEMBERS CURRENT AT 30 JUNE 2000:

**Dr Colin Adam**
BEc(Hons) PhD FIEAust FTSE
Chief Executive (Acting)
10 February 2000 —

**Professor Mary O'Kane**
BSc PhD
Vice-Chancellor
University of Adelaide
28 May 1997
— 31 December 2000

**Mr John Gandel**
AO
Chairman, Gandel Group Pty Ltd
23 February 1999
— 22 February 2004

**Mr Norbury Rogers**
BCom FCA
Senior Consultant
Ernst & Young
28 May 1997
— 31 December 2000

**Mr Russell Higgins**
BEc(Hons)
Secretary, Department of Industry, Science and Resources
7 April 1997 — 30 June 2000

**Professor Vicki Sara**
BA(Hons) PhD DOC
Chair, Australian Research Council
15 July 1998 — 14 July 2003

**Mr Don McDonald**
Grazier
15 July 1998 — 14 July 2003

TERMS COMPLETED DURING YEAR:

**Dr Malcolm McIntosh**
AC Kt BSc PhD FTSE FRAeS
FIEAust CPEng
Chief Executive of CSIRO
3 January 1996
— 7 February 2000

# CSIRO SERVICE CHARTER

## WHO WE ARE

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a statutory agency of the Government of Australia.

## WHAT WE DO

CSIRO serves 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 Australia's national and international objectives;

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

## OUR CUSTOMERS

Our customers include:

- business, including business associations and individual businesses;
- the Commonwealth and State governments and their agencies;
- the Australian public.

## CUSTOMER SERVICES

For organisations and individuals seeking scientific research expertise, we will:

- assist in clarifying the scientific expertise required to address the customer's needs;
- where CSIRO has the available expertise, develop a proposal for CSIRO to provide a service to the customer;
- negotiate a contract with the customer;
- conduct research or other scientific services as specified in the contract with the customer in a professional manner.

For governments and their agencies, we will provide:

- strategic and applied research in support of national and regional economic, social and environmental objectives;
- submissions to inquiries and working parties where scientific and technical advice is required;

- delivery of scientific and technological inputs to foreign trade missions and overseas aid projects.

For people, companies and other organisations seeking information we will:

- provide up-to-date, accurate information about CSIRO and its activity;
- provide information and expert opinion on national and international developments in areas of science in which CSIRO has expertise;
- where the enquiry is outside CSIRO's expertise, direct the enquirer to organisations which may be able to provide the information.

## OUR SERVICE STANDARDS

Our performance can be measured against the following standards:

- in all activities the potential benefit to the Australian community will be identifiable;
- all scientific and commercial activity will be conducted with due professional care and skill;
- the Organisation will seek, through advisory committees, representing the sectors of the economy, and other means, the input of senior industry and government officials in deciding its research priorities;
- the Organisation will seek and respond to feedback from the client for each major research project undertaken;
- the Organisation will utilise its scientific capability as effectively as possible when addressing the needs of its customers;
- advice given will be independent and based on appropriate expertise;
- CSIRO will listen to the community and recognise its concerns, and help to inform Australians about developments in science and its applications.

## STAFF CONDUCT

The Staff Code of Conduct is based on four main principles:

- staff are expected to perform their duties with professionalism and integrity, and work efficiently to enable CSIRO to meet its research and corporate goals;
- fairness, honesty, equity and all legal requirements are to be observed by all CSIRO staff in the conduct of official duties and during interactions with clients and members of the public;
- real or apparent conflicts of interest are to be avoided on all occasions;
- intellectual property including confidential information will be properly protected during employment with CSIRO and afterwards, and appropriate business and commercial protocols will be strictly observed by staff.

## CHECKING OUR PERFORMANCE

We will:

- evaluate our services against the standards we have set in this Charter, to see if we are meeting those standards;
- informally review the standards set out in this Charter during the year in response to ongoing changes; and
- formally review the standards set out in this Charter at least once a year and adjust them in light of comments received, and include in the Annual Report, which is tabled in Parliament, the outcomes of the formal review and the adjustments made to the Charter as a result.

The Charter will be independently reviewed at least every three years. CSIRO invites comments from customers, stakeholders and staff as part of its monitoring and review procedures.

## STRUCTURE, MANAGEMENT AND STAFF

The *Science and Industry Research Legislation 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 industries; environment and natural resources; manufacturing, information and service industries; and minerals and energy industries. 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 matrix structure are in the Organisation Charts following. (Chart 1: Corporate responsibilities; Chart 2: Sector responsibilities; Chart 3: Operational arrangements).

The locations of CSIRO's main sites are shown on the map that follows these charts.

CSIRO staff are employed under Section 32 of the *SIR Act* 1949. Senior managers are listed following the charts and map.

At 30 June 2000 CSIRO had a total staff of 6 409, which has an equivalent full-time value of 6 085.25 units. The numbers employed in different job categories are shown below.

### STAFF BY GENDER AND PRINCIPAL FUNCTIONAL AREA

| | FEMALE | MALE | TOTAL |
|---|---|---|---|
| Administrative Support | 669 | 232 | 901 |
| Communication & Information | 218 | 116 | 334 |
| Corporate Management | 7 | 61 | 68 |
| General Services | 72 | 61 | 133 |
| Research Management | 12 | 202 | 214 |
| Research Projects | 920 | 1 534 | 2 454 |
| Research Scientist | 219 | 1 346 | 1 565 |
| Senior Specialist | 2 | 28 | 30 |
| Technical Services | 107 | 603 | 710 |
| **TOTAL** | **2 226** | **4 183** | **6 409** |

## CHART 1 CORPORATE RESPONSIBILITIES AS AT 30/6/00

**THE BOARD**

**Mr Charles Allen, AO (Chairman)**

Dr Colin Adam • Mr John Gandel, AO • Mr Russell Higgins • Mr Don McDonald • Mr Don Mercer • Professor Mary O'Kane • Mr Norbury Rogers • Professor Vicki Sara

**General Counsel**
Mr Terry Healy

**CHIEF EXECUTIVE**
Dr Colin Adam (Acting)

**Corporate Executive Office**
Corporate Secretary Dr Ted Cain

**Risk Assessment & Audit**
General Manager Mr Peter O'Callaghan

**DEPUTY CHIEF EXECUTIVES**

**Dr Bruce Hobbs**
Deputy Chief Executive
Chair: Minerals & Energy Industries Alliance

**Dr Ron Sandland**
Deputy Chief Executive
Chair: Manufacturing, Information & Service Industries Alliance

**Dr Chris Mallett**
Deputy Chief Executive
Chair: Agribusiness Industries Alliance

**Dr Paul Wellings**
Deputy Chief Executive
Chair: Environment & Natural Resources Alliance

### CSIRO DIVISIONS AND CORPORATE SUPPORT UNITS

**DIVISIONS**
- Building, Construction & Engineering
- Energy Technology
- Exploration & Mining
- Minerals
- Petroleum Resources

**DIVISIONS**
- Australia Telescope National Facility
- Health Sciences & Nutrition
- Manufacturing Science & Technology
- Mathematical & Information Sciences
- Molecular Science
- Telecommunications & Industrial Physics

**DIVISIONS**
- Animal Health
- Animal Production
- Food Science Australia*
- Plant Industry
- Textile & Fibre Technology
- Tropical Agriculture

**DIVISIONS**
- Atmospheric Research
- Entomology
- Forestry & Forest Products
- Land & Water
- Marine Research
- Wildlife & Ecology

Commercial Group
CSIRO Publishing

Information Technology Services
Corporate Property

Corporate Human Resources
Leadership, Career & Team Development

Corporate Finance
Strategic Planning & Evaluation

*a joint venture with Afisc

## CHART 2: SECTOR RESPONSIBILITIES AS AT 30 JUNE 2000

| | Sector Coordinator |
|---|---|
| **AGRIBUSINESS INDUSTRIES (CHAIR: DR CHRIS MALLETT)** | |
| Field Crops | Dr Jim Peacock<br>Plant Industry |
| Food Processing | Mr John Buhot<br>Food Science Australia |
| Forestry, Wood and Paper Industries | Dr Glen Kile<br>Forestry and Forest Products |
| Horticulture | Dr Nigel Scott<br>Plant Industry |
| Meat, Dairy and Aquaculture | Mr Shaun Coffey<br>Tropical Agriculture |
| Textiles, Clothing and Footwear | Dr Peter Gordon<br>Textile and Fibre Technology |
| **ENVIRONMENT AND NATURAL RESOURCES (CHAIR: DR PAUL WELLINGS)** | |
| Biodiversity | Dr Brian Walker<br>Wildlife and Ecology |
| Climate and Atmosphere | Dr Graeme Pearman<br>Atmospheric Research |
| Land and Water | Dr Graham Harris<br>Land and Water |
| Marine | Dr Nancy Bray<br>Marine Research |

## MANUFACTURING, INFORMATION AND SERVICE INDUSTRIES (CHAIR: DR RON SANDLAND)

| | |
|---|---|
| Information Technology and Telecommunications | Dr Rhys Francis<br>Mathematical and Information Sciences |
| Built Environment | Mr Larry Little<br>Building, Construction and Engineering |
| Measurement Standards | Dr Barry Inglis<br>Telecommunications and Industrial Physics |
| Radio Astronomy | Professor Ron Ekers<br>Australia Telescope National Facility |
| Services | Dr Murray Cameron<br>Mathematical and Information Sciences |
| Chemicals and Plastics | Dr Greg Simpson<br>Molecular Science |
| Integrated Manufactured Products | Dr Ian Sare<br>Manufacturing Science and Technology |
| Pharmaceuticals and Human Health | Professor Richard Head<br>Health Sciences and Nutrition |

## MINERALS AND ENERGY INDUSTRIES (CHAIR: DR BRUCE HOBBS)

| | |
|---|---|
| Energy | Dr John Wright<br>Energy Technology |
| Mineral Exploration and Mining | Dr David Dekker<br>Exploration and Mining<br>(NB: deceased 16 July 2000) |
| Mineral Processing and Metal Production | Dr Rod Hill<br>Minerals |
| Petroleum | Dr Adrian Williams<br>Petroleum Resources |

## CHART 3 CSIRO OPERATIONS AND REPORTING

Acting Chief Executive - Dr Colin Adam

ALLIANCES and SECTORS

| Deputy Chief Executives / DIVISIONS | Agribusiness Industries | | | | | | Environment & Natural Resources | | | | Manufacturing, Information & Service Industries | | | | | | | | Minerals & Energy Industries | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Crops | Food Processing | Forestry, Wood & Paper Industries | Horticulture | Meat, Dairy & Aquaculture | Textiles, Clothing & Footwear | Biodiversity | Climate & Atmosphere | Land & Water | Marine | IT & Telecommunications | Built Environment | Measurement Standards | Radio Astronomy | Services | Chemicals & Plastics | Integrated Manufactured Products | Pharmaceuticals & Human Health | Energy | Mineral Exploration & Mining | Mineral Processing & Metal Production | Petroleum |
| **DR CHRIS MALLET** | | | | | | | | | | | | | | | | | | | | | | |
| Animal Health | | ● | | | ● | ● | | | | | | | | | | | | | | | | |
| Animal Production | | | | | ● | ● | | ● | | | | | | | | | | | | | | |
| Food Science Australia | ● | ● | | ● | ● | | | | | | | | | | | ● | | | | | | |
| Plant Industry | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | | | | | | | | | |
| Textile & Fibre Technology | | | | | | ● | | | | | | | | | | | | | | | | |
| Tropical Agriculture | ● | | | | ● | | ● | ● | ● | ● | | | | | | | | | | | | |
| **DR PAUL WELLINGS** | | | | | | | | | | | | | | | | | | | | | | |
| Atmospheric Research | | | | | | | | ● | | | | | | | | | | | | | | |
| Entomology | ● | | ● | ● | ● | ● | ● | ● | | | | ● | | | | ● | | ● | | | | |
| Forestry & Forest Products | | | ● | | | | ● | ● | ● | | | ● | | | | | | | ● | | | |
| Land & Water | ● | | | ● | ● | | ● | ● | ● | | | ● | | | | | | | ● | ● | ● | |
| Marine Research | | | | | ● | | ● | ● | | ● | | | | | | | | ● | | | | |
| Wildlife & Ecology | ● | | ● | | ● | ● | ● | ● | ● | | | | | | | | | | | | | |
| **DR RON SANDLAND** | | | | | | | | | | | | | | | | | | | | | | |
| Australia Telescope National Facility | | | | | | | | | | | | | | ● | | | | | | | | |
| Health Sciences & Nutrition | ● | ● | | | ● | | | | | | | | | | | | | ● | | | | |
| Manufacturing Science & Technology | | | | | | | | | | | | ● | | | ● | ● | ● | | ● | ● | ● | |
| Mathematical & Information Sciences | | ● | ● | | ● | | ● | ● | ● | ● | ● | ● | | | ● | | ● | | | ● | ● | ● |
| Molecular Science | | | | | | | | | | | | ● | | | | ● | | ● | | | ● | ● |
| Telecommunications & Industrial Physics | | | | | | | | ● | | | ● | ● | ● | | ● | | ● | | ● | ● | ● | |
| **DR BRUCE HOBBS** | | | | | | | | | | | | | | | | | | | | | | |
| Building, Construction & Engineering | | | | | | | | ● | | | | ● | | | | ● | ● | | | | ● | ● |
| Energy Technology | | | | | | | | ● | ● | ● | | | | | | | | | ● | | ● | |
| Exploration & Mining | | | | | | | | | | | | | | | | | | | ● | ● | | ● |
| Minerals | | | | | | | | | | | | | | | | | | | ● | | ● | |
| Petroleum Resources | | | | | | | | | | | | | | | | | | | ● | | | ● |

As at 30 June 2000

# CSIRO LOCATIONS

## SENIOR STAFF AND ADDRESSES (AS AT 30 JUNE 2000)

### CSIRO HEAD OFFICE - CANBERRA

PO Box 225, DICKSON, ACT 2602
Tel: (02) 6276 6766

### CHIEF EXECUTIVE

Dr Colin Adam (Acting)

### DEPUTY CHIEF EXECUTIVES

Dr Bruce Hobbs
Dr Chris Mallett
Dr Ron Sandland
Dr Paul Wellings

## CORPORATE EXECUTIVE OFFICE

### CORPORATE SECRETARY

Dr Ted Cain

### GOVERNMENT BUSINESS AND INTERNATIONAL SCIENTIFIC LIAISON

Principal Secretary
Dr Beth Heyde

### MANAGER EDUCATION

Mr Ross Kingsland

### MANAGER MINISTERIAL AND PARLIAMENTARY LIAISON

Ms Marie Keir

### DIRECTOR NATIONAL AWARENESS

Mr Julian Cribb

## CORPORATE GENERAL MANAGERS

### GENERAL COUNSEL

Mr Terry Healy

### 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, AM
Private Bag 1
ASPENDALE VIC 3195
Tel: (03) 9239 4400 Fax: (03) 9239 4444

### THE AUSTRALIA TELESCOPE NATIONAL FACILITY

Director: Professor Ron Ekers
PO Box 76
EPPING NSW 1710
Tel: (02) 9372 4100 Fax: (02) 9372 4310

### BUILDING, CONSTRUCTION AND ENGINEERING

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

### ENERGY TECHNOLOGY

Chief: Dr John Wright
PO Box 136
NORTH RYDE NSW 1670
Tel: (02) 9490 8666 Fax: (02) 9490 8909

### ENTOMOLOGY

Chief: Dr Jim Cullen
GPO Box 1700
CANBERRA ACT 2601
Tel: (02) 6246 4001 Fax: (02) 6246 4000

### EXPLORATION AND MINING

Acting Chief: Dr John Read
Private Bag No 5
WEMBLEY WA 6913
Tel: (08) 9333 6200 Fax: (08) 9387 8642

### FOOD SCIENCE AUSTRALIA*

Chief Executive: Dr Michael Eyles
PO Box 52
NORTH RYDE NSW 1670
Tel: (02) 9490 8333 Fax: (02) 9490 8499

* Joint venture between Afisc and CSIRO Food Science & Technology

### FORESTRY AND FOREST PRODUCTS

Chief: Dr Glen Kile
PO Box E4008
KINGSTON ACT 2604
Tel: (02) 6281 8211 Fax: (02) 6281 8312

### HEALTH SCIENCES AND NUTRITION

Chief: Professor Richard Head
PO Box 10041
ADELAIDE BC SA 5000
Tel: (08) 8303 8800 Fax: (08) 8303 8899

### LAND AND WATER

Chief: Dr Graham Harris
GPO Box 1666
CANBERRA ACT 2601
Tel: (02) 6246 5700 Fax: (02) 6246 5800

### MANUFACTURING SCIENCE AND TECHNOLOGY

Chief: Dr Ian Sare
Private Bag 33
CLAYTON SOUTH MDC VIC 3169
Tel: (03) 9545 2777 Fax: (03) 9544 1128

### MARINE RESEARCH

Chief: Dr Nancy Bray
GPO Box 1538
HOBART TAS 7001
Tel: (03) 6232 5222 Fax: (03) 6232 5000

### MATHEMATICAL AND INFORMATION SCIENCES

Chief: Dr Murray Cameron
Locked Bag 17
NORTH RYDE NSW 1670
Tel: (02) 9325 3100 Fax: (02) 9325 3200

### MINERALS

Chief: Dr Rod Hill
Box 312
CLAYTON SOUTH VIC 3169
Tel: (03) 9545 8500 Fax: (03) 9562 8919

### MOLECULAR SCIENCE

Chief: Dr Annabelle Duncan
Private Bag 10
CLAYTON SOUTH VIC 3169
Tel: (03) 9545 2222 Fax: (03) 9545 2446

PETROLEUM RESOURCES
Chief: Dr Adrian Williams
PO Box 3000
GLEN WAVERLEY VIC 3150
Tel: (03) 9259 6800 Fax: (03) 9259 6900

PLANT INDUSTRY
Chief: Dr Jim Peacock, AC
GPO Box 1600
CANBERRA ACT 2601
Tel: (02) 6246 4911 Fax: (02) 6246 5000

TELECOMMUNICATIONS AND INDUSTRIAL PHYSICS
Acting Chief: Dr Gerry Haddad
PO Box 76
EPPING NSW 1710
Tel: (02) 9372 4222 Fax: (02) 9372 4400

TEXTILE AND FIBRE TECHNOLOGY
Chief: Dr Brett Bateup
PO Box 21
BELMONT VIC 3216
Tel: (03) 5246 4000 Fax: (03) 5246 4057

TROPICAL AGRICULTURE
Chief: Dr Elizabeth Heij
120 Meiers Road
Indooroopilly QLD 4068
Tel: (07) 3214 2200 Fax: (07) 3214 2288

WILDLIFE AND ECOLOGY
Chief: Dr Steven Morton
GPO Box 284
CANBERRA ACT 2601
Tel: (02) 6242 1600 Fax: (02) 6242 1555

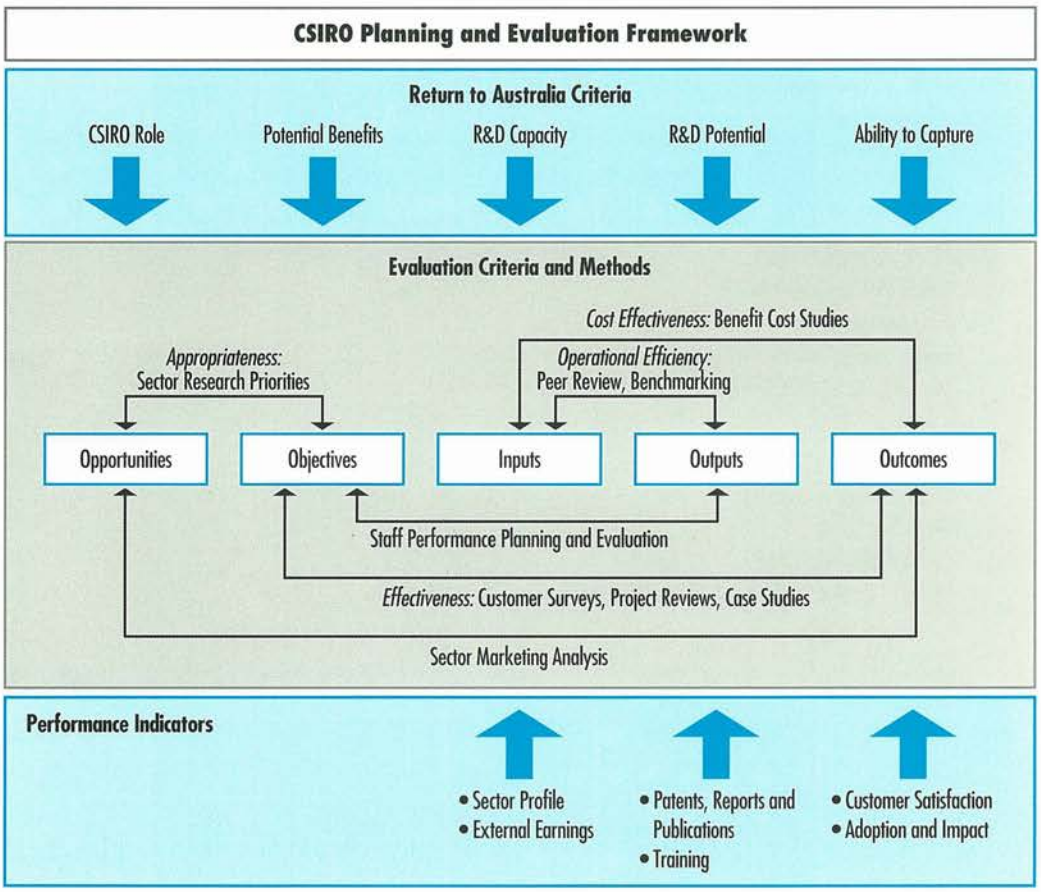
# CSIRO PERFORMANCE

## INTRODUCTION

CSIRO's overall performance has been good in what has been a difficult year. The decline in business investment in R&D over the past few years back to the early 1990 levels of 0.67 per cent of GDP, has made collaboration with Australian industry more difficult particularly in the mining related sectors. Continuing cost pressures on CSIRO for infrastructure and wages have resulted in a reduction of staff numbers by about 1 000 since 1990, placing further pressure on the ability to achieve the planned outputs. Like other agencies, Y2K and GST implementations, together with due diligence investigations related to the required outsourcing of administrative IT and property sale and leaseback, have absorbed much of senior management attention and the latter two will continue to do so in the coming year.

The formal performance indicators negotiated with government are part of CSIRO's overall planning and evaluation framework as shown in Figure 1.

**Figure 1**



The framework has evolved from CSIRO's priority setting methodology developed in 1990 and now incorporates the Government's Outcomes and Outputs accrual-based budgeting philosophy within the overall Opportunities-Objectives-Inputs-Outputs-Outcomes context.

THE PERFORMANCE INDICATORS ARE:

| | |
|---|---|
| **Input Indicators** | Sector Profile<br>External Earnings |
| **Output Indicators** | Publications, Reports and Patents<br>Trained Students |
| **Outcome Indicators** | Customer Satisfaction<br>Adoption and Impact of Research and Advice |

CSIRO is a part of the national innovation system for Australia and responsible for some 10 per cent of the nation's R&D effort. CSIRO's success in achieving benefits for Australia is dependent on business and community partnerships with CSIRO for the commercialisation of technology and uptake of research results and scientific advice. It is also dependent on a healthy and vigorous scientific base and continuing supply of high quality graduates from the university sector. See Box.

CSIRO'S ROLE IN THE NATIONAL INNOVATION SYSTEM

*CSIRO's linkages within the national innovation system are developed through:*

- conducting mission-oriented, strategic research with commercial and public good benefits, mostly in collaboration with industry, universities and other public sector R&D providers;
- commercialising CSIRO developed technology, products and processes, including financial and legal aspects such as protection of intellectual property;
- assisting industry access Australian and overseas technology and fostering local and international scientific cooperation. Providing access to world class research facilities and specialist advice and technical services;
- building business networks with customers and the encouragement of continuing relationships;
- providing a nexus between policy makers, funders and other providers of research and contributing to public policy development;
- liaising with Commonwealth, State/Territory and Local Governments, industry, universities and other research users to identify research priorities and to coordinate the development of Australia's research infrastructure;
- managing national research facilities – the Australia Telescope, Australian Animal Health Laboratory, Oceanographic Research Vessel *Franklin* and the National Measurement Laboratory;
- conducting education, research training and science and technology awareness programs; and
- promoting Australia's R&D capacities and the achievements of Australia's innovative companies.

## INPUT INDICATORS

### SECTOR PROFILE

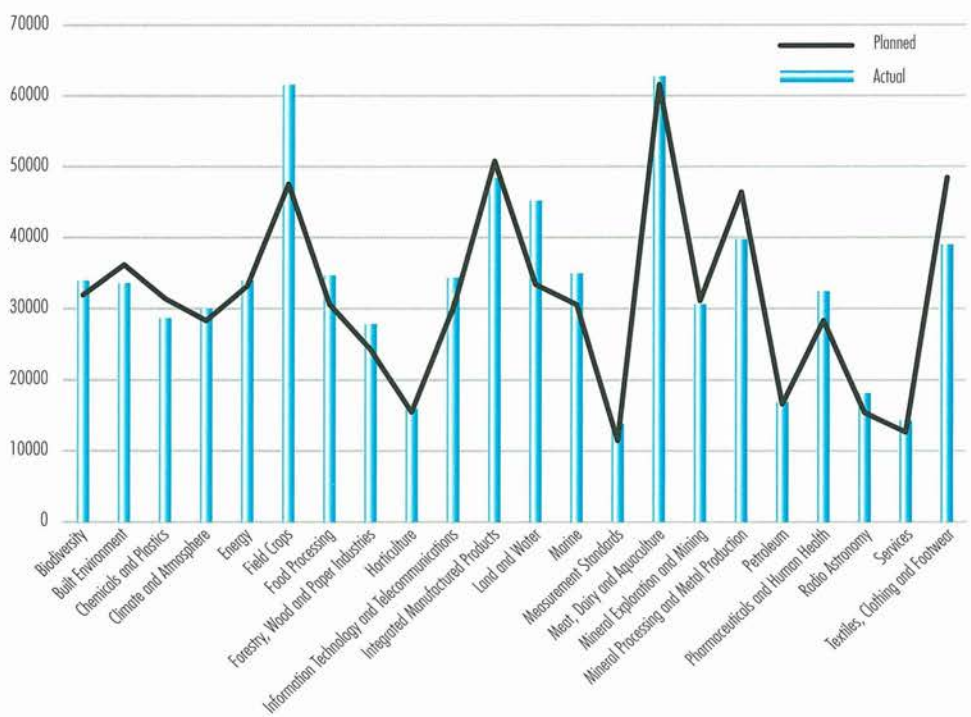
*This indicator measures CSIRO's shift of resources in line with changing priorities as determined in consultation with Government, Sector Advisory Committees and CSIRO customers in the public and private sectors.*

CSIRO's research planning and priority setting is based on an assessment of the attractiveness and feasibility of research opportunities in 22 customer-focused Sectors. External Sector Advisory Committees (SACs) play a key role in advising CSIRO on priorities within Sectors.

Figure 2 shows the Sectoral distribution of total expenditure by CSIRO Divisions in 1999-00. Total expenditure includes expenditure from both appropriation and external income.

For comparison, the Figure also shows the planned level of investment in each Sector. The 'planned' investments incorporate approved changes to the levels that were determined prior to commencement of the current triennium and published in the *CSIRO Strategic Research Plan 1997-98 to 1999-00* (SRP). It should also be noted that the chart reflects an estimate of CSIRO's operational activities in Food Science Australia (a joint venture with Afisc) which differ from the legal interest.

**Figure 2: CSIRO Expenditure by Sector, 1999-2000: Actual versus Planned, $'000**
(Planned data include approved shifts from the original Strategic Research Plan)



While the broad pattern of expenditure between Sectors is consistent with strategic investment decisions and expected external earnings, actual expenditure varies from SRP estimates in individual Sectors for a number of reasons.

Economic and other circumstances have a significant impact on the capacity of firms and agencies to either undertake or commission research. The fall in Business Expenditure on R&D (BERD) reported by the Australian Bureau of Statistics is particularly reflected in the results shown here for the Mineral Processing and Metal Production Sector, the Built Environment, Chemicals and Plastics, and Integrated Manufactured Products Sectors. The result for the Textiles, Clothing and Footwear Sector reflects ongoing adjustment in the wool industry and the restructuring of The Woolmark Company (the dominant channel of external R&D funds in the Sector).

The increased expenditure for the Field Crops Sector reflects both the healthy financial position of the Grains Research and Development Corporation, and the rapid growth of interest in biotechnology-related research amongst companies with a range of interests in the life sciences. Increased recognition of the scale and urgency of Australia's problem with salinity and related regional environmental management issues, has led to a significant boost in expenditure for the Land and Water Sector.

Actual expenditure also reflects cash management decisions taken by Divisions throughout the year – decisions that were not explicitly factored into SRP estimates of planned investment.

Most importantly, there has been a rapid maturing of the relationship between CSIRO and SACs in the period since preparation of the SRP, leading to some revisions to the initial plans – including redirection of effort both between and within Sectors.

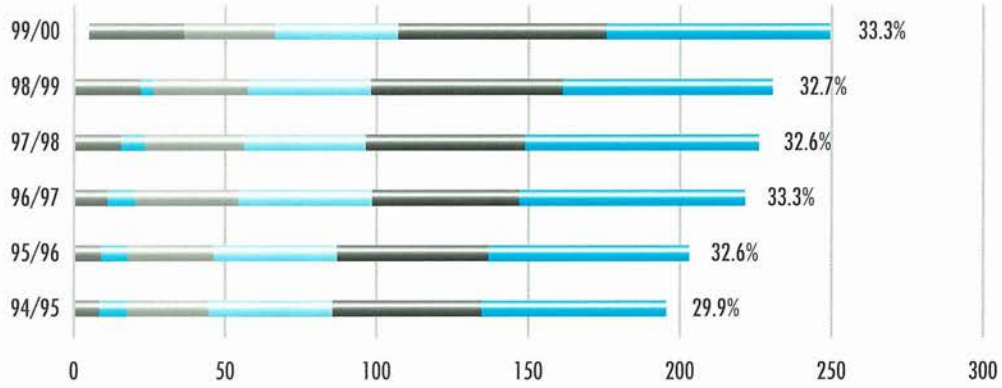
## EXTERNAL EARNINGS

*This indicator reflects the demand for CSIRO's research and services consistent with its mission.*

CSIRO has again exceeded its 30 per cent external earnings target by almost 10 per cent coming in at $249.5 million or 33.3 per cent of total income in 1999-00. This compares to a result of 32.7 per cent last year.

The sources and trends for the external income are shown in Figure 3.

**Figure 3: Amounts and Sources of External Earnings, $ million**




| | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 |
|---|---|---|---|---|---|---|
| Australian Private Sector | 61.16 | 66.39 | 74.72 | 77.45 | 69.41 | 73.96 |
| Commonwealth, State & Local Govt | 49.01 | 49.76 | 48.42 | 52.30 | 63.10 | 68.57 |
| Rural Industry R&D Corporations | 41.08 | 40.75 | 44.20 | 40.31 | 40.76 | 40.67 |
| Cooperative Research Centres | 26.91 | 28.41 | 33.96 | 32.54 | 31.30 | 30.04 |
| Other Competitive Schemes | 9.14 | 7.86 | 9.24 | 8.06 | 4.14 | 0 |
| Overseas Entities | 8.31 | 8.93 | 11.05 | 15.47 | 21.88 | 31.39 |
| Other | | | | | | 4.9 |

The most significant trend has been the steady growth in earnings from overseas entities (largely private sector), quadrupling since 1994-95 to $31 million, some 5 per cent of overall turnover. Total earnings from the private sector, including the industry component of the Rural R&D Corporations, now account for almost half of CSIRO's external earnings or about 15 per cent of turnover. Revenue from 'Other Competitive Schemes' has been declining and has been incorporated in the 'Government' category. Of the 'Government' category, 58 per cent of the revenue is from the Commonwealth. The new 'Other' category represents the net of various items not processed directly through the customer database. In previous years this category was assigned across the other categories on the basis of secondary information.

## OUTPUT INDICATORS

### PUBLICATIONS, REPORTS AND PATENTS

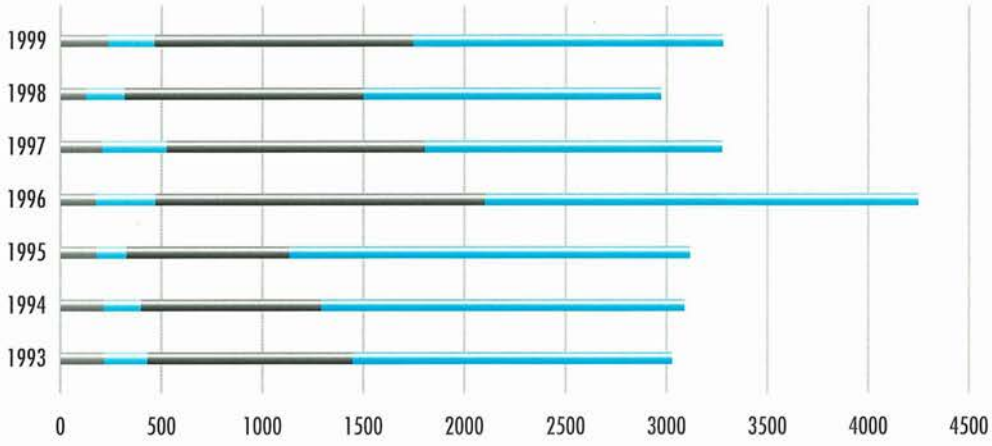
*This indicator is used to assess primarily CSIRO's contribution to, and hence ability to access, the world's knowledge base.*

### PUBLICATIONS

The publications data are shown in Figure 4. Apart from the 1996 anomaly (the year that the method of data collection was changed), there appears to be a slight upward trend in total publications, despite the 12 per cent decline in staff numbers over the period.

Citation analysis of publications in refereed journals was undertaken in 1996 (revealing the overall strong impact of CSIRO science) and will be repeated in 2001.

**Figure 4: CSIRO publications**




| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Books & Chapters | 216 | 213 | 179 | 175 | 207 | 123 | 236 |
| Technical Reports | 214 | 186 | 148 | 295 | 318 | 194 | 229 |
| Conference Papers | 1016 | 891 | 805 | 1630 | 1278 | 1183 | 1280 |
| Journal Articles | 1582 | 1799 | 1984 | 2149 | 1682 | 1472 | 1535 |

### REPORTS

The number of client reports recorded declined slightly to 7 339 in 1999 from 8 099 the previous year, compared to 7 095 in 1997 and 5 076 in 1996. One third of the reports relate to project activity while the other reports result from the provision of testing and calibration services by Animal Health (3 793) and Telecommunications and Industrial Physics (1 060).

## PATENTS

As at 30 June 2000, CSIRO had 63 Patent Cooperation Treaty applications in place, down from 84 as at 30 June 1999, and below the average of 80 over the last five years. The total number of Australian and foreign patents and applications (excluding PCTs) held at 30 June 2000 is 3 436, up from 3 371 last year. The decision to file, prosecute and/or maintain a patent takes into account the technical considerations, patent attorney and legal advice, market conditions, and the wishes of commercial partners.

Income from the patent holding in 1999-00 increased to $8.3 million against an expenditure of $5.7 million for legal and patent portfolio management costs.

In a study, commissioned jointly with the Australian Research Council, of Australian inventions patented in the USA, it was found that:

- Australia's patenting rate per GDP is below world average and falling. There would need to be a 70 per cent increase in the patent portfolio to match those of our competitors;
- Australia's patent portfolio is characterised as largely old economy, not of high impact, long cycle time, but with strong science linkage;
- areas of strength and opportunity are in biotechnology and pharmaceuticals;
- areas of weakness and decline are in telecommunications and semiconductors; and
- industry is very dependent on public sector science (90 per cent of scientific citations versus 73 per cent in the USA).

In the context of Australia's overall performance, CSIRO was found to:

- lead Australia in patenting across a wide spectrum of technology areas;
- have more than doubled its patenting rate over the last five years;
- have the strongest co-patenting with industry (20 per cent compared to 12 per cent for universities); and
- be the organisation whose papers are the ones most cited in Australian patents.

## TRAINING

*This indicator reflects CSIRO's contribution to the development of the skills base of Australia and its own staff.*

In 2000 CSIRO jointly supervised a total of 522 postgraduate research students, including 379 PhD students and 143 Masters or Honours students; 30 per cent of these students were supervised through the Organisation's involvement in the Cooperative Research Centre (CRC) program. The overall number of students supervised is 31 per cent lower than in 1999, and the proportion via the CRC program is about the same as in previous years.

The restructuring of some Divisions, closure of a number of CRCs, and issues related to the availability of high quality students, workload on supervising scientists and intellectual property ownership accounted for most of the decline. This year a more detailed set of data was collected.

In 2000 CSIRO is sponsoring 101 postgraduate students. This includes full scholarships for 30 PhD and two Masters or Honours students and partial scholarships for a further 61 PhD and eight Masters or Honours students. The total number of students sponsored represents a 20 per cent decrease on 1998 and 1999.

The overall number of students supervised and sponsored represents a significant contribution to the training of Australia's researchers and science-based professionals. CSIRO intends to examine the issues behind this year's change and to develop strategies to improve linkages with universities further.

CSIRO also contributes to student lectures and seminars, undergraduate and TAFE courses, short courses, summer schools, apprenticeships and vacation student programs.

CSIRO's internal, professional training and development programs are aimed at assisting staff at major, career transition points. Twenty-two senior staff, including three external participants, took part in the Leadership Development Program, CSIRO's major succession planning activity. This program is designed to better skill participants in their current and future leadership roles.

Leadership in innovation: Achievement through teams is a joint venture with the Business/Higher Education Round Table. It is an innovative, experiential program aimed at leaders in industry, academia and public sector research agencies. Twenty-five participants from CSIRO completed the four programs conducted during the year.

Eighty research project leaders completed the four Project Leaders' Programs. Their action learning reports on topics such as marketing R&D, team building and project evaluation contribute to a significant resource for organisational and individual learning.

A new series of courses for supervisors and team leaders was piloted in 1999. The courses provide core skills in people management, legal obligations, financial management and commercialisation for all staff who have supervisory responsibilities. The series of short courses will be made available for Divisional and regional delivery during 2000.

As part of CSIRO's increasing international consulting work in research leadership, two major development programs were conducted. One program was for 50 senior staff in the Indonesian Institute of Sciences (LIPI) and the other was a Project Leadership Program for 20 staff of the New Zealand Crown Research Institute for Geological and Nuclear Sciences.

## OUTCOME INDICATORS

### CUSTOMER SATISFACTION

*This indicator relates to CSIRO's responsiveness to the needs of customers with whom the Organisation has a contractual arrangement. The indicator is assessed through a range of measures including repeat business, formal surveys, and joint project management. The analysis will therefore tend to exclude the provision of scientific advice to aid Government policy making.*

The level of repeat business remains high at 75 per cent of all contracts on average across the Organisation. The range of variability between Divisions in the level of repeat business (40 - 90 per cent) reflects a number of factors such as the stability of the industry sector.

Project committees, or similar means of joint project management, were used for about 50 per cent of contracts. In situations where it would be impractical to have this form of customer interaction every effort is made to establish and maintain an ongoing rapport with the customer.

Overall satisfaction levels for this financial year remain high. Specific comments from customers in survey responses include:

'Everything indicates that the relationship is good and it has got better over the years. The level of interaction is high and there is an excellent relationship with researchers.'

'...the research program is being conducted by a single-minded and dedicated research team... This research program has a strong reputation amongst biological control practitioners worldwide, and this reputation appears to be justified.'

'We would like to make special mention of your personal skills in project management...In our view you have performed the task of project management with great distinction, and shown yourself to be highly skilled in providing scientific leadership, in negotiating joint work, and in collating and interpreting research results. You are also an excellent writer and it has been a particular pleasure for us to work with you in developing communication materials.'

Amongst the issues on which customers indicated that performance could be improved the most commonly mentioned were timeliness, cost, reporting, appreciation of the commercial realities, and complexity in the interaction. Specific comments from customers in relation to these issues include:

'Had some concerns earlier that projects were not focussed enough on commercial outcomes and matters of industrial significance. Research staff didn't necessarily understand the commercial deal and where our organisation was coming from, so were a little tentative outside their area of excellence.'

'Sometimes the pathway to market is not clear and CSIRO needs to be able to show where the research will stop and implementation will start and how this will be managed.'

CSIRO is addressing most of the issues raised through its programs for staff development. The issue of cost is not so easily managed. It is likely to remain an issue for some customers as CSIRO meets its obligations under the government's competitive neutrality policy.

## ADOPTION AND IMPACT OF RESEARCH AND ADVICE

*This indicator assesses the significance or impact of CSIRO's work. The indicator 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.*

The research is reported by CSIRO Sectors, grouped into Alliances — Manufacturing, Information and Service Industries; Minerals and Energy Industries; Environment and Natural Resources; and Agribusiness Industries.

In accord with the new reporting requirements under the *CAC Act*, we also report on factors and trends influencing each Sector, how they impact on research, and the strategies CSIRO has developed to optimise our contributions.

INDEX

# MANUFACTURING, INFORMATION AND SERVICE INDUSTRIES

## INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS SECTOR

### PLANNED SECTOR OUTCOME

***A globally competitive Australian IT&T sector.***

### INDUSTRY CONTEXT

The Information Technology and Telecommunications (IT&T) Sector encompasses electronic commerce, telecommunications and computer networking, mobile communications and electronic media systems.

The Sector continues to be one of the fastest growing in the Australian economy with a sustained growth rate of 12 per cent over the last five years. Senator Richard Alston, Minister for Communications, Information Technology and the Arts said in his December 1998 speech entitled "A Strategic Framework for the Information Economy": "The information economy is generating opportunities across all sectors — it is a new source of jobs for regional and city-based Australians, it provides opportunities for Australian business, wealth creation through ready access to a global marketplace, and reductions in the cost of transactions."

Apart from the direct benefits of revenue and employment, the successful implementation of IT&T hardware and software is a critical factor for business and one of growing importance in the success of many industries. IT&T products and services have substantial impact on productivity in all industries and in particular the service industries. This trend is expected to continue.

The IT&T industry is driven by the explosion in networks, especially Internet/intranet services, access and its adoption by business. A huge range of new application areas is opening up as companies move towards systems integration and customisation to improve performance and save on costs. This reflects a major shift from 'one size fits all' to solutions tailored to each individual business.

Very short product lead times, as short as three months, and life-cycles (one to two years) influenced by global alliances are a feature of the Sector. Deregulation of telecommunications services continues to have a major impact.

Australia's IT&T equipment manufacturers are world competitive — exporting one-third of production and undertaking high levels of R&D. Major telecommunications equipment suppliers are moving into Australia because Australia offers them an ideal cost-effective stable environment in the Asian time zone, combined with a significant source of innovation.

### CSIRO'S STRATEGIC RESPONSE

The response to this rapidly changing industry sector includes the following strategic goals:

- to create the new wireless infrastructure technologies needed for Australia to compete in global markets for the information economy;
- to enable full Australian participation in the global information economy by developing optimised adaptive networks that are cost competitive and provide the requisite quality of service;

- to increase the effectiveness and efficiency of organisations by creating systems to capture, keep, locate and show necessary documents for all time;
- to achieve electronic delivery of personalised and enhanced services by developing service trading systems around an 'honest broker' service;
- to enable the early deployment of new and improved service delivery via the Internet by integrating information systems operated by very many business units;
- to improve the effectiveness of information systems by designing and implementing fully engaging, fit-for-purpose intuitive interfaces;
- to reduce the risks and costs associated with the creation of scalable distributed information systems by increasing design and implementation productivity;
- to increase mobile access to on-line information systems by adapting and enhancing existing technologies for use in both rural and commercial areas;
- to underpin the local development of advanced microwave system technologies for 'dual use' civilian and military applications;
- to enable the creation of new and better information services by automatically tailoring and synthesising documents and multi-media information.

## RESEARCH OUTCOMES

*Providing Sydney's information highway.* CSIRO's Internet Marketplace technology is being used to deliver integrated planning and property information via the Internet for the Sydney Information Highway project. Members of the public, council staff and businesses can access, display and query data, such as property boundaries and the location of services, improving the quality of information available for planning, and the ease of access.

*Wireless local area network standard to use CSIRO technology.* The Institute of Electrical and Electronic Engineers completed the specification for its new high-speed wireless Local Area Networks (LANs) standard in 1999. The standard incorporates CSIRO's patented solution for high-speed communications in the indoor, multi-path environment. CSIRO has already licensed its prototype system and the patented technology to a local start-up company developing compliant products.

*A better search engine.* P@NOPTIC is a new search engine for corporate and government intranets. It improves the accessibility of information within organisations, as well as the information flow to clients. P@NOPTIC is undergoing trials with a number of organisations and has already been adopted by the Australian National University (ANU) and the Centre for Mental Health Research. P@NOPTIC was developed by CSIRO and the ANU within the Advanced Computational Systems Cooperative Research Centre and incorporates technology that has consistently achieved best practice results in international competitive evaluation.

*Millimetre-wave integrated circuit technology.* CSIRO has developed world class Indium Phosphide millimetre-wave integrated circuits. Amplifiers at 100 and 200 GHz have exhibited the best combination of gain, noise figure and bandwidth ever reported. The world's first 100 GHz bi-directional amplifier and IC voltage controlled oscillator have been demonstrated. These chips will revolutionise the design of

millimetre-wave radio astronomy receivers. They enable industry to develop better imaging sensors for security, improved collision detection systems for intelligent transport networks and new ultra-wideband systems for delivery of wide-band telecommunications services.

*Two-way radio communications system for underground mines.* CSIRO has developed a two-way emergency communications system to be used in the event of a mining disaster. This is the first time that an integrated, two-way system has been achieved anywhere and finally solves the problems associated with transmitting radio signals through 200 metres of rock after all other communications infrastructure has been destroyed. This patented technology has the potential to improve general mine safety while improving productivity.

## BUILT ENVIRONMENT SECTOR

### PLANNED SECTOR OUTCOME

***Improved economic competitiveness and quality of life in the built environment.***

### INDUSTRY CONTEXT

The Built Environment is the nation's largest asset. Built Environment industries — construction, transport, utilities — generate 17 per cent of the nation's economic output, employ 15 per cent of the nation's workforce and contribute 7 per cent in exports.

Some key issues shaping Australia's built environment are:

- the environmental deterioration of human settlements (poor air and water quality, transport congestion and end use energy inefficiency);
- national water supply is facing severe population and environmental pressure;
- increasing cost of national infrastructure is creating demand for increasingly sophisticated tools for planning and management;
- poor information flow in the construction industry is producing operating inefficiency, errors and waste;
- low built environmental efficiency and productivity, reflected in a large sector balance of trade deficit, indicates a need for greater application of IT and automation;
- pollution and high energy consumption in indoor environments;
- environmental sustainability is driving the construction industry to increase recycling of construction material and reduce waste;
- performance-based design codes and standards are critical to innovation in building design and materials.

## CSIRO'S STRATEGIC RESPONSE

The Sector's strategic direction is focussed on key global drivers for Australia over the next decade. These are global competitiveness and integration, applying information and communications technologies, and environmental sustainability. From these and extensive consultation with industry in 1999, CSIRO has developed a new research portfolio for 2000-03. The portfolio has 13 strategic objectives as follows:

- fire science and technology for the built environment: to reduce fire protection and prevention costs and enhance human safety in design and construction through development of advanced fire engineering methods and new fire safe materials. With the introduction of performance based fire codes in Australia (a world first), fire engineering is playing an increasingly important role in the design and construction of large, complex buildings;
- improving service life performance of buildings and infrastructure: to develop innovative products and systems and accurate service-life prediction tools to ensure more durable and reliable infrastructure. The cost to maintain Australia's infrastructure assets is about $25 billion per annum;
- integrated design and construction support systems: to reduce design and construction errors, costs and times for buildings and facilities through the development of precise component (object) representations plus mathematical optimisation and visualisation models for information, materials, labour and equipment use. Up to 7 per cent of total project costs are due to errors and rework; labour and equipment operational efficiency is currently only 40-60 per cent;
- environment engineering for human productivity: to improve the quality of indoor and personal environments by developing new software, processes and products. Improved technologies can provide savings of about $5 billion annually. Lost productivity and illness due to poor indoor environment costs $10 billion annually in Australia;
- efficient use of electricity distribution assets: to develop technologies that improve the efficiency of power transfer and ensure reliability, stability and quality of supply in the electricity transmission and distribution industries;
- optimising infrastructure network performance: to improve the efficiency and resilience of key network infrastructures by developing an improved performance capability for complex network systems that can be applied across different types of infrastructure network and operator to meet their designated performance requirements;
- intelligent transport systems: to reduce congestion, and improve the safety of Australia's transport systems through Intelligent Transport System information and control system technology, and contribute to the Australian industry's international competitiveness. Benefits of proposed research to Australia via direct saving of costs through reduced travel time, an increase in road safety, reduced carbon dioxide emissions and the overall improvement in road fleet efficiency is estimated at $3 billion per year;
- advanced technologies for integrated urban water management: to reduce the economic and environmental cost of managing urban water, wastewater and stormwater and improve the quality of water services by developing a range of technologies and systems. Maintenance and replacement costs for the Australian urban water industry will approximately double during the next 20 years while the industry will face increasing social and environmental pressures to achieve more efficient water use, protect public health and prevent long term environmental damage;

- solid waste reactivation for construction: to minimise waste by reactivating solid wastes for use as alternative materials and products for construction. CSIRO research will deliver waste reactivation technologies suitable for 75 per cent of all solid waste from industrial, construction and mining sources. This will also provide entry into the $300 billion fast growing global waste management market;
- low energy accelerated processing: to reduce environmental emissions and improve cement product performance by developing new process technologies for the cement and concrete products industry. Accelerated curing of concrete and ceramic products can achieve energy savings of $100 million annually, reduce environmental emissions, and improve product consistency;
- new generation building materials: to develop a new generation of polymer-based building materials with enhanced performance and recyclability. The built environment uses almost 20 per cent of plastics produced, but the range of applications for plastics is limited by deficiencies in performance and recyclability;
- sustainable smart coatings technologies: to develop new coatings technologies with improved durability, performance and environmental sustainability;
- improving the performance of windows and façades: to deliver new technologies and new methods for controlling heat, noise, security and strength functions into the building façade.

## RESEARCH OUTCOMES

***Rubber composites.*** CSIRO has taken patents on new research in high performance composite materials that can be used in the construction industry, for example, plastic nails; and novel surface treatment of rubber materials to produce high performance blends. Typically, the blends can be used as ABS/Rubber pipes suitable for sewerage applications and are capable of capturing 20 per cent of the existing PVC market. Agreements are in place with Australian fastener manufacturers who intend to market the product worldwide. Commercialisation of the technology focuses on recycling of tyre rubber and developing new uses for these waste materials in rubber and rubber composite applications.

***FASE/CellSim.*** FASE (Frequency Assignment by Stochastic Evolution) software has helped Telstra Mobilenet to achieve network capacity beyond any known international benchmark. New features have been added at the request of operators to optimise the assignment of Base Colour Codes (BCC) and Network Colour Codes (NCC) to cells, improving handover performance. Telstra Mobilenet has signed a second Agreement worth $170 000 with CSIRO to develop two simulation platforms.

***Membrane microfiltration.*** Studies conducted on membranes used in water microfiltration systems have identified a number of approaches to improve system performance and minimise levels of fouling of the membranes, when the system treats source waters that contain natural organic matter. The particular components of natural organic matter that exacerbate the fouling have been identified and strategies for dealing with them have been developed. The approach is particularly relevant to drinking water treatment and as a pre-treatment before desalination, making it attractive to a wide range of water management authorities. This work was carried out under the auspices of the Cooperative Research Centre for Water Quality and Treatment. Commercial opportunities are currently being assessed.

*Urban water program.* 'Capital efficiency' studies have been conducted to assess methods of driving water system assets harder. Results indicate that localised systems for groups of 10 000 people are the best option. These systems cover water supply, collection and wastewater treatment plants. They reduce sewage transport costs and offer greater opportunities for recycling treated water. The feasibility stage of the Urban Water program undertaken as a multi-divisional project was completed in March 2000. Five specific research areas were found vital to achieve significant improvements in system design and operation. A plan to pursue these research areas in collaboration with the water utilities and the Water Services Association of Australia is being implemented.

*Property condition index.* A Property Condition Index was developed for Housing Queensland as a workable measure to assess the performance, adequacy and quality of its housing stock. It was implemented in prototype software to provide data that will facilitate decisions on selling, maintaining and reviewing the building stock of Housing Queensland. A cost-based index of outstanding maintenance was extended to include a standards index and an ageing factor. The software is being linked to condition data on all 55 000 dwellings to estimate the condition of the entire property portfolio and to provide planning data. CSIRO retains part ownership of the software, in collaboration with the Department of Housing, in anticipation of future sales to, or collaboration with, other large scale housing and built asset managers.

*Simulation of construction activities.* A process known as discrete-event simulation was used to model the construction processes involved in an office tenancy fit-out for a 1 500 square metre open floor space, from empty shell to completed and cleaned offices. In discrete-event simulation models, the construction process is broken down into components that are assembled to describe the 'state' of the system at the chosen level of complexity. This 'state' remains constant until the next round of changes occur and the model is re-evaluated. The project demonstrated the feasibility of modelling construction processes using discrete event simulation and allowed variable work practices such as activity sequencing, multi-skilling and crew sizes to be evaluated for process re-engineering. The model showed that options involving multi-skilling and changing crew sizing had to be carefully chosen to improve both the speed and cost of construction.

## MEASUREMENT STANDARDS SECTOR

### PLANNED SECTOR OUTCOME

***Orderly commerce, national and international trade, technical harmony between manufacturers, and fulfilment of Australia's responsibilities under the Treaty of the Metre and other international agreements.***

### INDUSTRY CONTEXT

The Measurement Standards Sector is concerned with physical standards of measurement. Measurement standards are an infrastructural component of the economy: physical standards underpin the national standards and conformance infrastructure that provides the technical basis for orderly commerce, national and international trade, technical harmony between manufacturers and Governmental regulatory activities. CSIRO's work for this sector is undertaken in the National Measurement Laboratory – National Facility (NML).

Standards are of increasing importance in international trade. A Global Mutual Recognition Arrangement has been established between National Measurement Institutes to provide mutual recognition of national measurement standards and calibration certificates. Parties to this arrangement will have to demonstrate the equivalence of their national standards through participation in a program of 'key comparisons' and the integrity of their calibration services through accreditation of those services to ISO 17025 or equivalent.

The Asia Pacific Economic Cooperation has recognised the importance of measurement standards in promoting trade. This has led to significant work for the NML in assisting the development of measurement infrastructure in Asia Pacific countries.

## CSIRO'S STRATEGIC RESPONSE

CSIRO aims to provide value to Australia through activities in ten key areas:

- basic standards R&D – undertake leading-edge R&D to maintain international credibility for Australian measurement standards;
- primary standards R&D – develop and maintain primary standards for which there are legal units, as required under the *National Measurement Act* (1960);
- international recognition – ensure that Australia's measurement standards are internationally recognised, are equivalent to those of its major trading partners and do not represent a technical barrier to Australian trade and trade agreements;
- gas mixture standards – establish standard gas mixtures for carbon-based gases in support of environmental and industrial measurements, and to act as a base for Australia's position in international carbon trading;
- high flow standards – extend the range of standards for gas flow measurement to provide legal traceability of utility metering in gas distribution;
- metrology in medicine and health – develop new standards and techniques to increase accuracy and reliability of medical diagnosis and therapy;
- standards and calibration services – continue to provide an effective calibration service to underpin testing, quality, and product development in Australia;
- accreditation of calibration services – gain accreditation to ISO 17025 in support of Australia's entry into the Global Mutual Recognition Arrangement on standards and calibration certificates;
- national measurement system – provide leadership in measurement and support for other elements of Australia's standards and conformance infrastructure to ensure a coherent national system;
- technology transfer and Asia Pacific cooperation – capitalise on the NML's expertise in metrology for the benefit of Australian industry and Australia's regional interests.

## RESEARCH OUTCOMES

***Atomic-based kilogram.*** CSIRO has measured the density of single-crystal silicon as part of a major contribution to the possible international redefinition of the kilogram in terms of atomic masses. The measurements were made on near perfect spheres produced at CSIRO and definitive results were reported to an international conference in May 2000.

*International time synchronisation.* CSIRO's National Measurement Laboratory has developed a new Global Positioning System (GPS)-based system for national and international time synchronisation and frequency comparison. Systems are currently installed in seven national laboratories in the Asia-Pacific region, with a further two installations imminent. The systems can be operated remotely (via a telephone line or the Internet) by CSIRO and are especially suitable for countries with newly established timing laboratories.

*High voltage resistance ratio.* In the framework of the Asia Pacific Metrology Programme (APMP), CSIRO piloted a successful round-robin on the measurement of DC voltage ratio using resistance dividers up to 100 kilovolt. The other participating countries were Singapore, Hong Kong, Taiwan and Japan. The comparison is part of a program to establish international mutual recognition within the region, in support of the APEC objective of eliminating technical barriers to trade.

*New acoustic primary standard.* A new wideband primary standard to operate from 20 hertz to 20 kilohertz, the full audio range, has been developed and commissioned. The standard is based on the principle of reciprocity whereby the feature of reference microphones that allows them to be used as both sources and detectors of sound is employed to enable a set of three microphones to be absolutely calibrated, without the need for a known reference sound field. The new system is designed so that difficult sets of necessary corrections can be calculated and applied over the full frequency range. Acoustic instrumentation is routinely calibrated up to 20 kilohertz so the introduction of the new system has made the Australian measurement chain continuous over the full frequency range for the first time.

## RADIO ASTRONOMY SECTOR

### PLANNED SECTOR OUTCOME

***The Australia Telescope operating as a recognised world class national facility dedicated to the advancement of knowledge.***

#### CONTEXT

CSIRO's effort in this Sector centres on the Australia Telescope National Facility (ATNF), which has 'advancement of knowledge' as its primary goal. International linkages for Australian science and technology spin-offs are two significant consequences of activity in this Sector.

Continual upgrading of the Facility is essential if it is to remain world class. Upgrades funded by the Major National Research Facilities program are providing state-of-the-art millimetre-wave receiving systems, as well as extending the Australian network of telescopes used for Very Long Baseline Interferometry. These upgrades will be completed by 2002. Operations and science will then be dominated by the impact of the new facilities.

Internationally, radio astronomy is dominated by National Facilities, supporting university-based users. International facilities will become increasingly important over the next decade.

The ATNF has an international involvement, in participating in the design and construction of the Array for Microwave Background Anisotropy Facility in Taiwan. This is a collaborative project with the Academia Sinica Institute of Astronomy and Astrophysics, Taiwan, funded by the Taiwan Ministry of Education.

Two major international radio astronomy developments are being planned: the Atacama Large Millimetre Array (ALMA) and the Square Kilometre Array (SKA). These will let astronomers attack key questions such as how the early Universe evolved. To maintain its position in world radio astronomy, Australia needs to be involved in these projects.

The SKA is an international billion-dollar project to build the next-generation radio telescope with a sensitivity 100 times greater than today's telescopes. Construction is expected to begin around 2010. Australia is well-positioned to play a key role in the development of the SKA. It is possible that it will be located in Australia. The technology development required will have wide industrial application and construction will involve significant industrial contracts.

## CSIRO'S STRATEGY

The critical overall objective of the ATNF is to remain at the forefront of world radio astronomy. As a National Research Facility, the ATNF enables its users – 80 per cent of whom are from outside CSIRO – to carry out leading-edge radio astronomy.

The ATNF has identified five strategic objectives to satisfy its users. They are to:

- operate the National Facility for radio astronomy research;
- maintain the ATNF's forefront position by extending the Facility through continuing introduction of state-of-the-art equipment and instrumentation;
- exploit the upgraded Facility (particularly its millimetre-wave capabilities) to make new astronomical discoveries;
- position Australia for participation in future major international facilities, particularly the Square-Kilometre Array project;
- conduct an effective outreach program to increase public awareness of Australia's achievements in astronomy and attract young people to a career in science.

## RESEARCH OUTCOMES

***Parkes multibeam system finds 'hidden' galaxies.*** CSIRO's new multibeam receiving system has allowed the Parkes telescope to swiftly survey the whole southern sky for neutral hydrogen gas, the raw material from which stars are made, in our Galaxy and others. The galaxy survey was completed in February 2000, and in May 2000 the collected data were released for the use of astronomers world wide. The results have revealed much about how galaxies are distributed in the nearby Universe. Another survey searched for previously undetected galaxies hidden from sight behind the Milky Way. Many new galaxies were found and their distribution has been mapped.

***Multibeam pulsar hunt.*** The multibeam system has been used to hunt for pulsars in our Galaxy. By May 2000 the survey was 70 per cent complete, and 550 new pulsars had been detected. These represent a major contribution to the total number of detected pulsars, since only about 750 pulsars were known prior to the survey.

*Australia Telescope complements NASA's X-ray mission.* The quasar called PKS 0637-752 was one of the first objects observed by NASA's new X-ray orbiting telescope, Chandra, following its launch in July 1999. Chandra spotted an X-ray jet emerging from the source. An international team observed the quasar with the Australia Telescope Compact Array and the orbiting Japanese telescope HALCA. The combined radio and X-ray results, together with previous radio observations, have placed stringent limits on possible explanations for the X-ray jet.

## SERVICE SECTOR

### PLANNED SECTOR OUTCOME

***Enhanced organisational performance of service sector enterprises through more effective management and use of information for decision making.***

### INDUSTRY CONTEXT

The activities of the Service Sector are diverse, encompassing wholesale and retail trade; health services; finance and insurance; travel and tourism; and property and business services. While the Service Sector accounts for only 4 per cent of Australia's total R&D expenditure of $8.7 billion, overall business expenditure on R&D is substantial ($340 million). The most R&D intensive areas are wholesale trade, finance and insurance and business services.

Information technology and telecommunications (IT&T) provides the main technology base for the Service Sector. IT&T systems integration and customisation is a key factor in improving productivity in service firms. A huge range of new application areas within service firms is opening up because of the Internet and continuing trends in performance/cost of IT&T components. Examples are data mining, personalised services and electronic service delivery. CSIRO is currently undertaking a multidisciplinary project in collaboration with Viator Inc to develop an online travel planner.

Any industry usually approaches new technology in the sequence adopt – adapt – invent. Australian service firms are beginning to move from the 'adapt' to the 'invent' stage. R&D intensity is significantly higher in the USA than in Australia: this indicates the direction in which Australian firms will have to move to remain competitive.

Globalisation is a major issue for service industries world wide. This is apparent in the substantial and growing world trade in commercial services. The Internet and on-line services are having an enormous impact on globalisation.

Australian service firms can be both world-scale and competitive: service firms are the only Australian firms in *Forbes'* global best 400 large firms, and there are four Australian Service Sector firms in *Fortune's* Global 500.

## CSIRO'S STRATEGIC RESPONSE

CSIRO has continued to develop its profile as a supplier of R&D to the Service Sector. Through extensive industry consultation we have identified and initiated projects with considerable long term potential to deliver competitive benefits to Australian companies.

Our research is directed towards achieving these goals:

- to improve the effectiveness of decision making in uncertain business environments by developing new techniques and software implementations for modelling, measuring and assessing risk;
- to improve productivity and competitiveness, through an integrated approach to gathering, analysing and using information;
- to increase the cost effectiveness of health care delivery and outcomes through integrated health care and health service delivery systems;
- to improve the access, quality and efficiency of health care for Australia's ageing and remote population through telehealth technology;
- to improve the quality and cost effectiveness of diagnosis and treatment through computer-aided decision support and clinical advisory systems;
- to facilitate cost efficiencies and new business opportunities, based on personalised and enhanced service delivery in electronic commerce via the creation of electronic trading environments;
- to improve delivery of goods and services at reduced cost through improvements in supply chain management;
- to achieve secure and cost effective protection of physical, human and electronic assets through use of intelligent vision systems;
- to improve significantly the efficiency and effectiveness of asset monitoring through use of advanced monitoring technologies.

## RESEARCH OUTCOMES

***Options development and pricing with Reditus.*** CSIRO's *Reditus* software package is for developing and pricing complex options products for financial markets. The 'finite element method' is used in engineering to mathematically model fluid flows. CSIRO researchers discovered that it is also applicable to the challenge of pricing complex financial options products. *Reditus* is the first financial options development and pricing software to be based on this method. It is more accurate and versatile than other methods and will be a valuable tool for quantitative analysts. *Reditus* allows rapid development of new, tailored options products and exotic options types. It is currently being used by the Commonwealth Bank and the National Australia Bank.

***Telehealth.*** CSIRO's Hospital Without Walls initiative aims to develop a range of technologies to allow elderly and chronically ill patients to be cared for more effectively in their own homes. This will have a substantial impact on the quality of life and cost of health care for these patients, whether they live in cities or in rural and remote areas. Appropriate use of the technology can dramatically lower costs, for example

by lessening the number of remote patients who need to be transferred to major centres (transfers that cost up to $10 000 per patient), and reducing institutional care. The first stage of the system was unveiled at the *Commercialising Health Innovations Forum* in October 1999 in Melbourne, and plans are being finalised for initial clinical trials.

*Solving complex rostering problems with StaffSmart.* CSIRO, in conjunction with an Adelaide-based company, Time and People Australia, has developed a complete solution for automated staff rostering, attendance and payroll management. *StaffSmart* delivers optimised rosters that can handle changes in demand, while satisfying workplace award conditions and accommodating staff preferences. *StaffSmart* delivers flexibility, time-saving and improved staff relations. Marketing programs are currently being developed, and it is being used by the Olympic Security Command Centre to roster security staff at the Olympic Games in September 2000.

*Acoustic mine imaging.* The Acoustic Mine Imaging project aims to provide underwater imaging of mines in turbid waters, by using ultrasound to illuminate objects in the water and analyse echoes received at an array of receivers. The project is funded by the Australian Department of Defence, through a contract with Thomson Marconi Sonar. CSIRO is a sub-contractor, providing unique expertise based on its past work in medical ultrasound. The first phase of the Full Scale Engineering Development, including several sea trials, was completed successfully in March 2000.

*Solarscan.* Sydney company Polartechnics is now seeking commercialisation partners for Solarscan, an automated system for the detection and classification of melanomas. CSIRO's Image Analysis group is playing a key role in the development of this technology, creating software algorithms that analyse images of skin lesions and predict the likelihood of their malignancy. Solarscan was demonstrated and well received in March 2000 at the 58th Annual Meeting of the American Academy of Dermatology.

## CHEMICALS AND PLASTICS SECTOR

### PLANNED SECTOR OUTCOME

***Economic, social and environmental benefits for Australia from application of chemical, biochemical and polymer technologies.***

### INDUSTRY CONTEXT

The Chemicals and Plastics Sector encompasses commodity chemicals; bioactives (pesticides and herbicides, for example); surfactants and cosmetics; paint and ink; other speciality chemicals (dyes and explosives, for example); plastic resins; rubber and plastic products; and synthetic fibres. It is a significant provider of materials for manufacturing, mining and agriculture as well as supplying products directly to consumers.

The chemicals and plastics industry in Australia is characterised by a few large local companies, a few large foreign multi-national companies and a large and growing number (around 2 500) of small-to-medium sized companies employing fewer than 50 staff each. Australian industrial operations are not large on a world scale and local companies are generally better able to compete internationally in specialty or commodity niche areas. (Specialty chemicals have a product focus and generally involve lower capital cost processes.)

There are three vital strategic factors for the Sector:

- sustainability (economic viability, environmental sustainability and social responsibility);
- the nature and pace of technical change;
- the impact of biotechnology.

The chemical industry worldwide is going through a period of substantial change with a marked trend towards biotechnology development and life science initiatives. A feature of the industry, both in Australia and overseas, is major restructuring into traditional chemical firms and vertically integrated life science companies. Biotechnology is expected to have a major impact in the more 'traditional' chemical production and processing activities. The chemical industry worldwide is a mature industry and the trend to life sciences heralds a marked shift in R&D.

## CSIRO'S STRATEGIC RESPONSE

The change in the industry is being mirrored by significant change within CSIRO away from traditional approaches to crop protection products toward biotechnology-based approaches to bioactive molecule discovery and a bioprocessing initiative involving scale-up and downstream processing, protein purification and engineering, and large scale cell cultivation. Bioprocessing routes to industrial chemicals fit well with the specialty chemicals focus of the Australian chemical industry.

Our research is directed to helping Australian industry achieve the following goals:

- rapid expansion of bioprocessing as a core capability;
- manufacture of new and improved polymer-based products (for example coatings, fibres, elastomers, tooth fillings, optical lenses, sensing devices);
- use of packaging that is biodegradable or recyclable; secure (for authentication and identification of high value products); or enhances the quality of fresh and processed food;
- use of socially, ecologically and economically acceptable crop protection products well suited to integrated production systems in Australia;
- improvement and control of adhesion, permeability, surface conductivity and radiation attenuation for polymer products;
- design and formulation of high-added value specialty chemical products or processes;
- retention of Australia's market advantage for export grain by maintaining its ability to produce, store and sell clean, dry, insect-free grain;
- environmentally aware manufacture of non-commodity chemicals, in which all steps, from selection of raw materials to disposal of effluent, are integrated;
- improvement of service life of polymer coatings, composites and engineering polymers.

## RESEARCH OUTCOMES

*New biodegradable packaging.* CSIRO, with the Cooperative Research Centre for International Food Manufacture and Packaging Science, has developed new biodegradable packaging materials based on

starch. The benefits of these materials are two-fold: the raw materials are derived from a renewable resource, in contrast to the petrochemical-derived plastics currently used, and the starch-based materials will break down in compost heaps and thereby reduce the amount of packaging waste ending up in landfill. These new packaging materials have been successfully trialed on full-scale equipment by several interested companies this year and commercial production of at least one application is anticipated.

*'Breathable film' technology.* A novel, multi-layered film structure and activation process has been developed and patented by CSIRO as part of its work with the Cooperative Research Centre for International Food Manufacture and Packaging Science. The storage life of fresh produce can be extended by carefully matching the packaging film's permeability to a particular product's requirements. A large range of different polymeric films is currently used to address the packaging needs of the vast array of fresh products sold in commercial outlets. The Cooperative Research Centre developed film has the potential to replace all these different films because fresh produce packagers would only need to keep one film stock – which could be activated according to the needs of each product – instead of a large array of films.

*Biopesticides gather momentum.* BioCane™ (manufactured by BioCare Technology Pty Ltd, Sydney), a fungus-based product developed by CSIRO and the Bureau of Sugar Experiment Stations in collaboration with BioCare Technology, for control of the grey-backed canegrub, was granted full registration by the National Registration Authority in March 2000. The product, which contains spores of a naturally occurring fungal pathogen, was launched at a sugar conference in Bundaberg in May 2000. Green Guard™, a product for locust and grasshopper control, based on spores of another strain of the same fungus, is close to registration. During the year, CSIRO's nematode biopesticide technology was licensed to The Clean River Company for global marketing, production and distribution.

*Grain storage technology commercialised.* CSIRO has signed an agreement with United Phosphorus Limited, a world-leading manufacturer of aluminum phosphide, to commercialise new technology for the fumigation of grain storages. The invention, from CSIRO's Stored Grain Research Laboratory, is a new formulation of aluminium phosphide that is inherently safer than current formulations. It will be used in a portable generator for the controlled production and delivery of phosphine to fumigate grain storages. The new technology will be made commercially available to the Australian grain storage industry in time for the next harvest season. Global commercialisation will then follow.

*MIEX plant comes on-line.* Orica's MIEX®, resin manufacturing plant in Melbourne is about to come on-line. Its first customer will be the new Wanneroo Groundwater Treatment Plant recently announced by the Water Corporation of Western Australia. Scheduled to open in 2001, Wanneroo will be the first plant in the world to use the MIEX® DOC process to remove dissolved organic carbon (DOC) from drinking water. The process was developed by Orica Watercare, CSIRO and the South Australian Water Corporation and is being marketed internationally. Orica and CSIRO are working on a new generation of resins designed to withstand the harsh conditions encountered in mineral processing.

*Surface engineering of polymers.* Holden Ltd has commenced production of Commodore VT-Series II vehicles with Body Side Mouldings that are surface-modified by the SICOR process, which enhances the adhesion of painted body panels, making them non-detachable. The introduction of SICOR completely eliminated component failures that are now at an unprecedented 'zero-rate'. The components are manufactured at Socobell, Melbourne and assembled at Holden's plant in Elizabeth, South Australia. The

production is carried out under the Holden-CSIRO licence agreement. Both Holden and CSIRO are currently verifying the applicability of the SICOR process in a broader range of commercial applications.

*Ultrafine nucleating agents.* With Micronisers Pty Ltd and Uniqema Pty Ltd, CSIRO has developed methods to produce nucleating agents for polyolefins, with ultrafine, sub-micron particle size. These polyolefins enhance polymer clarity and mechanical properties, finding use in diverse applications from food containers to automotive bumper bars. Commercial production of these polyolefins began in early 2000 and sales are occurring in both local and export markets.

## INTEGRATED MANUFACTURED PRODUCTS SECTOR

### PLANNED SECTOR OUTCOME

***Maintenance and growth of a viable, technologically advanced, high value-adding and wealth-creating Australian manufacturing sector.***

#### INDUSTRY CONTEXT

The Integrated Manufactured Products Sector covers machinery and equipment (especially transport equipment), instruments (especially measuring and testing instruments), methods for metal-based manufacturing (die casting, welding, coatings, alloys, forging and casting), manufacturing processes (including design and rapid prototyping) and the operation of distributed manufacturing enterprises.

Some significant aspects of the environment for manufacturing are:

- product development lead time and product life cycle are now almost half what they were ten years ago. This narrows the window of market opportunity;
- customers demand products that are customised to their needs and local conditions;
- there is a continuing need for differentiated products, often to fill niche markets;
- tools are required for facilitating globally-distributed manufacturing;
- adaptable/reconfigurable manufacturing systems, information and communication technologies, and modelling and simulation are key to manufacturing capabilities;
- manufacturing processes that minimise waste and energy consumption will be necessary to respond to increasingly stringent community expectations and environmental regulation. Use of environmentally acceptable processes could well become a prerequisite to being able to export into particular markets.

## CSIRO'S STRATEGIC RESPONSE

CSIRO's current customer base is diverse and includes small and medium enterprises (SMEs). The majority of Australian manufacturers are primarily interested in incremental improvements in products and processes.

Our research is directed to helping Australian industry achieve the following goals:

- lower energy use and waste to both reduce cost and maintain licence-to-operate in an increasingly constrained environmental framework;
- reduce weight and improve energy efficiency in transport equipment;
- improve quality and productivity by developing measurement, inspection and quality assurance tools;
- create and grow businesses based on sensing and monitoring;
- create a vertically integrated minerals-metal production-manufacturing chain based on magnesium and titanium alloys;
- improve productivity, quality and cost-effectiveness in manufacturing processes;
- be world competitive in customised and niche-volume production;
- operate in dynamic, global supply chains through effective distributed manufacturing systems;
- create and grow businesses based on biomimetic, nanoscale manufacturing;
- reduce costs of existing micromanufactured products and develop new, differentiated high-value products based upon small-scale physical system manufacturing.

## RESEARCH OUTCOMES

*High performance automotive bearings.* Four new, high strength-bearing alloys have been developed by CSIRO to give ACL Bearing Company a competitive edge in local and overseas markets. A pilot scale production facility for the continuous casting of aluminium-based, automotive bearing alloys has been transferred to ACL at Launceston, Tasmania for recommissioning.

*Silicon carbide technology.* CSIRO's silicon carbide technology is being transferred to Concord Engineering Investments, establishing a fledgling manufacturing industry for Australia. It will be used to produce wear resistant materials for applications in the mining industry.

*New instrument licensed to GBC.* A novel instrument for measuring the viscosity and elasticity of a wide range of materials has been licensed to Melbourne-based GBC Scientific Equipment Pty Ltd. Development of the Micro Fourier Rheometer (MFR) means that paint and adhesives manufacturers can watch how the viscosity and elasticity of their paints and glues change as they are cured. The MFR only needs a tiny sample of material to measure, for example, biological fluids such as teardrops that are difficult to obtain in large quantities. Another useful application of the technology will be in testing new drugs without relying on subjective feedback from patients.

*aXcessaustralia low emission vehicle (LEV).* CSIRO has designed the switched reluctance electric motor, generator, and the power and control electronics to be used in the aXcessaustralia Low Emission Vehicle project. In conjunction with the Cooperative Research Centre for Alloy and Solidification Technology (CAST), CSIRO also designed and produced seven light alloy castings. The display vehicle will be shown to the automotive industry around the world over the next 12-18 months.

*Blue water.* Blue water results from the corrosion of copper in 'soft' waters. It can lead to water quality complaints, and a customer perception of a potential health risk. CSIRO, working with the water authorities and copper tube manufacturers, has shown that blue water occurs more readily in certain forms of copper and in water that is low in chlorine and high in pH. It may be prevented in new plumbing and a solution is being sought to control blue water corrosion in existing installations. This research is ongoing, but various preventive measures arising from these findings are under consideration by the Water Services Association of Australia, the industry body that represents the major water suppliers in the country.

## PHARMACEUTICALS AND HUMAN HEALTH SECTOR

### PLANNED SECTOR OUTCOME

***Improved health care, prevention of illness and disease, avoided treatment costs, improved public health and growth in the Australian pharmaceutical and medical industries.***

### INDUSTRY CONTEXT

The Pharmaceuticals and Human Health Sector focuses on health outcomes realised primarily through the pharmaceutical industry. It encompasses pharmaceuticals, diagnostics, nutritional products, *in-vivo* medical devices and other health care products.

The global pharmaceutical industry is large ($300 billion per annum) with large companies, each of which has less than 4 per cent of the global market. Recent science and technology trends (high throughput screening, combinatorial chemistry, an explosion of genetic information) provide a new era of molecular discovery and design. Biotechnological approaches are now fundamental and many large, diversified companies are moving towards a 'life sciences' focus. Numerous small biotechnology companies provide drug development opportunities. R&D underpins the industry and firms invest substantial amounts in R&D.

Key drivers are:

- time and cost to market – cost from discovery to drug registration averages $150 million; development times are increasing and product life cycle times decreasing;
- innovation deficit – a global shortfall in product development;
- genomics, natural products and biotechnology processes;
- changing patterns of disease;
- cost of health care.

There are over 140 companies in the Australian pharmaceutical industry, including a number of significant majority Australian-owned companies. Ninety per cent of these firms engage in R&D activity, often at significant levels. The ability to capture the benefits of R&D has been hampered in the past by the absence of a culture of pharmaceutical development to translate research outputs to products. Government policy stemming from the Pharmaceutical Development Plan of 1990 has assisted in redressing this impediment.

## CSIRO'S STRATEGIC RESPONSE

CSIRO research will be aimed at adding value to the industry in the following areas:

- anti-infective agents for the control of selected infectious diseases;
- capitalising on Australia's unique biodiversity for the discovery and development of bioactive molecules for pharmaceuticals and nutriceuticals;
- biomaterials for ophthalmic, cardiovascular, orthopaedic and wound-healing products;
- agents and strategies for the prevention, diagnosis and treatment of prostate and colon cancers;
- improved therapeutic effectiveness and reduced side-effects through targeted delivery of new and existing drugs, genes and gene modifiers;
- therapeutic agents for diabetes through rational drug design;
- innovative technology for diagnostic reagents;
- enhanced growth and repair of human and animal tissues using growth factor agents.

## RESEARCH OUTCOMES

*Hepatitis B*. A research collaboration with AMRAD Corp Ltd has produced a promising new compound for the treatment of hepatitis B virus infection. Successful phase 1 clinical trials completed in March 2000 demonstrated excellent pharmacological properties with lower toxicity than conventional drugs. It is expected that the compound will enter phase 2 clinical trials in late 2000 or early 2001.

*Gene therapy*. CSIRO and the German pharmaceutical company HepaVec AG have signed an Option Agreement allowing the company to evaluate and develop CSIRO technology for revolutionary new treatments for malignant diseases such as pancreatic cancer, liver cancer and metabolic diseases such as Wilson's disease. The technology uses inactivated sheep viruses that have been shown in mice to satisfactorily deliver gene therapy compounds in the presence of pre-existing immunity to human viruses from the same family. Thus, these reagents may play a useful role in human gene therapy.

*Drug delivery*. CSIRO has signed an exclusive license with Life Technologies Inc (LTI) to commercialise CSIRO's Tris-conjugate gene delivery technology for research use only. A small suite of human antibodies has been selected that show specificity for prostate cancer cell lines. The license further provides the company with a non-exclusive license to use the technology for animal diagnostics and therapies. LTI is a world leader in the development and marketing of non-viral gene transfer systems for research use.

*Relenza™*. CSIRO has received its first substantial royalty payment for Relenza™ the world's first effective treatment for all strains of influenza. Relenza™ is based on CSIRO research that revealed the molecular structure of an influenza enzyme, and identified a target for the synthetic 'designer' drug molecule. It was developed by Biota Holdings and is being marketed worldwide by GlaxoWellcome.

*IBDV*. A significant royalty payment has been received from the commercialisation of a vaccine developed by CSIRO for infectious bursal disease, a major disease in poultry. This vaccine was one of the first of its kind to be developed for veterinary purposes. Infectious bursal disease virus (IBDV) attacks the

immune system of young chickens, causing illness and death. The control of IBDV infection is a major priority of the poultry industry; losses caused by IBDV are estimated to cost at least $1 billion worldwide.

*Elastomedic.* UK listed company, AorTech International PLC, has purchased Elastomedic Pty Ltd, the Australian company set up to manufacture CSIRO-developed polyurethanes for medical use. AorTech specialises in artificial heart valves and other cardiovascular devices, and is interested in the use of Elast-Eon polyurethane for heart valve application. It is also interested in helping Elastomedic exploit other biomaterials applications of the technology. CSIRO has accrued cash benefit from the sale.

## MINERALS AND ENERGY INDUSTRIES

### ENERGY SECTOR

#### PLANNED SECTOR OUTCOME

***Improved efficiency, sustainability and environmental acceptability in the supply and use of energy resources.***

#### INDUSTRY CONTEXT

This Sector encompasses the production of energy resources (excluding natural gas and petroleum), energy generation and supply, energy end use efficiency and related environmental aspects, particularly the reduction of greenhouse gas emissions.

Australia's domestic energy industry is changing rapidly in the face of fundamental and far-reaching market reform. This is affecting production, distribution and delivery of both electricity and gas.

The coal industry, Australia's major exporter and supplier of some 80 per cent of domestic energy, is being rationalised with increased productivity essential in light of price pressures, international competition, the emergence of a range of new power generation options and the impact of the Kyoto agreements to contain carbon dioxide emissions.

The two key drivers for the Sector are downward cost pressures to keep energy prices at competitive international levels, and greenhouse gas concerns. Other factors are:

- coal will remain as Australia's leading commodity export with continuing pressure to increase productivity and lower cost;
- clean coal technologies will remain the major source of domestic energy, with gas to increase its share;
- increased penetration of distributed energy, including cogeneration, into the market;
- renewable energy, assisted by government incentives, will receive considerable investment;
- energy efficiency and conservation measures will be adopted across industry;
- exports of mining and energy equipment and services will grow with opportunities, flowing from the Kyoto protocol, for technologies in the clean coal, renewable, end use efficiency, and environmental areas.

## CSIRO'S STRATEGIC RESPONSE

The Energy Sector continues to refocus its efforts to better address the drivers listed above.

The Sector contributes to the:

- prediction of future energy trends and technology innovation;
- enhanced cost competitiveness of coal production;
- improved environmental, health and safety aspects of coal production;
- cleaner, more efficient power generation from fossil fuels with lower greenhouse emissions;
- development and use of distributed energy generation;
- development of high efficiency, cost effective energy storage;
- development and utilisation of renewable energy;
- direct mitigation of greenhouse gas emissions;
- enhanced energy end use efficiency.

One major response is the construction of a world class energy R&D centre at Newcastle funded by CSIRO and the New South Wales Government to provide a focus for CSIRO's energy R&D activities.

## RESEARCH OUTCOMES

*Mine visualisation.* CSIRO has developed a 3D visualisation system that integrates and displays complex disparate data sets found in surface and underground mines. The system is Internet-based and allows operators to simulate a range of different scenarios. It provides a low cost, interactive environment to access mine site information and facilitate communications, planning and risk assessment across the mine's activities simultaneously.

*Mine accident prevention.* A collision prevention warning system has been developed for large mine trucks, to help reduce the possibility of accidents. Sensors on trucks warn a driver if people or plant equipment are at the rear of trucks, where drivers often have little or no visibility. Mine employees wear the sensors as they move around the mine site and sensors are also fitted to vulnerable stationary plant objects and mobile equipment such as small vehicles.

*Coal fragmentation.* Software is now available to help companies determine the best blasting and crushing practice for coal, which will contribute to increased industry efficiencies. The software contains simulation models of unit processes and the accompanying report describes some fundamental factors controlling coal fragmentation and resulting size distributions from the coal face. The package was developed jointly by CSIRO and Julius Krutschnitt Research Centre through the Cooperative Research Centre for Mining Technology and Equipment.

*Coal dewatering.* CSIRO has trialled an air purged, vibrating basket centrifuge at a coal preparation plant to demonstrate its value in dewatering coarse coal. Coal is washed before shipping to meet export standards, and therefore needs to be dried before loading. Significant reductions in the water content of product coal were achieved in this improved process, which could lead to substantial cost-savings.

*On-line measurement of mass flow rates.* CSIRO has developed and successfully tested an ultrasonic technique for the on-line measurement of mass flow rates of coal in pulverised coal-fired power stations. The system uses gauges to monitor the flow across all feed pipes from individual mills. This allows power station operators to assess the balance between the flows and hence the efficiency of combustion.

*Hybrid solar/fossil fuel power generation.* A 12m diameter, solar thermal concentrating dish has been erected and a solar-methane reforming reactor built as part of a major new facility to determine the feasibility of a combined solar/gas technology for advanced power generation and energy storage. A test station for evaluating polymer electrolyte membrane (PEM) fuel cells has also been built to study the effect of how varying fuel composition affects their performance prior to the fuel cells being integrated into the main facility.

*Biomass.* CSIRO's wood biomass technology has been selected for a 1 megawatt demonstration plant in Western Australia. This system uses fluid bed carbonisation to produce both electricity and activated carbon from mallee trees grown to ameliorate salinity caused by rising water tables in agricultural land. In addition the plant will also produce eucalyptus oil.

*Energy storage.* A lightweight 'power-pack', comprising a state of the art supercapacitor and novel long-lasting batteries, has been made and delivered to aXcessaustralia and Holden for demonstration in their hybrid vehicles.

## MINERAL EXPLORATION AND MINING SECTOR

### PLANNED SECTOR OUTCOME

***Cost-effective identification of major ore deposits, improved minesite productivity, enhanced levels of occupational health and safety and reduced environmental impacts.***

### INDUSTRY CONTEXT

The Sector is concerned with the exploration for, and mining of, economically viable, naturally occurring, solid, inorganic mineral deposits. Environmental impacts of mining, minesite rehabilitation and occupational health and safety considerations are also included.

A number of Australian mining and exploration companies are prominent at a global level; some 42 per cent of the total exploration budget of Australian-based companies is expended overseas and about 20 per cent of the world's exploration budget is spent here. Two key industry organisations are the Australian Mineral Industries Research Association (AMIRA) (which includes some 88 Australian exploration companies) and Austmine Ltd (which comprises some 137 service and manufacturing companies with exports of mining equipment and services over $1 billion per year).

The minerals industry is still in a deep cyclical low in mineral prices and has intensified its focus on cost reduction and diversified markets. Spending for future growth has been severely curtailed, with particular impact on exploration and R&D. The associated growth in outsourcing provides opportunities for CSIRO. Smaller companies also play an important and increasing role in the Australian industry by providing niche products and contract services.

## CSIRO'S STRATEGIC RESPONSE

CSIRO's Sector activities have been reshaped around two concepts:

*The Glass Earth* — to discover the next generation of giant ore deposits in Australia by making the top one kilometre of the Australian continent, and the processes operating within it, transparent.

Objectives of the research are to:

- develop geological concepts that deliver validated area selection criteria to industry;
- provide innovative technologies to recognise ore-bearing systems and locate ore deposits;
- provide specialised concepts and technologies for exploration within and through the Australian regolith.

*The Accessible Earth* — to optimise the efficiency, safety and cost effectiveness of mining systems by making fully accessible new and existing types of mineral deposits as well as deposits that are currently sub-economic.

The objectives for this concept are to:

- improve ore body delineation, rock mass characterisation and mine design reliability;
- optimise mine operations and product quality;
- develop innovation mining and extraction systems;
- develop technologies that improve mine safety and health;
- develop technologies that protect the environment;
- optimise exploration to market systems.

## RESEARCH OUTCOMES

*Operational Airborne Research Spectrometer (OARS).* For the first time, mineral explorers have access to maps of mineral deposits that are generated from the air during low-altitude, airborne, geophysical surveys. This development reflects CSIRO's thrust to reduce the cost of airborne exploration by flying several instruments at the same time. OARS, the unique line-profiling spectrometer system developed by CSIRO and Fugro Airborne Surveys Pty Ltd, is now being offered as part of Fugro's worldwide commercial services, alongside magnetic and radiometric measurements.

*Modelling helps target new gold discovery.* Exploration concepts based on CSIRO computer models played a role in the discovery of the rich Wallaby gold deposit in the Laverton area of Western Australia. Placer Dome Inc, the discoverers of Wallaby, estimate that it has an in-ground value of over $1 billion and will be productive for at least 10 years.

*Location and Monitoring for Personal Safety (LAMPS).* LAMPS, a new emergency communication system developed by CSIRO, will increase safety in underground mines. This fail-safe status and location monitoring system can signal optimal evacuation routes and relay air quality data as well as report on the location and status of miners. Following successful underground trials at the Gympie Eldorado gold mine, Queensland, the coal industry is supporting the development of an 'intrinsically safe' commercial system for both coal and metalliferous mines.

*Automated load-haul-dump truck.* CSIRO and the University of Sydney have developed a new automation system for driverless operation of underground loaders and trucks. This system, which aims to increase productivity and safety in underground mines, has been developed with industry funding through the Cooperative Research Centre for Mining Technology and Equipment. CSIRO is now providing support to Caterpillar Elphinstone and Dynamic Automation Systems to integrate the new technology into a commercial system.

*Application of HyMap imagery to the mining environment.* Hyperspectral imagery from the airborne HyMap system has been successfully used by CSIRO to monitor levels of iron ore dust settling on mangroves adjacent to the Port Hedland ore loading facilities in Western Australia. HyMap data has also been used to monitor acid rock drainage sources at an old pyrite mine in South Australia. The success of this demonstration project, carried out in collaboration with the Department of Primary Industry and Resources, South Australia, has led to the use of HyMap imagery to monitor other abandoned mine sites.

## MINERAL PROCESSING AND METAL PRODUCTION SECTOR

### PLANNED SECTOR OUTCOME

***Lower operating costs, improved process efficiency, intensity, and product quality in the mineral processing and metal production industries.***

#### INDUSTRY CONTEXT

This Sector transforms as-mined, mineral ores to mineral products, chemically processed minerals, and refined and unrefined metal.

The Sector has demonstrated a high appetite for technology, and Australian industry over the years has been a receptive developer and adaptor of technologies. It currently operates against a backdrop of increasing globalisation, erosion of in-house research capability, and the need to process more complex, often lower-grade ore bodies in the face of declining commodity prices and lower profitability. Pressure for 'sustainable' processing will continue to grow — with implications for greenhouse gas reduction, recycling and zero waste processes and the social impacts of mining and processing.

Commodity prices are depressed, in part due to the Asian economic crisis, and this is placing pressure on companies to use new technologies to reduce operating costs and to maximise return on assets in the short to medium term. Demand will pick up as the global economy improves, but real prices are predicted to decline over the longer term, underpinning the call for continuing innovation. There is a window of opportunity for Australian minerals technology as downsizing in North America and Europe continues. Amalgamations and take-overs have produced a small number of large trans-nationals although a large number of medium sized processing companies are poised to play an increasing role in the future.

The technology needs for this Sector are:

- process intensification, simplification and optimisation;
- increasing the degree of asset utilisation to lower capital and operating costs;
- strategies and practices that will lead to sustainable mineral processing, including increased recovery of valuable components and reduced waste and greenhouse emissions;
- processing lower grade, complex, impure and difficult-to-treat deposits;
- integrated 'manufacturing-style' systems to optimise the flow of materials to market.

## CSIRO'S STRATEGIC RESPONSE

In response to these identified needs, CSIRO research is focusing on:

- strategies and technologies for sustainability, to assist industry meet economic, environmental and social expectations;
- technologies for process improvement;
- techniques to increase asset utilisation, including monitoring and control;
- techniques for difficult-to-treat ores;
- technologies for mining and mineral processing in 2010;
- technologies for differentiating Australia's commodities to increase export competitiveness;
- establishment of new light metal industries based on aluminium, magnesium and titanium;
- development of enabling technologies in chemical, biochemical, physical, mathematical and engineering disciplines for access by industry.

## RESEARCH OUTCOMES

***Pilot plant produces flame-retardant magnesium hydroxide.*** Using a process developed by CSIRO, the Flamemag International GIE pilot plant located at CSIRO Clayton has produced over ten tonnes of magnesium hydroxide over a six month period. Operation over this timeframe has allowed the development of comprehensive design data for a full-scale production plant, and the magnesium hydroxide produced is now undergoing worldwide market evaluation.

***Alumina analyser for iron ore slurry.*** CSIRO, with the support of Hamersley Iron, has developed and successfully tested an on-stream analyser. The analyser continuously monitors the levels of alumina in iron ore slurry solids, prior to their being pumped into wet high intensity magnetic separators (WHIMS). The analyser can be used to optimise the operation of the WHIMS and improve their efficiency, allowing improved product recovery and quality.

***Characterising Australian iron ores.*** CSIRO has successfully developed software to assist iron ore mining companies operating in Australia. Information obtained about a variety of iron oxide and gangue minerals in iron ore samples using optical microscopy is assessed by the software, which then produces data about the optimum grind size and likely downstream processing performance of the ore. This enables assessment of possible flowsheet options, prior to committing to expensive laboratory and pilot scale test work.

*Increased access to million dollar microscopes.* From their own desktop computers, metallurgists and material engineers can now use a microscope thousands of kilometres away, via TelePresence Microscopy (TPM). CSIRO has adapted the concept of TPM from a system used by the US Department of Energy, improving data security and adding interactivity and speed to build a TPM system unique in its power in Australia. Australian mining companies will now be able to access microscopy facilities at CSIRO Clayton from remote locations with ease and confidence, achieving greater efficiencies and reduced costs.

## PETROLEUM SECTOR

### PLANNED SECTOR OUTCOME

***An internationally competitive, profitable and environmentally sustainable Australian oil and gas industry operating with high standards of occupational health and safety.***

### INDUSTRY CONTEXT

The oil and gas sector accounts for production of more than half of Australia's energy needs and therefore has a direct influence on the competitiveness of industry and on the community. Australia is gas rich, though most is remote from markets; gas will grow to 28 per cent of total energy needs by 2010. Oil is set to decline from 80 per cent of self-sufficiency in the absence of further significant discoveries. Oil and gas prices are expected to remain approximately at current levels for the next few years. Petroleum exploration remains high, despite downturn in other parts of industry expenditure.

The key drivers for the industry are:

- to improve the Australian exploration performance. Increased resources and competitive finding costs are pre-requisites for the long-term performance of the petroleum industry;
- to improve the financial viability of the Australian petroleum industry through technology improvements. There is a focus on increased productivity from investments, especially drilling and offshore facilities, in the face of a flat price outlook and with operations in increasingly deeper water further offshore;
- to minimise the impact on Australia's marine environment;
- to maximise value to Australia from its oil and gas resources. This requires capture of the value of natural gas resources (with the associated opportunity of a growing gas industry), and increasing the fraction of the total oil-in-place that can be economically produced;
- to accommodate the greenhouse gas mitigation requirements associated with the Kyoto protocol to maintain a viable industry.

The focus of the industry is on offshore north-west Australia and this is anticipated to continue for several decades.

## CSIRO'S STRATEGIC RESPONSE

R&D aimed at meeting the challenges of the key industry drivers includes:

- increasing petroleum reserves and the success rates of exploration;
- increasing the quality of appraisal and field development of reserves;
- cutting costs and increasing returns from drilling;
- developing better data integration, risk and uncertainty technologies to improve business decisions taken in an uncertain environment;
- extracting increased value from gas production and processing;
- enabling economic flow rates from 'tight'/low permeability reservoirs;
- developing options for storage or disposal of carbon dioxide produced by gas production and processing;
- enabling sustainable disposal of drilling and production waste;
- predicting extreme ocean conditions as input to the design of offshore facilities.

## RESEARCH OUTCOMES

*Abnormally high pressures.* A research program to predict abnormally high pressures in potential reservoir rocks has been initiated by CSIRO. The program is managed within the Australian Petroleum Research Cooperative Research Centre with the participation of three industry sponsors, Schlumberger, Japan National Oil Corporation – Technology Research Centre (JNOC-TRC) and the West Australian Petroleum Pty Ltd (WAPET). A specific prediction project was carried out in partnership with WAPET and Schlumberger that investigated the risk and uncertainty of overpressure in a potential drilling prospect in the North West Shelf. The outcome reported by WAPET provided a significantly reduced perception of risk for the whole permit, with a 30 per cent reduction in the expected drilling costs for four wells, saving $30 million, and consequently increasing the whole permit value.

*Drilling systems.* A database for managing drilling sites with multiple clients has been successfully completed and is being marketed and used on a global basis. The technology highlights actions that will help reduce drilling costs. Apache Energy and Santos are using CSIRO's technology in prospects in Australia.

*Hydrodynamic database for the North West Shelf.* A reliable, comprehensive and quality-controlled database has been developed, containing information about pressure features and hydrodynamics throughout the entire North West Shelf. The data will be used to assess petroleum reservoirs in fractured rock. The North West Shelf fault seal integrity and hydrodynamics study is sponsored by 14 petroleum companies, the Australian Geological Survey Organisation (AGSO) and the Minerals and Energy Research Institute of Western Australia (MERIWA). The database is being used by several petroleum companies operating in the North West Shelf.

*Maintenance of exploration and production wells.* Drilling fluid design methodology has been developed by CSIRO and used successfully to complete new wells. Cost reductions in excess of $50 million have been achieved. The technology will be incorporated into 'A Driller's Wellbore Stability Tool' that is being developed for operating companies in a consortium project. This Tool evaluates wellbore stability in terms of mechanical, drilling fluid-shale interaction, and thermal mechanisms, and finds solutions to overcome the problems.

*Hydraulic fracturing in mining.* Hydraulic fracturing was introduced by CSIRO at an underground coal mine on the Central Coast of New South Wales as a method to control caving events. The mine was under the threat of closure because of safety and profitability issues. Because of the dangers to workers, waiting for natural cave-ins was a significant risk. Hydraulic fracturing has allowed the mine to continue to operate safely and profitably by introducing a means of controlling the timing of caving events. Hydraulic fracturing was also introduced as a new method to induce caving in hard-rock block caving operations, and patents on the process have been granted in Australia, South Africa, and the US, with patents pending in Chile and Canada.

*Micro-scale kinetics analysis.* CSIRO has developed a new analytical procedure to enable a better understanding of how oil is generated, using milligram amounts of source rocks. The 'micro scale closed system' kinetic analysis procedure measures the rates at which oil is generated from potentially fertile source rocks. The CSIRO method bridges a gap between more conventional techniques and will provide a more accurate assessment of oil generation from Australian source rocks.

*Oil inclusion geochemistry.* CSIRO, in collaboration with the Australian Geological Survey Organisation (AGSO), has applied MCI (molecular composition of inclusions) technology to assessing the prospects and the history of levels of hydrocarbon in the Southern Margin frontier area of the Great Australian Bight. The technology has produced samples of pristine oil trapped in inclusions, providing reliable evidence of palaeo-oil composition in the Jerboa-1 well. Previously, the more conventional technique of solvent extraction of oil from sandstones from the same interval was contaminated by indigenous, immature organic matter, yielding ambiguous results. These cleaner samples give the industry a better understanding of the potential of this South Australian site.

*Gas outburst modelling.* Conditions that permit outbursts of gas in mining sites are a significant safety risk. CSIRO, with support from BHP Coal, Shell Coal and the Australian Coal Association Research Program, has developed a new, computer based-model that simulates the evolutionary mechanisms of gas outburst. The model enables a quantitative analysis of outburst factors, including coal deformation and failure under stress, the formation of free gas in coal fractures, and changes in permeability flow conditions. The analysis provides a tool for improved assessment of outburst risk for a range of mining conditions. It is being used to investigate the setting of appropriate safety standards without reducing levels of mine production.

*Australian flowmeter for North Sea Oil.* Kvaerner Oilfield products, licensees of a CSIRO-developed multiphase flowmeter, has been awarded the contract to supply a meter for the Texaco expansion in the UK North Sea. This is the first commercial sale of the meter, which monitors the flows of oil and water in pipes.

# ENVIRONMENT AND NATURAL RESOURCES

## BIODIVERSITY SECTOR

### PLANNED SECTOR OUTCOME

***Improved understanding of biodiversity and other resources applied to deliver economic, social and environmental benefits from sustainable natural resource-based industries.***

### INDUSTRY CONTEXT

With the demand for environmental solutions never stronger — driven by national policies and regulations and by substantial international factors, including trade — biodiversity is a key Sector in both public good and private benefit terms. Sustainability requirements identified by many Sectors require knowledge and skills with a biodiversity base.

There is a growing recognition of the range of values and uses of biological resources. Economic benefit stems from direct use of species for their products, such as trees for timber, and indirect use of others that support ecosystem functions, such as micro-organisms cycling soil nutrients. Tourism is a major and growing economic asset that is substantially based on visitors experiencing Australia's biodiversity.

There is a considerable range of providers of biodiversity related research in Australia but few focus on the large-scale issues that CSIRO's breadth of skills allows it to do particularly well.

### CSIRO'S STRATEGIC RESPONSE

CSIRO is active at the generic, regional and national levels, providing overviews and conceptual and organising frameworks that benefit from, and are complementary to, work in other organisations. CSIRO has an advantage in being able to integrate its research in this Sector with that in its other environment Sectors, its production Sectors, and with other research organisations, to give balanced ecological approaches.

The most significant areas for attention include:

- knowledge and informatics;
- ecosystem sustainability;
- regional and national sustainability;
- conservation and use;
- pests, weeds and diseases;
- sustainable tourism;
- ecological risk assessment of genetically modified organisms.

### RESEARCH OUTCOMES

*Biodiversity protecting citrus orchards from thrips.* Encouraging a variety of plants in the ground cover of orchards in South Australia will save growers millions of dollars in the form of free pest control. CSIRO research with farmers in a Natural Heritage Trust project has shown that a diverse range of plant cover provides good habitat for natural enemies of Kelly's Citrus Thrips, which infect the orchards' soil. Damage by thrips causes losses of $6 million each year in export value of navel oranges from the Riverland and Sunraysia regions alone. Using this form of pest control will also save orchard owners the costs of spraying for the thrips.

*Communities plan their future.* Communities in the Goldfields region of Western Australia have received a series of land use plans developed with technical assistance from CSIRO and the Western Australian Department of Agriculture, and financial assistance from the Land and Water Resources Research and Development Corporation (LWRRDC). The plans identify the extent to which competing land uses are compatible with each other. Conducting negotiations among the different sectors has allowed the growth of a common vision for future land use in the region, which will continue to evolve over time.

*Fire in the top end.* CSIRO has gained new insights into the impact of fire on biodiversity in northern Australia. The study shows that biodiversity is influenced more by whether or not fire occurs, rather than by the season in which it happens. Current fire management practices aim to conduct extensive burns early in the dry season, to reduce the amounts of available fuel and the intensity of fires later in the season. However, CSIRO has found that reducing the extent of this burning should be better for biodiversity conservation as the damage incurred is less significant, even if occasional large wildfires appear more destructive. This message is being conveyed to fire managers in the region.

*Bitou bush biting the dust.* CSIRO, with its partners in the Cooperative Research Centre for Weed Management Systems, has released two bugs to help reduce the environmental damage done by bitou bush. The bugs are eating their way through the whole range of the weed; the seed fly, *Mesoclanis polana* is now found from Rainbow Beach in Queensland to Tathra in southern New South Wales, causing seed losses of up to 40 per cent. The defoliating moth *Tortrix sp.*, that regularly kills whole plants in its native South Africa, has recently been released after several years of detailed work on its behaviour and specificity. Monitoring the impact of these insects will continue.

## CLIMATE AND ATMOSPHERE SECTOR

### PLANNED SECTOR OUTCOME

***Sustainable management of the atmosphere and of those parts of the economy and community that are sensitive to the climate system.***

### INDUSTRY CONTEXT

The Sector covers the economic, social and environmental impact of weather and climate, as well as the effect of economic and social activities on climate and the atmospheric environment. Key issues are human environmental impacts such as urban and regional air pollution, stratospheric ozone depletion and greenhouse/climate change. Also covered are natural phenomena such as climatic variability (drought), tropical cyclones and the impact of and responses to climate variability and climate change.

The UN Framework Convention on Climate Change, the National Greenhouse Strategy, and Australia's obligations under the Kyoto Protocol are major drivers for this Sector. CSIRO works very closely with the Australian Greenhouse Office and with a growing range of State and private sector organisations in need of climate and greenhouse-related advice and/or solutions to problems.

Other drivers are the Montreal Protocol on Ozone Depleting Substances, the National Environment Protection Measure (NEPM) for Air, drought exceptional circumstances policy, and the need for solutions for sustainable management of Australia's environmental resources.

CSIRO is the largest provider of climate and atmosphere-related research in Australia (and the Southern Hemisphere). It works closely with and complements the research activities of the Bureau of Meteorology, Cooperative Research Centres and universities, and State Agencies such as the Queensland Centre for Climate Applications.

## CSIRO'S STRATEGIC RESPONSE

CSIRO is tightly tied into the domestic and global policy development processes and with the major players in them. The Sector's strategy has the following key elements:

- capitalise on the last decade of investment in climate process and modelling research;
- further improve forecasting abilities;
- underpin Australia's position with respect to the Climate Change and Ozone Protocols, in particular seeking solutions in the biosphere for managing carbon emissions;
- provide air quality forecasting technology and seek to strengthen knowledge of the relationship between air quality and human health;
- provide scientific input to the development of public policy in this area;
- support the Australian Government in its negotiation of climate agreements bearing in mind their potential impact on Australia's economy and social situation;
- maximise the effectiveness of national expenditure on climate research by collaboration and communication with key stakeholders.

## RESEARCH OUTCOMES

***International climate change science reviews.*** CSIRO scientists are making major contributions to a range of international science reviews, particularly those commissioned by the *Intergovernmental Panel on Climate Change*. This includes preparing special reports on the impact of aviation, and on land-use change and forestry. The participation demonstrates the international standing of Australian research, and highlights Australia's commitments under international treaties. The research results will contribute to a greater understanding of greenhouse science, and assist in the further formulation of Australian policy in this area.

***Greenhouse mitigation.*** CSIRO research into ways of reducing levels of emissions of methane produced by agricultural stock has resulted in the development of a prototype vaccine. Using sheep as a model, appropriate vaccine formulation, protocols, and suitable feed additives have been developed. CSIRO is

now preparing to evaluate the effectiveness of the prototype vaccine on farm animals to determine production responses.

*Air pollution.* A major multi-agency consultancy in partnership with ERM Ltd for the Environment Protection Department of Hong Kong is nearing completion, and has led to the development of a new air pollution model by CSIRO. The new model is easy to use, and has been well received by independent experts.

## LAND AND WATER SECTOR

### PLANNED SECTOR OUTCOME

***Sustainable use of Australia's land and water resources.***

### INDUSTRY CONTEXT

The Land and Water Sector is focused on the ecological, economic and social issues that underpin sustainable regional development and long-term management of the Australian landscape. The key focus is on delivery of large scale solutions to major national natural resource management problems.

The Sector's core agenda is to develop an in-depth understanding of natural and managed ecosystems across a range of scales and to determine solutions that minimise the impact of human activity on the function and health of terrestrial and aquatic environments. The Sector has developed strategic links to environmental policy units, local, State and Commonwealth Governments, agribusiness, water, mining and manufacturing industries, and community-based land management groups.

### CSIRO'S STRATEGIC RESPONSE

The Sector's strategic direction is increasingly at a broad 'landscape' scale and directed to system-wide issues. There is a particular focus on capabilities for big, interdisciplinary studies at larger scales on complex issues. Research will be focused on:

- landscape scale systems understanding and the development of systems models to predict the impact of management practices on ecosystem function, productivity and restoration of landscapes;
- water quality and quantity, the impact of climate variability on water management, and the impact of Council of Australian Governments (COAG) water reforms on water allocation and environmental flows;
- increased water use efficiency in irrigated agriculture;
- solutions to dryland and in-stream salinity management and rehabilitation of saline areas;
- land management impacts on river and storage water quality and coastal/estuarine environments;
- land atmosphere interactions, carbon cycling;
- contaminant behaviour in groundwater, aquatic and terrestrial environments: risk assessment, ecotoxicity, remediation/rehabilitation;
- socio-economic impacts of environmental management practices;
- design of environmentally benign agricultural production/management systems.

## RESEARCH OUTCOMES

*Sydney Catchment Audit*. A CSIRO team carried out a risk assessment of the Sydney region water supply catchments for the Sydney Catchment Authority (SCA). The final report led to some major reassessments of policy and practice; in particular preparation of a new regional environmental plan and the granting of increased regulatory powers to the Sydney Catchment Authority. A $9 million project to upgrade the Upper Canal is proposed and a total of $153.5 million is being spent building new or upgrading existing sewage treatment plants.

*Climate variability*. It is now widely accepted that rainfall patterns and catchment hydrology in Australia are significantly different from all other regions and continents, with the partial exception of part of southern Africa. Rainfall variability is very high in almost all regions in respect to amount and the lengths of wet and dry spells. CSIRO has developed a downscaling model that has been extrapolated from global climatic models and applied at a regional scale. It has been successfully applied to rainfall data over the 1958-1998 period for south-western Western Australia. This has improved CSIRO's ability to incorporate the effects of climate variability for water resource modelling.

*Protecting the irrigation food bowl of Australia*. CSIRO research and delivery has contributed substantially to irrigation water management and irrigated area management. Australian irrigated agricultural production is worth $6 billion at the farm gate, with processing and manufacturing amounting to $24 billion. Murray Irrigation Ltd, using information from the Salt Water and Groundwater MANagement series of computer models (SWAGMAN) developed by CSIRO, has adopted a policy of limiting irrigation intensity on a farm. This is a world first application of this knowledge and has resulted in improved water use efficiency and environmental maintenance.

*Pesticide impacts work attracting world attention*. A computer modelling technique developed by scientists at CSIRO to reduce the impact of agricultural pesticides on rivers, lakes and groundwater is attracting world attention. The PIRI (Pesticide Impact Ranking Index) model helps farmers and regulators minimise the chances of a chemical pesticide ending up in the local water supply. The International Atomic Energy Agency (IAEA) in Vienna has expressed interest in the model, which is already used in Malaysia, Thailand and Ecuador. PIRI calculates the likelihood of a pesticide moving into groundwater by predicting the toxicity, chemical properties, application and frequency of pesticides used, and then factors in seasonal and soil variables. Companies using PIRI should achieve reductions in the levels of pesticides used in agriculture.

*Predictive modelling of copper concentrations in the Fly River, Papua New Guinea*. A computer model has been used in a recent ecological risk assessment conducted by Ok Tedi Mining Limited to predict the impact of future mine operations on the river system. The model has been developed by CSIRO to predict dissolved copper concentrations in the Fly River system downstream of the Ok Tedi copper mine. The model development is an extension of detailed process-based studies conducted by CSIRO over the last seven years to understand the factors governing the fate, transport and bioavailability of copper in the Fly River.

*Contaminated sediments and sediment quality*. New assessment approaches are being applied in studies of sediment contaminants at a range of sites across the country, including Sydney Harbour. CSIRO is conducting the work as part of the Australia/Germany Alliance for Managing Contaminated Sediments, which is partly funded by the federal Department of Industry, Science and Resources. The CSIRO team is

conducting research into the links between measured metal contamination and the impacts on aquatic organisms. Chemical studies of metal mobilisation processes revealed deficiencies in currently accepted chemical predictors of biological effects. To validate these, new bioassays for sediment toxicity have been developed based on benthic algae. Such studies are leading to more reliable sediment guidelines as well as allowing more meaningful evaluations of options for remediation.

*Monitoring vegetation and dryland salinity*. Land monitoring information products have been developed by CSIRO that provide maps of changes in salt-affected land and in perennial vegetation. The Land Monitor Project is a large-scale, operational project in which CSIRO, in collaboration with State agencies, is producing land monitoring information products covering the entire south-west agricultural region of Western Australia, which is drastically affected by salinity. The project is supported by six State agencies under the Western Australian Salinity Action Plan, and the National Heritage Trust. Information generated by the project is distributed to State agencies and is widely available.

## MARINE SECTOR

### PLANNED SECTOR OUTCOME

***Improved knowledge of the resources, systems and processes of Australia's exclusive economic zone (EEZ) applied to their exploration, exploitation and sustainable management.***

### INDUSTRY CONTEXT

Research in the Marine Sector is relevant to economic and environmental activity in Australia's marine territory, one of the world's largest marine jurisdictions. We have an obligation to understand, preserve and utilise the vast potential wealth of our ocean territory in a responsible and sustainable manner.

Our oceans are a public domain, with many activities competing for access. Pressures on the ocean from land and offshore activities are considerable, and increasing. Economic, environmental and public good considerations can only be balanced through a combination of fundamental research into ocean processes and ecosystems, and development of robust techniques for assessing and mitigating the risks to ecological integrity that stem from human use.

Australia's Ocean Policy (issued in December 1998) is premised on an ecosystem approach to planning for multiple uses of the marine environment. The associated Marine Science and Technology Plan (released in June 1999) identifies national research priorities and forms the basis of an integrated national marine research strategy. Both are strong drivers of work in the CSIRO Marine Sector.

### CSIRO'S STRATEGIC RESPONSE

Given the recent, strongly articulated Australia's Oceans Policy, the Sector's strategic response is to focus on the research required to meet those national goals, which are both environmental and economic. The Marine Sector has identified the following as priority areas for the next three years:

- exploring the Exclusive Economic Zone and supporting multiple-use marine management, specifically around south eastern Australia as part of Oceans Policy implementation, and on the North West Shelf in collaboration with the Western Australian State Government;

- catchment-to-coastal zone integrated research, specifically in the context of the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, and through other large collaborative studies such as the Ord-Bonaparte program;
- climate impacts in the marine environment, responding to a growing demand for detailed regional application of the climate predictive capability developed by CSIRO and the Bureau of Meteorology over the last few years.

The challenges we face as custodians of the world's largest and most diverse Exclusive Economic Zone are daunting in scope. Collaboration and co-investment are key elements of our strategic response. This Sector is the largest provider of marine research in Australia and in the Southern Hemisphere. In that leadership role, we work from the conviction that Australia needs all of its (widely distributed) players to work together if we are to have any hope of making a dent in those challenges. We also play a crucial international role as the regional leader for international programs.

We co-invest in research with industry and Government, in order to get to more effective and comprehensive outcomes than a straight purchaser-provider arrangement allows, and to remove major obstacles in the path to adoption. The newly-identified priorities push us into areas where co-investment has been absent in the past, but where needs and opportunities have been identified.

## RESEARCH OUTCOMES

*The Strategic Research Fund for the Marine Environment (SRFME)*. The value that CSIRO's strategic marine research can deliver to marine managers has been demonstrated by the establishment of an important joint venture partnership with the Western Australian government. The new 'Strategic Research Fund for the Environment' will run for 6 years and will determine the role that CSIRO should play in delivering marine research to the State.

*Seagrass review*. A comprehensive examination of the state of Australian seagrasses and their vital role in marine ecosystems was completed for the Fisheries Research and Development Corporation (FRDC). The report recommends a program and priorities to stop seagrass loss, enhance and restore seagrass ecosystems and establish the link between seagrass and fisheries.

*Coastal prawn farm pollution*. A three year study was completed with the Aquaculture Cooperative Research Centre, and financial support from the Fisheries Research and Development Corporation, into preventing pollution from coastal prawn farms. It has resulted in a system to manage and eliminate polluting effluents. It is likely that the new system will play a major role in the establishment of new farms and in the future framing of regulations.

*Marine pests in Port Phillip Bay*. A five year study of marine pests in Melbourne's Port Phillip Bay was completed. The report, the most comprehensive of its kind in the world, examined in detail the distribution, abundance and sources of exotic species in the Bay. The information it contains will be used to develop better management plans for reducing the impact of marine pests in the Bay.

*Huon Estuary study*. A three year study of the Huon Estuary in Tasmania, the major location for salmon aquaculture in Australia, was completed with the Tasmanian Aquaculture and Fisheries Institute. Funded by the Fisheries Research and Development Corporation, the study provides valuable insights into the cycling

of nutrients, the links between nutrients and algal blooms, and the impacts of aquaculture. The project provides a more complete understanding of the working dynamics of an estuarine system affected by aquaculture, agriculture, industry, forestry, and tourism. It will be used as a basis for decisions on the management of the estuary.

*Sustainable development of Southern Bluefin Tuna.* CSIRO provided the scientific documentation underpinning Australia's case in the dispute with Japan over Japan's failure to cooperate in the conservation of Southern Bluefin Tuna. The International Tribunal on the Law of the Sea granted Australia provisional measures to stop Japan's experimental fishing program for Southern Bluefin Tuna.

*Managing bycatch.* The final report of a five year study funded by the Fisheries Research and Development Corporation on the ecological sustainability of bycatch and biodiversity in prawn trawl fisheries, is having a substantial impact on the management of tropical prawn trawl fisheries. The approaches and methods developed in the study are being applied in the Northern Prawn Fishery and CSIRO has been requested to apply them to the Queensland East Coast Trawl Fishery and the Torres Strait Prawn Trawl Fishery.

*Independent review of CSIRO's fishery assessment models.* An independent review by the Torres Strait Fisheries Assessment Group has concluded that CSIRO's advice is helping lead to better fisheries management in that region. The review strongly endorsed CSIRO's advisory activities and the continued development of CSIRO's Torres Strait Tropical Rock Lobster fishery assessment model and supporting research. The review followed CSIRO advice that the fishery is possibly biologically over-exploited.

*Predicting productive areas for prawn spawning.* A software tool has been developed that uses information about ocean currents and tidal movements in the Gulf of Carpentaria to predict recruitment into the most productive prawn spawning areas. Funded by the Fisheries Research and Development Corporation, the tool will allow better management of the Northern Prawn Fishery by identifying the areas that need protection to maintain a healthy fishery, and the areas that can remain open to fishing without having an impact on future stocks.

# AGRIBUSINESS INDUSTRIES

## FIELD CROPS SECTOR

### PLANNED SECTOR OUTCOME

***Increased profitability for producers, marketers and processors, an increased range of differentiated quality plant products, and reduced chemical usage in production and postharvest systems.***

### INDUSTRY CONTEXT

The prospects for growth in the Sector industries, both in commodity quantity and in product quality differentiation, are high. Currently, the Sector is in a healthy condition despite depressed commodity prices. Moreover, increasing demand for food and food products on a global scale and in particular in markets targeted by Australian agricultural and food industries, is assured.

However, a major problem facing the cropping industries is the existing and further potential loss of prime production land through increasing salinity and acidification. Research has paved the way for major improvements in management practices in all of the cropping industries to help solve this situation.

Industry has recognised that CSIRO's research is playing an increasingly important role in the Sector as in recent years the State Departments of Agriculture have progressively down-sized their research capacities and emphasised their roles in regulatory affairs. The CSIRO response has been to increase collaborative research programs with the State Departments, particularly in on-farm operations, and to increase collaborations with a growing number of elite farmer groups, ensuring rapid adoption of research into practice.

### CSIRO'S STRATEGIC RESPONSE

Ecologically sustainable cropping systems research will have high priority in the Sector and is a major area of cross-Sectoral importance. Also of high priority is pest research, from mice in crops to insects in stored grain.

Gene technologies will be of major importance for cropping industries of the future, but a key strategy in our research is to develop technologies that will bridge the transition between current conventional breeding and transgenic breeding of the future.

Gene technologies have opened the way for new approaches into the control of fungal pathogens in our crops, currently a limiting factor in the growth of the grain legume industries. Protein, starch and fatty acid composition of grains for the food chain can now be specific objectives in plant improvement programs.

There are new opportunities for the sugar and cotton cropping industries in 300 000 irrigated hectares of Western Australia, Northern Territory and Queensland. These expansions are strongly dependent on CSIRO's high technology management and breeding research and on its capacity to design farming systems that meet government and consumer expectations about sustainability.

## RESEARCH OUTCOMES

*Expanding global agribusiness for Australia*. CSIRO has found a genetic 'promoter' that will improve Australian agricultural production and provide access to both export markets, as well as to other vitally important proprietary research technology. A promoter is a DNA switch responsible for turning genes on and off, and controlling the gene's work area and level of activity. Much of the current gene technology research in plants uses one promoter that is owned overseas. CSIRO scientists have found a 'suite of promoters', which works as well as, and in some cases better than, the overseas version. CSIRO and RhoBio, an international organisation specialising in the plant biotechnology of field crops, have formed a strategic research alliance to collaborate in agricultural biotechnology, centred around this technology.

*Picking winners using gene technology*. Using a DNA marker, a kind of 'flag' that marks a particular characteristic, CSIRO scientists have been able to reduce the time needed to select wheat plants that resist cereal cyst nematode, and speed up the normal breeding process. This use of gene technology does not involve transferring genes from any other species. It means farmers can have better crop varieties much sooner, helping to keep them world competitive. The research has been funded by the Grains Research and Development Corporation.

*Genomics for sugarcane improvement*. A total of 5 800 unique sugarcane gene sequences expressed in stems and roots have been identified. A number of sequences from mature stems have unknown functions and are likely to be a good source of novel genes that play an important role in sugar accumulation. Their novelty will allow the use of the genes to be protected through patents, securing them for the Australian industry.

*New alliances with agribusiness*. The FARMSCAPE project has achieved industry acceptance with strong demand from agribusiness companies to participate in and pay for this CSIRO managed training and accreditation program. The program, supported by CSIRO and the Grains Research and Development Corporation, in consort with State agencies in APSRU (Agricultural Production Systems Research Unit), transfers monitoring and modelling skills and tools to agribusiness groups engaged in providing on-farm management advice in dryland farming systems.

*Booklice in stored grain*. A national survey of the distribution and pest status of booklice in grain storage has been completed by CSIRO, in collaboration with bulk handling companies and state departments. The survey shows that booklice is now a major pest throughout Australia, and that different species are present in different regions. An integrated system for booklice control has been proposed.

*Biological control of take-all*. A soil-borne fungus, originally isolated by CSIRO, that can control take-all disease in wheat, has been formulated and tested in joint research sponsored by the Australian Centre for International Agricultural Research (ACIAR). The system has already been sold in China, and other commercialisation activities are underway.

*Rodent management strategy*. The CSIRO Rodent Group, together with colleagues from South East Asian countries, has developed strategies for managing rats in rice agro-ecosystems. The outputs of this ACIAR-funded project form the nucleus of a national rodent management strategy developed for Indonesia in early 2000. This strategy was developed and adopted, following a specific request from the National Farmers' Association of Indonesia.

## FOOD PROCESSING SECTOR

### PLANNED SECTOR OUTCOME

***Increased international competitiveness and export development of the Australian food processing industry with improvements in nutrition and food safety.***

### INDUSTRY CONTEXT

The processed food industry is the largest manufacturing sector in Australia, with annual turnover of approximately $44 billion. It comprises over 3 500 firms of varying size and employs one in five of the manufacturing work force. It sources more than 90 per cent of its ingredients from the Australian agricultural sector and serves export and national markets, with export growth of approximately 11 per cent per annum for the last eight years.

The 'participation rate' by food companies in R&D has been low historically, but this is changing significantly in response to a market place in which innovation plays a key role. CSIRO continues to play lead roles for public and private R&D for the sector.

The primary R&D drivers for the sector in the medium term are:

- *globalisation of markets and R&D* - driving competitiveness in domestic and export markets;
- *consumerism* - increasing demands for sustainably produced, safe, wholesome, convenient and affordable quality food products with health benefit attributes;
- *technology domination/transfer* - advances in other disciplines (eg information technology, nutrition and health sciences) incorporated in food products and processes; and
- *international and domestic regulation and policy* - affecting food composition, production and manufacturing systems and food labelling, for example health claims.

### CSIRO'S STRATEGIC RESPONSE

CSIRO research will focus on:

- innovations to food product ingredients through developing new materials and improving their quality and functionality;
- developing efficient product manufacture and delivery systems;
- methods and strategies to improve the safety of food;
- identifying foods with specific health attributes and developing public information programs; and
- understanding consumer demands and preferences for food products.

## RESEARCH OUTCOMES

*Prevention of tooth decay*. A process for manufacture of a new peptide ingredient – Recaldent™ – has been developed by a team from Melbourne University, CSIRO-Food Science Australia and Bonlac Foods Ltd. This functional ingredient has been incorporated into a sugarless chewing gum available in North America and parts of Europe. The peptide product helps prevent tooth decay by rebuilding the teeth's mineral coating, and fights the effects of acid in the mouth.

*Folate bioavailability from wheat aleurone*. A wheat aleurone flour, (*Nature's Gold*), developed by Goodman Fielder Ltd, has been shown to contain a significant level of the B-group vitamin folate. Clinical studies conducted by CSIRO have shown that the folate in *Nature's Gold* is easily absorbed by the body, so that the Recommended Dietary Allowance of folate can be met by consuming 100g of the product. This work has led to a number of significant commercial developments with the potential to improve public health.

*Delivering improved quality wheats*. CSIRO and the Quality Wheat Cooperative Research Centre have developed a simple test to detect rain-damaged wheat that can be carried out by farmers in the field. The test uses antibodies and a simple card to detect proteins that are produced in wheat grain when rain falls on the crop during the final stages of grain ripening. The test allows farmers to segregate damaged from undamaged wheat, and provides grain handlers and processors with greater assurance that the wheat being used in food production is of good quality. The system has now been licensed for use in Australia and internationally.

*New honey industry HACCP manual.* A Hazard Analysis Critical Control Point (HACCP) Manual was developed by Food Science Australia for the Australian Honey Industry. This work was sponsored by Capilano Honey to improve the quality control of its products. The manual has been embraced by the industry and has also achieved Australian Quarantine Inspection Service compliance for export conditions for that product.

*Extension to industry of methodology for optimisation of cheese yield*. In a Dairy Research and Development Corporation supported project, a methodology has been devised by CSIRO for optimising cheese yields within large production plants. Based on measures of mass and composition of milk, whey and cheese, and predictive yield formulae, the method provides a daily index of the efficiency of converting milk solids into cheese, and the means for identifying sources of loss. The methodology has been incorporated in a course offered to cheese companies in conjunction with the University of Melbourne. One large manufacturer has indicated savings of up to $600 000 per plant by fully adopting this new philosophy and methodology.

*A new process for manufacture of whey protein isolate*. A novel process for the manufacture of a whey protein-based food ingredient has been successfully trialed. The process has been incorporated into a commercial-scale plant to manufacture the new ingredient. The process results in a differentiated whey protein isolate, and it has created a new and lucrative export business for Australia because almost all production from the plant will be exported. The product is targeted at the lucrative nutritional foods market.

*Phytosterol-enriched margarines*. In a comprehensive study of 90 men and women with mildly elevated cholesterol levels, CSIRO showed that both high and low fat margarines supplemented with phytosterols reduced the harmful LDL cholesterol by about 9 per cent. This could reduce heart disease rates by 12-18

per cent in the long term. The study also showed that the fall in plasma levels of the fat soluble vitamin beta carotene, which occurs frequently with consumption of the phytosterol margarines, could be easily overcome by increasing the number of serves of fruit and vegetables to five per day.

*New and improved food processes.* A wide range of exciting new and improved food processes have been developed. In one project, a pilot plant process has been developed to produce reformed meat with good texture from low quality meat using extrusion technology. These products have good potential in catering and fast food markets in Australia, and excellent prospects in Asia where similar fish based products are well established. Another project run in conjunction with the Food and Packaging Cooperative Research Centre has developed and validated a model for predicting the quality of bread for different operating conditions in a batch oven. This work has led to the development of a model for a continuous oven, which is needed for optimising oven operations to produce better quality bread more cost effectively.

*A natural antioxidant product.* The positive health benefits of consuming high levels of antioxidant vitamins and carotenoids, typically contained in a diet of fresh fruit and vegetables, has recently been promoted widely in the community. CSIRO and Food Science Australia have conducted research in which a specially formulated, spray-dried extract of fruit and vegetables was consumed by participants, in conjunction with a diet low in fruit and vegetables. The results showed an increase in the levels of plasma concentration of antioxidant vitamins and carotenoids in the participants' bodies, consistent with eating 5-7 servings of fruit and vegetables a day. These results are expected to lead to the development of novel food products that will supply antioxidants to population groups with low intakes of fruits and vegetables.

*New dairy ingredients with enhanced physical functionality.* New technologies for lower-cost formulation of yoghurt and dairy desserts, calcium fortification of dairy products and manufacture of high-fat powders have been developed by Food Science Australia and are in various stages of commercialisation.

*Foundations for improved storage and transport.* Software for modelling heat and mass transfer in food storage and distribution has been developed and implemented in a range of industry supported projects. Experiments have been undertaken to determine heat and mass transfer in export and domestic food distribution during actual shipments, as well as in simulated and controlled laboratory conditions.

## FORESTRY, WOOD AND PAPER INDUSTRIES SECTOR

### PLANNED SECTOR OUTCOME

***Enhanced international competitiveness, market focus and sustainability of Australia's forestry, wood and paper industries.***

### INDUSTRY CONTEXT

The Forestry, Wood and Paper Industries Sector includes all stages of the value chain from sustainable management of native forests and plantations, to tree harvesting and log transportation, wood processing into building materials and furniture, pulp and paper, and recycled fibre processing and products. It also embraces the environmental impact of forestry and processing operations. The Sector's significant contribution to Australia's sustainable development will be increasingly important in the future.

The Sector's 1 per cent share of National GDP increases to 4.5 per cent if the value of environmental services provided by Australia's commercial forests is included.

Some of the key factors influencing the Sector include:

- international policy to reduce deforestation and improvements in protection and management of natural forests for the sustained supply of commercial and environmental goods and services;
- declining access to native forests and expansion of plantations for wood supply;
- the role of forests in carbon sequestration and potential greenhouse gas emission trading;
- recognition of the capacity of new forests to supply environmental benefits such as amelioration of degraded land and management of catchment water balances;
- competition from wood substitutes and the need to continuously improve performance and quality of wood-based products and materials, especially in commodity markets;
- composites that maximize resource use and have predictable service performance; and
- demand for high performance, light weight paper and board.

## CSIRO'S STRATEGIC RESPONSE

CSIRO has the following strategic research objectives:

- sustainable management systems for native forests;
- sustainable management and enhanced productivity of plantations;
- value enhancement in the forest;
- risk management – pathogens, pests, fire and drought;
- forest operations – their economic and environmental performance;
- wood processing and value added products; and
- fibre quality, paper making and paper quality.

## RESEARCH OUTCOMES

***Rapid estimation of pulp yield.*** Predicting the pulp yields of individual eucalypt trees has been made easier by a new method developed by CSIRO and the Cooperative Research Centre for Hardwood Fibre and Paper Science. The method, which is based on near infrared spectroscopy, is a major benefit in tree breeding programs aimed at maximising pulp production.

***Sustaining eucalypt plantation productivity.*** Research in Western Australia's south-west is contributing to management approaches that will ensure that the region's rapidly expanding bluegum (*Eucalyptus globulus*) plantations retain high productivity levels through their second and subsequent rotations. The plantations have been established on agricultural land and will produce premium woodchips for export to Asian markets. The research aims to retain the high levels of soil fertility that were built up during previous agricultural land uses. The work is being carried out with assistance from Sotico and local growers, who are implementing results as soon as they are available to improve management. For

example, the research has shown that burning logging slash results in substantial nutrient loss from the site, so this practice has been reduced.

*Guide to sustainable effluent irrigation of tree plantations*. The release of Australia's first comprehensive guide for designing and managing effluent-irrigated tree plantations is an important milestone in the national effort to protect Australia's inland rivers and coastal estuaries from nutrient pollution and algal outbreaks. Previously, tertiary treated sewage was pumped routinely into rivers and streams, increasing levels of nitrogen and phosphorus that in turn, and under the right conditions, led to algal blooms. Recently, however, off-river disposal has become the norm, with many authorities establishing plantations to dispose of sewage. Using the Guideline, authorities can ensure there is no runoff to streams nor is there any leakage to groundwater. *Sustainable Effluent-Irrigated Plantations: An Australian Guideline* was prepared by a CSIRO team, based on their own research and findings from trials and operational plantations in four Australian States and in New Zealand.

*Mapping termite hazard around Australia*. A mapping project using information gathered by school student members of CSIRO's Double Helix science club has provided a clearer picture of how the termite hazard to houses varies around Australia. The results have been used to produce a hazard map of Australia. The findings will assist decision-making on what precautions should be taken against termites in different parts of the country. They will also provide a significant input to revisions of relevant building standards and regulations.

*A clearer view of forest soil.* Foresters managing 50 000 hectares of native forest in southern New South Wales now have the soils information they need at their fingertips following the development by CSIRO of an innovative software package. The package, supplied on two CDs, uses a personal-computer-based geographic information system (GIS) and web-browser software to access information presented in maps, landscape models, graphs, photographs and text.

*How far can a bushfire spot ahead?* A study by CSIRO has led to a predictive model of spot fire behaviour and will help fire managers predict how far ahead of a blaze spot fires could break out. The study, using a specially built, vertical wind tunnel, has increased understanding of the hazards posed by burning embers transported ahead of bushfires.

*Looking at long-term preservative performance.* Thirty-five years ago, eucalypt and pine stakes were set up to test the performance of various timber preservative treatments. Recent inspections have confirmed that long-term resistance to deterioration in the wood can be achieved, even in areas with a high hazard rating such as tropical Innisfail in Queensland. Long-term testing makes it possible to determine how long it takes for different preservative/timber combinations to fail. It also allows evaluation of how quickly accelerated field simulation could predict known field performance. This is a powerful tool for the rapid prediction of the performance of new preservatives.

*High marks for CSIRO research*. An independent evaluation of CSIRO research for the Forestry, Wood and Paper Industries Sector has found the economic benefits from a range of projects far outweigh costs. Interviews with clients and collaborators provided qualitative assessments of research activities within each area. Benefit/cost analyses were undertaken for five projects.

*CSIRO software aids tropical timber identification*. Forest managers in Sarawak, Malaysia, plan to use CSIRO timber identification software to help protect endangered tree species and ensure the correct timber is supplied to buyers. With the prototype software, CSIROID, installed on their laptop computers,

foresters will be able to compare defining wood structural features revealed by a hand-held lens against images on the screen.

*Important bushfire warnings*. A preliminary examination of the behaviour of high-intensity experimental fires led to the issue of a leaflet warning firefighters that the chance of fire spread was actually higher than was indicated in current prediction tables. *Project Vesta*, undertaken by CSIRO and Western Australia's Department of Conservation and Land Management, was designed to provide the data needed to develop more accurate ways to predict bushfire spread. Research included studies of nearly 100 experimental fires lit in jarrah forests over the past two summers.

## HORTICULTURE SECTOR

### PLANNED SECTOR OUTCOME

***Increased competitiveness, profitability and environmental sustainability of Australia's horticultural industries.***

### INDUSTRY CONTEXT

Australia's location, land and water resources and diverse range of climates make it possible to grow an extensive range of temperate, sub-tropical and tropical produce. Off-season horticultural products from Australia are increasingly meeting market opportunities in the Northern Hemisphere.

The following factors differentiate the horticulture sector from other agricultural production:

- most horticultural crops are highly perishable and are purchased (and often consumed) fresh. Quality of the produce is therefore highly dependent on good supply chain management;
- ultimate quality, whether fresh or further processed is largely determined 'on farm' and it is there that many value-added issues need to be addressed and solved;
- horticulture is at the intensive end of the crop production spectrum, requiring specialist attention to achieve ecological sustainability, and in many cases produce is grown close to or within urban areas with some resultant natural resource use and access conflicts; and
- demand for healthy, fresh, natural produce is growing with consumer incomes and health awareness.

### CSIRO'S STRATEGIC RESPONSE

Increasingly, private companies and voluntary funding groups are co-investing with CSIRO and other agencies, and forming R&D partnerships with industry-based project steering committees. The key issues to be addressed by CSIRO research are:

- crop surety – paddock to plate (crop management). The two main drivers are increasing corporatisation in managing horticultural production as a business system and the market pull created by large retailers overseas and in Australia. This has led to a need for systems that can predict and manage both yield and quality. Projects in the Sector are addressing these issues by building on physiological and molecular studies of the structure, growth and nutrition of plants, the management of pests and diseases, postharvest packaging and processing, and the soil-plant-product continuum;

- genetic advances (crop improvement). Molecular genetics is providing the knowledge and tools to improve plant varieties by direct (genetically modified organisms) and indirect (genetic mapping) means. Molecular studies are also casting new light on the physiology and management of the soil-plant environment interaction; and
- market access and new incursions. Australia is facing increases in incursions of new pests and diseases to horticulture (such as papaya fruit fly, whitefly, banana fusarium wilt) from imports while there is increased pressure to ensure pest and disease free status of exports. CSIRO has considerable expertise in monitoring, detecting and identifying pest and disease species using molecular biological techniques or the chemical signatures of the pests and diseases.

## RESEARCH OUTCOMES

*New winegrape varieties*. A consortium of major Australian wine producers has been working with CSIRO to assess four new varieties of red wine grape. The new grapes, named Tyrian, Cienna, Vermillion and Rubienne, are the most recent products of CSIRO's long-term grape breeding program. McWilliams, one of the wineries involved in the trials, launched Tyrian as a new varietal in its production range in April 2000.

*Better management of drainage*. A major project has made recommendations about the location and management of evaporation basins for storing salt that accumulates during irrigation drainage. The study was undertaken by CSIRO for the Murray Darling Basin Commission and has resulted in the development of best practice guidelines for land managers. The guidelines consider the effects of irrigation and drainage practices, climate, and geology in the Murray Darling catchments.

*Lychee management for better cropping*. CSIRO tropical fruit researchers have combined new knowledge about lychee physiology with past weather data to work out how to produce a bigger yield for growers. Pruning stimulates vegetative growth and flowering, and temperatures at flowering affect the amount of fruit set, so the timing of pruning in a lychee orchard is critical. Growers in New South Wales and Queensland can now use recommendations from this study to schedule orchard activities for the best potential result.

*Recycled effluent for horticultural production*. Collaborative work with State agencies and local horticulture growers on the Northern Adelaide Plains has resulted in a publication by CSIRO outlining issues that will need ongoing management in the use of recycled sewerage water. The major concerns identified are how to manage the build up of salts, and the possibility of heavy metal contamination.

*Soil water monitoring methods – what are the choices?* To assist irrigators in choosing the best of a wide range of soil water monitoring devices, an information booklet was commissioned from CSIRO by the Land and Water Resources Research and Development Corporation. The booklet contains information on the many and various forms of soil water monitoring devices and methods that are available. The National Program for Irrigation Research and Development has already foreshadowed the need to update the booklet as new products and methods become available.

*A new sub-surface irrigation system*. Research at the Griffith CSIRO laboratory and Charles Sturt University was commissioned by an Australian company to test a new configuration for sub-surface drip irrigation. Capillary Root Zone Irrigation, currently undergoing commercial trials, generates a wider and

more uniform soil-wetting pattern, which helps small seeds to become established in the ground, and assists in managing drainage beyond the root zone.

## MEAT, DAIRY AND AQUACULTURE SECTOR

### PLANNED SECTOR OUTCOME

***Enhanced international competitiveness and ecologically sustainable development of Australia's meat, dairy and aquaculture industries with maintenance of Australia's animal health status and food safety standards.***

### INDUSTRY CONTEXT

Australia's meat, dairy and aquaculture industries produce more than $13 billion products each year and bring in $6.5 billion in export earnings. This Sector encompasses red meat (beef and sheep), pigs, poultry, new animal industries, milk production and aquaculture of finfish, crustaceans and shellfish. Growth in this Sector will come from providing premium food products to increasingly affluent and discerning customers.

The major trends in science and technology underpinning the Sector are:

- the impact of molecular biology and gene technologies;
- increased emphasis on welfare in livestock husbandry;
- understanding needs and demands of consumers;
- integrating socio-economic and ecological objectives into redesigned production systems; and
- closer participation by stakeholders in R&D.

### CSIRO'S STRATEGIC RESPONSE

To meet the needs of the Sector, CSIRO's main aims will be to assist efficient production, sustainable resource use, manufactured inputs and market and consumer issues. To achieve these aims, research will focus on:

- developing the technologies that will help the sector enhance international competitiveness and enterprise profitability and improve the efficiency of supply chains;
- developing the technology and systems for ecologically sustainable development; and
- helping to maintain market access by reducing the risk of non-tariff barriers including disease status, food safety, nutrition and environmental concerns.

### RESEARCH OUTCOMES

*Assessing the role of red meat and dairy produce in the Australian diet.* A number of studies were undertaken to assess the contribution made by red meat and dairy products to the Australian diet base. The results showed that these foods play a key role in providing valuable micronutrients such as iron, zinc and calcium, as well as selected vitamins. Further studies highlighted areas for development of functional

ingredients with human health potential for both the meat and dairy sector. This information has been published for use by the health industry.

*Development of an improved prawn feed formulation.* A final report has been presented on the development of an improved prawn feed resulting from a joint project between CSIRO and Ridley Agri-products. The new formulation has resulted in 20 per cent faster growth rates in the prawns in the trials. Ridley is currently undertaking commercial trials prior to taking up an option to license the technology.

*Development of a package to control major pasture pest.* The redlegged earth mite, accidentally introduced into Western Australia in 1917, now costs Australian farmers in regions with a Mediterranean climate an estimated $200 million annually. A package has been developed by CSIRO that predicts a date when growers can spray once in spring, to control the mite throughout the year. This date, which varies between areas but not from year to year, is derived from a computer-based decision support system called TIMERITE® and is available to farmers for a small charge from the Kondinin Group. Extensive trials with TIMERITE® have shown a 43 per cent increase in subterranean clover seed yield and a 76 per cent increase in subterranean clover seedling density, and it has been hailed by farmers and the agricultural chemical industry. TIMERITE® was developed with support from The Woolmark Company and Bayer Australia.

*Australia free of very virulent infectious bursal disease virus.* CSIRO's characterisation of a variety of infectious bursal disease viruses from a number of different poultry production facilities around Australia demonstrated that the deadly very virulent virus is not present in Australia. This virus is responsible for the death of large numbers of chickens in Asia and Europe. The information was used by the Australian Government to support Australia's international claims of freedom from very virulent infectious bursal disease virus.

*A scientific and technical review of ovine Johne's disease.* A report was submitted to the Victorian Minister for Agriculture recommending future control measures of ovine Johne's disease. A CSIRO scientist was requested to conduct a scientific and technical review of the disease. The review examined the level of ovine Johne's disease in Australia and elsewhere, the diagnosis of the disease, and possible links with human disease. The report also considered the advantages, disadvantages and costs of the various control options.

*A new vaccine to reduce greenhouse gas emissions from farm animals.* Significant immune responses to vaccination have been achieved in sheep and cattle, and significant inhibition of methane-producing organisms (up to 80 per cent) has been demonstrated *in vitro* when the organisms are grown in the presence of antibodies from immunised animals. A vaccine to reduce methane gas emissions from sheep is under development, and CSIRO will begin field testing the vaccine in 2000 to determine production responses.

*Development of novel dairy fat spreads.* Through simple alterations to the diet of dairy cows, CSIRO scientists have developed a milk product that includes 2 per cent of the polyunsaturated fat omega-3, as well as a 25 per cent reduction in the saturated fat content of milk fat. The availability of milk and milk products enriched with omega-3 provides consumers with more options for including essential nutrients in their diets. CSIRO trials using the fat-modified milk have produced butter that has melting point characteristics very similar to that of spreadable margarines.

*Guarantee for meat quality based on cattle genetics.* Scientists in CSIRO, working with the Cooperative Research Centre for Cattle and Beef Quality, have identified breeds and lines of cattle that have outstanding genetic merit for retail beef yield, marbling and meat tenderness. This information is being delivered nationally and internationally to the beef industry through Australia's Beef Genetic Evaluation Scheme known as BREEDPLAN. In addition, the results are playing a key part in developing methods for achieving Meat Standards Australia grading targets, based on the guaranteed eating quality of Australian beef.

*A novel diet for feedlot cattle.* CSIRO and commercial partners have developed a feed formulation diet to fatten cattle in the tropics using local crop by-products. The diet is inexpensive and achieves weight gains equivalent to animals that have been fed a grain finishing option. It is based on by-products from the sugar and cotton industries and includes molasses, a treated form of bagasse and cottonseed meal.

## TEXTILE, CLOTHING AND FOOTWEAR SECTOR

### PLANNED SECTOR OUTCOME

***International competitiveness and environmental sustainability of Australia's TCF industries.***

### INDUSTRY CONTEXT

The Australian textile, clothing, footwear and leather (TCF&L) industries continue to undergo restructuring in response to the significant changes occurring globally and the difficulties in competing with countries with lower wage rates and infrastructure costs. With the majority of the world's TCF&L industries moving to South East Asia and India, Australia cannot compete in commodity textiles, clothing and footwear but must rely on the development of unique, innovative and high quality products.

While there have been closures in the industry, there has also been expansion and investment in a number of areas such as early stage wool processing, technical textiles and in fashion clothing design and manufacture.

The restructuring of the industry is conducted against a backdrop of the foreshadowed tariff reductions in 2005. To assist the TCF&L industries prepare for the reductions, the Federal Government has introduced a Strategic Investment Program (SIP) that will provide $700 million during 2000-05 to reimburse industry for investment in new capital equipment, and for R&D towards the development of innovative products and processes.

Overall the wool industry continues to experience downward price pressures although the market for fine and super fine wools has remained strong. International trade difficulties have led to a restructuring of the wool industry both at the grower and institutional level.

The Woolmark Company is restructuring and an interim Board has been appointed. In a review of the industry levy, a poll of wool growers has recommended a 2 per cent wool tax to support R&D and innovation with little or no investment in generic promotion programs. The Government has accepted this recommendation. The future of the wool industry lies in growers becoming more productive, that is, lowering the unit cost of production, and through increased demand for products containing wool, that are developed from new and innovative blends of wool with cotton and synthetic fibres.

Australian cotton production is now around the same quantity as that of wool with 3 million bales produced during the last year, giving a total export value of around $1.6 billion. Despite price pressures the Australian cotton industry has maintained its reputation for quality and productivity. The industry has a strong focus on sustainable water management and integrated pest management programs.

## CSIRO'S STRATEGIC RESPONSE

The Sector will:

- assist the domestic TCF&L industries meet the market demand for new and niche products, through the development of innovations in products and processes that reduce costs and enhance quality. The demand for Australian wool will be increased through the development of new and easy care products that include novel blends;
- engage in partnerships with industry to maximise the benefits of the Federal Government's TCF&L Strategic Investment Program;
- increase on-farm productivity by developing enhanced decision support systems that link fertiliser, pasture growth, nutrition and wool production and processing to assist in the reduction of fibre diameter without reducing fleece weight. Increasing on-farm productivity will be done within a framework of ecological and social sustainability;
- work closely with the cotton industry to reduce the use of pesticides and maximise better water use practices;
- increase the links between cotton and wool producers and the processing industries by improved measurement and prediction systems; and
- diversify the research portfolio to embrace all textiles and expand resources into cotton processing and technical textiles.

## RESEARCH OUTCOMES

*Rabbit Calicivirus Disease (RCD)*. The positive impact of RCD continues to be seen in some of Australia's driest areas, with the remarkable regeneration of grasses and shrubs. The epidemiology of RCD has shown that the calicivirus persists in recovered rabbits, perhaps explaining how the disease readily recurs in arid areas without the need for insect carriers. There is no evidence yet to indicate that the rabbits are developing a resistance to the virus, nor that the virus goes through a genetic change in its host. The benefits of RCD will continue to accumulate for several years, with obvious benefits to the sustainability of native pastures and the sheep industry.

*A new standard for wool testing*. A new version of 'Sirolan Laserscan' has become the industry standard for all pre-sale testing of greasy wool. Laserscan is a technology for measuring the diameter of the wool fibre by passing snippets of wool past a laser beam. From the image generated of the fibre, the mean fibre diameter and the coefficient of its variation are determined. The technology has been commercialised through the licensee, The Australian Wool Testing Authority Ltd, and replaces the traditional airflow method that only measured the mean fibre diameter, without any measure of its variability. The new technology, which is very rapid, enables wool classification and lot building to be based on more comprehensive data.

*New technology for on-farm measurement of wool*. A version of Laserscan that can be used in the shearing shed has been released to the wool growing industry. The technology, known as 'Fleecescan', allows the measurement of wool fibre in real time during shearing. In addition to providing better ways to class wool and build sale lots with tighter specifications during shearing, new opportunities for different selling strategies are made possible, such as the direct electronic selling of wool from farm to the mill. In addition, the technology provides additional information at shearing time for sheep breeding strategies based on desired wool properties.

*New fabric conditioning technology*. A new continuous fabric conditioning technology, 'CLIMA', developed with Sperotto Rimar, an Italian textile machine manufacturer, has been commercially released. The technology involves conditioning wool fabric by forcing conditioned air, which is recycled, through a continuously moving fabric. In conjunction with other wool finishing processes the technology substantially improves fabric quality, leading to an improvement in subsequent garment appearance and properties such as suppleness of handle and pressing performance.

*Leather measurement*. Thickness measurement is an important parameter in leather technology. Different leather thicknesses are required depending on the end use of the leather; uniformity of thickness is an important requirement for leather performance and appearance. The economics of leather making depend heavily on yield that is determined by a combination of thickness and area measurements. Present methods are subject to operator and instrument error leading to inconsistencies in the quality of finished leathers and the need for additional processing to correct for thickness variations. A new thickness measuring system for leather is undergoing commercial trials in collaborating tanneries and a partner is being sought to commercialise the technology. The technology substantially increases the accuracy and consistency of leather measurement and enables increased control of leather splitting operations that in turn reduces waste and increases yield.

*Controlling wool growth*. The genetic factors that control wool growth and quality in sheep are complex. Researchers have developed procedures for the tagging of sequences of DNA and displaying the tagged sequences on a grid, allowing the identification of up to 8 000 sequences. This knowledge enables the identification of the genes controlling wool follicle initiation and subsequent wool fibre development and growth. The technology will allow the manipulation of wool growth at the genetic level to increase wool quality and production.

*Improved nutrition for sheep*. Sheep in pens consumed significantly greater quantities of poor quality feed after it was treated with either superior rumen fungi or a fungal specific stimulant (nutrient). Field trials using both stimulants contained in lick blocks produced sheep with increased wool production and increased body weight that leads to shorter time to market for meat production. Commercialisation of the nutrient is underway.

*Improved grazing regimes*. Long-term trials show the persistence of winter-active phalaris is influenced by rotational grazing, soil fertility and cultivar type. All cultivars tolerated heavy grazing during drought under conditions of good soil fertility and persistence was significantly improved by rotational grazing. CSIRO has developed clear guidelines for managing winter-active phalaris and overcoming farmer resistance to wider sowing of these valuable cultivars. Phalaris is the most productive of the perennial grasses in temperate zones and wool production is significantly enhanced over alternative grass based pastures.

*Uptake of GrassGro*. CSIRO's 'GrassGro' decision support tool aids the management of business risk in wool production systems by linking fertiliser usage, pasture growth and nutritional levels with wool production. The decision support tool has been widely adopted by wool growers and is now being incorporated into 24 units of the undergraduate rural science course at the University of New England. A survey of 92 trained 'GrassGro' users indicated a generally favourable response to the new decision support tool.

## RESEARCH AWARDS

Outstanding performance in research is also recognised by various national award schemes. Two schemes operated by CSIRO are reported on below.

### THE CHAIRMAN'S MEDAL

The 1999 Chairman's Medal and CSIRO Medals were presented on 25 November 1999 by Professor Sir Robert May, AC, Chief Scientist, UK.

The winners of the Chairman's Medal were Team Leader: Mr Brian Myers, team members: Dr Richard Benyon, Dr Warren Bond, Ms Evelyn Colvin, Mr Ian Craig, Mr Randall Falkiner, Mr Gordon McLachlan, Dr Nicholas O'Brien, Ms Wanda Pienkowski, Dr Philip Polglase, Dr Chris J Smith, Dr Val Snow, Mr Leroy Stewart, Ms Jaqueline Sweeney, Dr Swaminathan Theiveyanathan, Mr Dean Tompkins, Mr Mark Tunningley and Ms Seija Tuomi for the Wagga Wagga Effluent Plantation Project.


**Chairman's Medal:**
From left to right are:
Back row: Mr Gordon McLachlan, Dr Nicholas O'Brien, Mr Leroy Stewart, Mr Ian Craig, Dr Philip Polglase.
Middle row: Dr Richard Benyon, Dr Val Snow, Mr Mark Tunningley, Dr Swaminathan Theiveyanathan, Mr Dean Tompkins, Ms Jaqueline Sweeney, Ms Wanda Pienkowski.
Front row: Mr Randall Falkiner, Ms Evelyn Colvin, Dr Warren Bond, CSIRO Chairman, Mr Charles Allen, AO, Mr Brian Myers, Dr Chris J Smith and Ms Seija Tuomi.

*Photo: David McClenaghan*

## CSIRO MEDALS

The CSIRO Medals for 1999 for CSIRO staff were awarded to:

- Dr John Farrow, Dr Phillip Fawell, Dr Ron Johnston, Dr Tuan Nguyen, Dr Murray Rudman, Dr Phil Schwarz, Mr Kosta Simic, Ms Jean Swift and Dr Len Warren, for development of new thickener technology for mineral processing;
- Dr Matt Ballard, Prof Don Bursill, Dr Rob Eldridge, Mr Mike Falkiner, Dr Neil Furlong, Dr Hung Nguyen and Mr Heng Taing, for the MIEX® project for purifying water;
- Mr Glen Auty, Dr Mark Berman, Mr Michael Best, Dr Edmond Breen, Dr Michael Buckley, Mr Ashley Dreier, Dr Paul Dunn, Mr Ron Ferguson, Mr Chris Freund, Dr Jim Gardner, Dr Ronald Jones, Dr Patrick Kearney, Mr Ian Macintyre, Mr Daniel Moore, Dr Bob Oreb, Mr David Pratt, Mr Paul Turtle and Dr Chris Walsh, for the development of the RoadCrack system.

The external CSIRO Medal winner was:

- Professor Joe Monaghan from Monash University, for his work on smoothed particle hydrodynamics.

**CSIRO Medallists:**

From left to right are Dr John Farrow, Dr Neil Furlong, CSIRO Chief Executive, Dr Malcolm McIntosh, guest of honour Professor Sir Robert May, AC and Mr Ian Macintyre.

*Photo: David McClenaghan*

## SIR IAN MCLENNAN ACHIEVEMENT FOR INDUSTRY AWARD

This award was established by the former CSIRO Advisory Council in 1985 to recognise outstanding contributions by CSIRO scientists to Australian industry.

The 1999 Award was presented on 26 October 1999 by Mr M A Besley, AO, Chairman, Commonwealth Bank of Australia. The winner was Mr Paul Gottlieb of CSIRO Minerals for his development of the QEM*SEM system for mineral analysis.

**Sir Ian McLennan Award**

From left to right are Mr M A Besley, AO, winner Mr Paul Gottlieb, and Sir Peter Derham.

*Photo: Geoff Lane*

# RESEARCH SUPPORT

## EDUCATION

CSIRO Education operates a range of projects to raise awareness of the value of scientific research and to encourage students to take up science careers. CSIRO Education works with students and teachers at the primary and secondary levels.

*Scientriffic* magazine has exceeded targets at the end of its first year of production with over 4 000 individual subscribers and 2 000 bulk subscriptions. All sponsors continued their support for a second year.

CSIRO Education continues to work with Network Ten to jointly produce each Tuesday's edition of *Totally Wild*, Australia's highest rating afternoon program for children. The half-hour program reaches over 250 000 viewers each week and features stories on scientific research including CSIRO's work, Double Helix events and other science education initiatives.

Several new teaching units have been developed and duplicated for use in the national network of nine CSIRO Science Education Centres. Topics for these units include food science and working scientifically.

## ENERGY SERVICES

Energy Services assesses and recommends methods to reduce CSIRO's overall energy usage in line with CSIRO policies and Government annual reduction targets and provide staff awareness and training programs.

Electricity usage at most sites can now be effectively monitored by the installation of a metering system. Alternative generation initiatives are being considered as part of forward strategies.

## FINANCE

Upon finalisation of the Sector research priorities process for 2000-03, divisional budgets for each year of the triennium were agreed by the Executive. These budgets were based on triennium appropriation funding announced in the May 1999 Federal Budget and external earnings projections. Key financial performance measures for operating result, cash and capital expenditure were set for each cost centre.

During the year financial systems were rigorously tested and withstood the Y2K problems. A GST compliant version of the *UNIBIS* accounting software was implemented, together with training, in readiness for the new tax system that commenced on 1 July 2000.

In accordance with the *Finance Minister's Orders* CSIRO's internally developed, and externally acquired, software was revalued and these assets are included in the 1999-00 financial statements for the first time.

## HUMAN RESOURCES

A major activity of Human Resources in the last financial year has been a comprehensive review of CSIRO's salary, classification and performance management systems. A review was undertaken as part of the 1998 Enterprise Agreement.

Recommendations were finalised in December 1999 and were accepted by CSIRO's Executive Committee. Detailed proposals will be put to a staff vote in July 2000. If accepted, the changes to the salary and classification system will be implemented immediately. Recommended changes to the performance management system will be advanced in the next round of enterprise bargaining.

The three industrial awards covering CSIRO staff (Redundancy; Tenure; and Salaries and Conditions of Service) were reviewed to ensure compliance with the requirements of the Workplace Relations Act. The Australian Industrial Relations Commission (AIRC) has removed redundant and 'non allowable' clauses and consolidated the remaining into one Award.

A review of CSIRO's OHS management arrangements was conducted including an evaluation against *AS/NZS 4804 Occupational Health and Safety Management*, Commonwealth R&D organisations (including the Australian Institute of Marine Science, the Defence Science and Technology Organisation, the Australian Geological Survey Organisation, the Australian National University and the Australian National Science and Technology Organisation), major corporations (including Orica, Dupont and Amcor) and national compensation and OHS performance data. The review identified a number of enhancements to the OHS Management System, which were approved by the Executive Committee and Board in December 1999.

## INFORMATION TECHNOLOGY SERVICES

One of the challenges for IT Services is to match the growth in demand for network capacity across a geographically diverse organisation. The strategies to overcome these issues relate to building a quality and scalable network environment. This starts at the basic cabling, with the Organisation's cable upgrade program, includes flexible LAN switches and extends to flexible Wide Area Networking utilising the most appropriate carrier. The CSIRO network has become a valuable resource supporting both the business and experimental requirements of the Organisation.

The CSIRO voice network went into full production using Voice over Internet Protocol (VoIP) between all major Australian capital cities in October 1999. This VoIP network is currently carrying more than 50 000 calls per month, containing around 200 000 minutes of long distance call time. Using this technology CSIRO has reduced the operational costs of its voice network by over $550 000 with further increased savings expected in the 2000-01 financial year. CSIRO is the lead agency in introducing this technology into the university sector through its membership of AARNet.

CSIRO's new World Wide Web site was launched in July 1999. The content of the system has been expanded through divisional input. Work has commenced on new graphics for the site and an electronic survey of all staff was conducted to assist with the redesign of CSIRO's intranet.

In August 1999 CSIRO's Electronic Journals Collection became available to scientists on their desktop.

The world's premier patent database was also another significant purchase. It was prompted by the CSIRO Commercial Committee's desire to integrate a greater awareness of the patent literature amongst scientists. CSIRO leads the Australian research community in the provision of electronic information to support science.

## NATIONAL AWARENESS

*Service to politicians.* Science Briefings have been extended to most State Parliaments where they are being well received. The Parliamentary Information Initiative, aimed at providing Federal politicians with regular information about CSIRO research, tailored to their own special requirements, has been evaluated and set up to operate over the next triennium.

*Corporate reputation.* Outcomes of public awareness activities have been measured by media analysis and public opinion research. Analysis of print media during 1999 showed that CSIRO continues to receive highly favourable print coverage in volume and quality. Qualitative public opinion research in June 2000 shows CSIRO to be among the most highly trusted research organisations.

*Gene Technology.* A Gene Technology Information Program to assist CSIRO communication with the public was begun in July 1999. This program was approved for a further three years in May 2000.

## PROPERTY

CSIRO's property assets are being efficiently and effectively managed, using the CSIRO Property Management Plan 2000 as a base for principles and strategies. This is being upgraded into a comprehensive Estate Management Plan 2000-05. Rationalisation and consolidation of resources continues in line with research requirements and budgetary parameters. The Internal Leasing Scheme provides the most appropriate means for generating funds for allocation to the maintenance and replacement of CSIRO's highly specialised assets.

Riverside Corporate Park, the centre of CSIRO research in New South Wales, is nearing completion with the sale of most lots completed and the construction of two CSIRO facilities imminent. The Riverside development recently won the national Property Council of Australia's Awards for Excellence for New South Wales and Australia.

The Capital Works program continues to facilitate the refurbishment and replacement of Research Facilities across the portfolio, with two major State funded projects (Western Australia and Queensland) included in those under construction.

A recent Government Property Review determined that six CSIRO properties were to be sold. A Board Sub-committee is to oversee the process.

## RISK ASSESSMENT AND AUDIT

A key element in CSIRO's corporate governance framework is the Board and Senior Management's understanding of the risks facing the Organisation.

To assist this understanding the Unit provided the Board Audit Committee with a summary of the high and significant risks at the CSIRO organisational level. These risks had been identified using the ongoing risk assessment process, which follows the Australian/New Zealand standard on risk management (AS/NZS 4360:1999). Management provided an overview of the strategies it has in place to mitigate each of these risks. It is envisaged that this organisational risk profile will be revised every six months on an ongoing basis.

A further important outcome is the provision of regular audit reports to Senior Management and the Board Audit Committee, which provide assurance that internal controls are in place and operating effectively.

## SECURITY

The Organisation's Security Policy was issued in February 1996. During 1999-00 the Security Reviews of Divisions covering protective, physical, personnel and administrative practices continued in accordance with the CSIRO Corporate Security Plan, 1998-01. The Plan was developed to identify security objectives that require improvement or continued management by the Corporate Security Adviser, Divisional and Site Security Officers.

During 2000 the new Commonwealth Protective Security Manual is to be released and will place additional demands upon CSIRO. The Organisation is well placed to meet the Government's requirements and demonstrate compliance to the new standards.

## DEVELOPMENTS SINCE 30 JUNE 2000

The *Commonwealth Authorities and Companies Act* 1997 requires CSIRO to report developments since the end of the financial year, giving particulars of any matter or circumstance that has arisen and has significantly affected or may significantly affect:

(i) the authority's operations in future financial years; or

(ii) the results of those operations in future years; or

(iii) the authority's state of affairs in future financial years.

On 1 July 2000 the divisions of Animal Health, Animal Production and livestock-related research within the Division of Tropical Agriculture merged to form the CSIRO Division of Livestock Industries (CLI). An international search is being conducted for Chief of Division.

A new Division will be formed by the merger of the remaining integrated agricultural systems work of the Division of Tropical Agriculture, with the ecological and biodiversity capabilities of the Division of Wildlife and Ecology. The Division will be formed by the end of 2000.

Australian National
Audit Office

**INDEPENDENT AUDIT REPORT**

To the Minister for Industry Sciences and Resources

**Scope**

I have audited the financial statements of the Commonwealth Scientific and Industrial Research Organisation for the year ended 30 June 2000. The financial statements comprise:

- Statement by Directors;
- Balance Sheet;
- Operating Statement;
- 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 you.

The audit has been conducted in accordance with 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 and statutory requirements in Australia so as to present a view of the organisation 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.

GPO Box 707 CANBERRA ACT 2601
Centenary House 19 National Circuit
BARTON ACT
Phone (02) 6203 7300 Fax (02) 6203 7777

**Audit Opinion**

In my opinion,

(i) the financial statements have been prepared in accordance with Schedule 2 of the Finance Minister's Orders; and

(ii) the financial statements give a true and fair view, in accordance with applicable Accounting Standards, other mandatory professional reporting requirements and Schedule 2 of the Finance Minister's Orders, of the financial position of the Commonwealth Scientific and Industrial Research Organisation as at 30 June 2000 and the results of its operations and its cash flows for the year then ended.

Australian National Audit Office

David C McKean
Executive Director

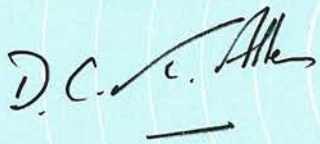
Delegate of the Auditor-General

Canberra
14 September 2000

## STATEMENT BY BOARD MEMBERS

In our opinion, the attached financial statements give a true and fair view of the matters required by Schedule 2 of the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act* 1997 for the year ended in June 2000.

Signed at Melbourne this 13th day of September 2000 in accordance with a resolution of the Board Members.



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

Colin M Adam
*(Acting Chief Executive and Board Member)*

## OPERATING STATEMENT
For the year ended 30 June 2000

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **Operating revenues** | | | |
| Revenues from Government | 5.1 | 617 093 | 475 390 |
| Sales of goods and services | 5.2 | 250 417 | 246 753 |
| Interest | 5.3 | 6 251 | 1 701 |
| Dividends | 5.4 | 138 | – |
| Net gains from sales of assets | 5.5 | 9 363 | 5 |
| Net foreign exchange gains | 5.6 | 53 | 119 |
| Other | 5.7 | 11 903 | 4 374 |
| **Total operating revenue** | | **895 218** | **728 342** |
| **Operating expenses** | | | |
| Employees | 6.1 | 437 902 | 420 808 |
| Suppliers | 6.2 | 255 246 | 247 505 |
| Depreciation and amortisation | 6.3 | 77 310 | 68 192 |
| Write-down of assets | 6.4 | 1 387 | 2 065 |
| Net losses from sales of assets | 6.5 | – | 4 779 |
| Interest | 6.6 | 535 | 417 |
| Other | 6.7 | 2 950 | 3 956 |
| **Total operating expenses** | | **775 330** | **747 722** |
| **Operating surplus/(deficit)** | | **119 888** | **(19 380)** |
| Net surplus/(deficit) attributable to the Government | | 119 888 | (19 380) |
| Accumulated surpluses at beginning of reporting period | | 577 960 | 597 340 |
| **Total available for appropriation** | | **697 848** | **577 960** |
| Revenue measure paid | 7 | (30 000) | – |
| Capital use paid | 1.17 | (112 804) | – |
| **Accumulated surpluses at end of reporting period** | | **555 044** | **577 960** |

The above statement should be read in conjunction with the accompanying notes.

## BALANCE SHEET
As at 30 June 2000

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **ASSETS** | | | |
| **Financial Assets** | | | |
| Cash | 9 | 54 624 | 53 611 |
| Receivables | 10 | 47 347 | 32 289 |
| Investments | 11 | 90 774 | 99 280 |
| **Total financial assets** | | **192 745** | **185 180** |
| **Non-Financial Assets** | | | |
| Land and buildings | 12 | 835 433 | 859 927 |
| Plant and equipment | 13 | 241 372 | 250 561 |
| Intangibles | 14 | 6 325 | – |
| Inventories | 15 | 745 | 549 |
| Other | 16 | 19 276 | 20 332 |
| **Total non-financial assets** | | **1 103 151** | **1 131 369** |
| **Total assets** | | **1 295 896** | **1 316 549** |
| **LIABILITIES** | | | |
| **Debt** | | | |
| Leases | 17 | 20 397 | 19 804 |
| Deposits - trust monies | | 9 464 | 16 296 |
| **Total debt** | | **29 861** | **36 100** |
| **Provisions and Payables** | | | |
| Employees | 18 | 156 552 | 145 889 |
| Suppliers | 19 | 28 299 | 25 839 |
| Other | 20 | 128 316 | 132 937 |
| **Total provisions and payables** | | **313 167** | **304 665** |
| **Total liabilities** | | **343 028** | **340 765** |
| **EQUITY** | | | |
| Reserves | 21 | 397 824 | 397 824 |
| Accumulated surpluses | 21 | 555 044 | 577 960 |
| **Total equity** | | **952 868** | **975 784** |
| **Total liabilities and equity** | | **1 295 896** | **1 316 549** |
| **Current assets** | | **155 079** | **123 781** |
| **Non-current assets** | | **1 140 817** | **1 192 768** |
| **Current liabilities** | | **175 451** | **157 364** |
| **Non-current liabilities** | | **167 577** | **183 401** |

The above statement should be read in conjunction with the accompanying notes.

## STATEMENT OF CASH FLOWS
For the year ended 30 June 2000

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **OPERATING ACTIVITIES** | | | |
| **Cash received** | | | |
| Appropriations | 5.1 | 617 093 | 475 390 |
| Sales of goods and services | | 240 397 | 248 293 |
| Dividends | | 138 | – |
| Interest | | 6 251 | 1 701 |
| Other | | – | 3 200 |
| | | 863 879 | 728 584 |
| **Cash used** | | | |
| Employees | | 418 539 | 411 872 |
| Suppliers | | 261 280 | 244 946 |
| Interest and other financing costs | | 535 | 417 |
| Other | | 6 831 | – |
| | | 687 185 | 657 235 |
| **Net cash provided by operating activities** | 22 | **176 694** | **71 349** |
| **INVESTING ACTIVITIES** | | | |
| **Cash received** | | | |
| Proceeds from sale of property, plant and equipment | | 17 124 | 31 988 |
| Proceeds from sale of equity instruments | | 10 596 | 19 |
| | | 27 720 | 32 007 |
| **Cash used** | | | |
| Purchase of property, plant and equipment | | 66 467 | 70 969 |
| Purchase of equity investment | | 3 416 | 1 841 |
| | | 69 883 | 72 810 |
| **Net cash used by investing activities** | | **42 163** | **40 803** |
| **FINANCING ACTIVITIES** | | | |
| **Cash received** | | | |
| Proceeds from debt | | 593 | – |
| **Cash used** | | | |
| Capital use - paid to Government | | 112 804 | – |
| Revenue measure - paid to Government | | 30 000 | – |
| | | 142 804 | – |
| **Net cash used by financing activities** | | **142 211** | **–** |
| Net increase/(decrease) in cash held | | (7 680) | 30 546 |
| Cash at 1 July | | 151 894 | 121 348 |
| **Cash at 30 June** | 22 | **144 214** | **151 894** |

The above statement should be read in conjunction with the accompanying notes.

# SCHEDULE OF COMMITMENTS
As at 30 June 2000

| | 2000 $'000 | 1999 $'000 |
|---|---|---|
| **By Type** | | |
| **Commitments payable** | | |
| **Capital commitments** | | |
| Land and buildings | 54 974 | 10 122 |
| Plant and equipment | 2 187 | 3 441 |
| **Total capital commitments** | **57 161** | **13 563** |
| **Other commitments** | | |
| Operating leases | 18 439 | 18 372 |
| Research and development commitments | 275 256 | 269 412 |
| Other commitments | 12 054 | 17 770 |
| **Total other commitments** | **305 749** | **305 554** |
| **Total commitments payable** | **362 910** | **319 117** |
| **Commitments receivable** | | |
| Research and development commitments | 230 681 | 239 668 |
| Other receivables | 4 231 | 4 266 |
| **Total commitments receivable** | **234 912** | **243 934** |
| **Net commitments payable** | **127 998** | **75 183** |
| **By Maturity** | | |
| **All net commitments** | | |
| One year or less | 58 736 | 32 641 |
| From one to five years | 63 408 | 34 596 |
| Over five years | 5 854 | 7 946 |
| **Net commitments** | **127 998** | **75 183** |
| **Operating lease commitments** | | |
| One year or less | 8 669 | 6 935 |
| From one to five years | 8 397 | 9 210 |
| Over five years | 1 373 | 2 227 |
| **Total operating lease commitments** | **18 439** | **18 372** |

The above schedule should be read in conjunction with the accompanying notes.

## SCHEDULE OF CONTINGENCIES
As at 30 June 2000

| | 2000 $'000 | 1999 $'000 |
|---|---|---|
| **Contingent losses** | | |
| Estimated legal claims arising from employment, motor vehicle accidents and contractual disputes. These matters are being fully defended. | 1 800 | 2 105 |
| Estimated cost of clean up of asbestos and chemical contaminations at Lindfield and Samford sites respectively. A provision of $1.5 million for the clean up of asbestos contamination at Lindfield site has been taken up at 30 June 2000 (Note 6.7). | – | 2 000 |
| | 1 800 | 4 105 |
| Contingent gains | | |
| Legal claims expected to succeed from recovery of debts. | (214) | (259) |
| **Net contingencies** | **1 586** | **3 846** |

## SCHEDULE OF UNQUANTIFIABLE CONTINGENCIES
As at 30 June 2000

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.

The CSIRO Environmental Management Committee identified a range of potential environmental risks associated with storage of low level radioactive waste at Woomera, SA, and low-level contamination of a number of sites with asbestos or other hazardous substances. External environmental consultants have been engaged to audit all sites and estimate the costs associated with any remedial action.

The above schedule should be read in conjunction with the accompanying notes.

# NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
For the year ended 30 June 2000

## NOTE 1 SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

### 1.1 Basis of Accounting

The financial statements are required by clause 1(b) of Schedule 1 to the *Commonwealth Authorities and Companies Act* 1997 and are a general purpose financial report.

The statements are prepared in accordance with:

- *Requirements for the Preparation of Financial Statements of Commonwealth Agencies and Authorities* made by the Minister for Finance and Administration in August 1999 (Schedule 2 to the Commonwealth Authorities and Companies (CAC) Orders);
- Australian Accounting Standards;
- other authoritative pronouncements of the Australian Accounting Standards Boards; and
- the Consensus Views of the Urgent Issues Group.

In addition, the statements are prepared having regard to:

- Statements of Accounting Concepts; and
- the Explanatory Notes to Schedule 2 to the CAC Orders issued by the Department of Finance and Administration.

The financial statements are 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 Changes in Accounting Policies

A change in accounting policy is identified in Note 1.8.

### 1.3 Consolidation

CSIRO is involved in a R&D Syndication, under which it acquired two subsidiary companies, Eveco Pty Ltd and Brooklyn Amber Pty Ltd during the year when investors exercised their put options. The only assets owned by these companies are intellectual property and there are no liabilities. These companies are currently in the process of being wound up by members voluntary liquidation and as a result they are not consolidated in CSIRO's financial statements.

### 1.4 Revenue Recognition

Parliamentary appropriation revenue is recognised at the time CSIRO becomes entitled to receive the revenue. Revenues from Government are revenues for CSIRO's core operating activities.

Revenue from contract research and development activities is recognised by reference to the stage of completion of contracts. The stage of completion is determined according to costs incurred to date after taking into account the total contract values and the estimated total costs. The balances of contract research and development activities in progress are accounted as either contract research work in progress (Note 16) or contract research revenue received in advance (Note 20) in the Balance Sheet. Where necessary, a surplus or deficit is recognised progressively for each contract research and development activity.

Revenue from sale of goods and other services is recognised upon delivery of goods and services performed.

Interest revenue is recognised on a proportional basis taking into account the interest rates applicable to the financial assets.

Licensing fees and royalties from the sale of products or technologies developed under agreements, are 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.

Revenue from disposal of non-current assets is recognised when control of the asset has passed to the buyer.

## 1.5 Resources Received Free of Charge

Services received free of charge are recognised in the Operating Statement as revenue when, and only when, a fair value can be reliably determined and the services would have been purchased if they had not been donated. Use of those resources is recognised as an expense.

Contributions of assets at no cost of acquisition or for nominal consideration are recognised at their fair value as revenue, and an asset when CSIRO gains control over the contributed asset and the asset qualifies for recognition.

## 1.6 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. The capitalisation threshold limit for intellectual property is $250 000. As at 30 June 2000 no research and development costs or intellectual property have been capitalised in the Balance Sheet.

## 1.7 Property, Plant and Equipment

### *Property*

All land, buildings and leasehold improvements were inspected, floor space of buildings measured, the remaining life assessed and revalued as at 30 June 1999 using the "deprival" method of valuation.

Land, which will continue to be used for research activity, was valued by CSIRO's registered valuer, Ross Stevens FAPI at "existing use value". 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 CSIRO but ignoring alternative uses.

Land designated for possible sale was valued at market value by registered external valuers, Paul McBurnie FAPI(Val) and (Econ), and Malcolm Collins AAPI(Val).

Buildings and leasehold improvements, which will continue to be used for research activities, were valued at depreciated replacement cost using current building prices to arrive at current gross replacement cost less accumulated depreciation having regard to the age and condition.

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

### *Plant and Equipment*

As at 1 July 1998, all plant and equipment with historical costs of $75 000 and over was revalued by the Australian Valuation Office using the "deprival" method. Other plant and equipment under that $75 000 threshold was valued in house at their depreciated replacement cost. Any assets, which would not be replaced, or are surplus to requirements, were valued at net realisable value.

All plant and equipment acquired after the revaluation date is valued at historical cost. The capitalisation threshold limit for property, plant and equipment is $3 000. The $3 000 threshold was selected because it facilitates 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.

Property, plant and equipment which are purchased from contract research funds and where the control and subsequent 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 and disclosed in Note 26.

### *Depreciation and Amortisation*

Depreciation is calculated on a straight line basis so as to write off the cost or revalued amount of each item of building, plant and equipment over its expected useful life. Leasehold improvements are amortised on a straight-line basis over the lesser of the estimated useful life of the improvement or the unexpired period of the lease.

An annual review of the economic useful life or depreciation and amortisation rates and methods was conducted and necessary adjustments recognised in the current and future reporting periods as appropriate.

Depreciation and amortisation rates applying to each class of depreciable assets are as follows:

| | |
|---|---|
| • Building on freehold land | 40 to 50 years |
| • Leasehold improvements | Lease term |
| • Passenger vehicles | 5 years |
| • Agricultural and transport equipment | 3 to 15 years |
| • Computing equipment | 2 to 5 years |
| • Scientific equipment | 5 to 25 years |
| • Furniture and office equipment | 4 to 15 years |
| • Workshop equipment | 20 years |
| • Research Vessels | 25 years |
| • Australia Telescope | 12 to 45 years |

The aggregate amount of depreciation and amortisation for the year is disclosed in Note 6.3.

***Recoverable amount test***

The carrying amounts of intangibles, property, plant and equipment assets are reviewed to determine whether they are in excess of the asset's recoverable amount. In assessing recoverable amounts, the relevant cash flows, including the expected cash inflows from future external revenue and appropriations by the Commonwealth Government, are considered and not discounted to their present value. No write-down to recoverable amount is made as a result of the review.

## 1.8 Intangibles

The Finance Minister's Orders require CSIRO to account for internally developed and externally acquired computer software. CSIRO has identified software with an estimated cost of more than $250 000 threshold which has been valued by the Australian Valuation Office as at 30 June 2000 using the "deprival" method (Note 14). The effect of this change in accounting policy has increased the operating surplus by $6.3 million (Note 5.7). Computer software is amortised on a straight-line basis over its remaining useful life of between 1 to 10 years.

## 1.9 Investments

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 1.6).

CSIRO fully provides for diminution in value of its investment in unlisted R&D associate companies due to the inherent business risk of companies involved in R&D and high technology industries (Note 11).

## 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 Employee Entitlements

### *Leave*

The liability for employee entitlements includes provisions for annual leave, long service leave, severance pay and redundancy. 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 liability for annual leave reflects the value of total annual leave entitlements of all employees at 30 June 2000 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 2000. In determining the present value of the liability, attrition rates and pay increases through promotion and inflation have been taken into account.

On 17 June 1998, CSIRO's Enterprise Agreement was certified. From that date, officers employed continuously on a term basis for more than one year will receive, on termination, a severance payment of one week's salary per completed six months' service. Provision for severance pay in respect of term staff was recognised at its nominal value.

### *Separation and redundancy*

Provision is made for separation and redundancy payments in cases where positions have either been identified as excess to requirements as a result of restructuring and relocation of Divisions and a reliable estimate of the amount payable can be determined.

### *Superannuation*

CSIRO discharges its liability for indefinite employees' 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% of salary (CSS) and 10.2% of salary (PSS). These contribution rates are determined by regular actuarial review. In addition a 3% employer productivity superannuation benefit is contributed for CSS and PSS members. For term employees who have chosen not to join CSS or PSS, a 7% employer productivity superannuation benefit is contributed to Australian Government Employees Superannuation Trust (AGEST) or other eligible superannuation funds.

## 1.12 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.

## 1.13 Insurance

As part of its risk management strategy, CSIRO has in place insurance cover with the Commonwealth Government's Managed Fund (Comcover), 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 catastrophic losses. Deductibles on the above insurances are up to $800 000.

## 1.14 Cash

For the purpose of the Statement of Cash Flows, cash includes cash at bank and on hand, deposits at call, trust monies and R&D Syndication deposits under contract. They are readily convertible to cash.

## 1.15 Inventories

Inventories held represent books, CD-ROMs and videos. They are held for resale and valued at the lower of cost and net realisable value.

## 1.16 Consumable Stores

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

### 1.17 Capital Usage Charge

A capital usage charge of 12% is imposed by the Commonwealth Government on the net assets of CSIRO at year end. The charge is adjusted to take account of asset gifts and revaluation increments during the financial year.

### 1.18 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.

### 1.19 Foreign Currency Transactions

Transactions denominated in a foreign currency are converted at the exchange rate prevailing at the date of the transaction. Foreign currency receivables and payables are also translated at the exchange rates prevailing at balance date. Associated currency gains and losses are brought to account in the Operating Statement.

Hedging is undertaken for specific exposures in order to avoid or minimise possible adverse financial effects of movements in exchange rates. Where a purchase or sale is specifically hedged, exchange differences arising up to the date of purchase or sale, and costs, premiums and discounts relative to the hedging transaction, are included with the measurement of purchase or sale.

### 1.20 Taxation

In accordance with section 53 of the Science and Industry Research Act, CSIRO is exempt from all forms of Australian taxation except fringe benefits tax and the goods and services tax. CSIRO pays applicable taxes in overseas countries.

### 1.21 Rounding

Amounts are rounded to the nearest $1 000 except in relation to:

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

### 1.22 Joint Ventures

CSIRO has interest in a number of joint venture operations and entities. Details of the joint venture operations and entities are disclosed in Note 23, and they are accounted for in accordance with Australian Accounting Standard, AAS19.

### 1.23 Financial Instruments

Accounting policies for financial instruments are stated in Note 34.

### 1.24 Contingencies

A material contingency, which is quantified and not recognised as an expense or revenue is disclosed in the Schedule of Contingencies unless the possible loss or gain is remote. Where a material contingency cannot be reasonably quantified it is disclosed in the Schedule of Unquantifiable Contingencies.

### 1.25 Reporting by Outcomes

A comparison of Budget and Actual figures by outcome specified in the Government Appropriation Acts is presented in Note 4.

### 1.26 Comparative Figures

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

Comparatives are not presented in Note 4 dealing with Reporting by Outcomes, due to 1999/2000 being the first year of the implementation of accrual budgeting framework by the Government.

## NOTE 2 ECONOMIC DEPENDENCY

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

## NOTE 3 SEGMENT 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.

## NOTE 4 REPORTING BY OUTCOMES

CSIRO's outputs contribute to a single Outcome, that is, to "enhance innovation, productivity and competitiveness in Australian industry with improved understanding and management of the environment and natural resources in the interest of the Australian community".

| | Actual $'000 | Budget $'000 |
|---|---|---|
| **(a) Reporting by Outcome for 1999/2000** | | |
| **Revenues** | | |
| Revenue from Government - Appropriation Acts 1 & 3 | 597 540 | 597 540 |
| Additional estimates of revenue from Government - Appropriation Acts 2 & 4 | 19 553 | 19 553 |
| | 617 093 | 617 093 |
| Revenue from other sources | 278 125 | 252 952 |
| Increase to original budget revenue from other sources | – | 11 709 |
| | 278 125 | 264 661 |
| **Total revenues** | **895 218** | **881 754** |
| **Net cost to budget outcome** | **888 134** | **881 754** |
| Total assets deployed as at 30.6.00 | 1 295 896 | 1 288 150 |
| Net assets deployed as at 30.6.00 | 952 868 | 945 784 |
| **(b) Report by outcome by funding source for 1999/2000** | | |
| Expenses against revenue from Government Appropriations | 617 093 | 617 093 |
| Expenses against revenue from other sources | 271 041 | 264 661 |
| **Total expenses against output** | **888 134** | **881 754** |

## NOTE 5 OPERATING REVENUES

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **5.1 Revenues from Government Appropriations** | | | |
| For research activities | | 500 000 | 475 390 |
| For capital usage charge | 1.17 | 117 093 | – |
| | 4 | 617 093 | 475 390 |
| **5.2 Sales of goods and services** | | | |
| Research and development activities | | 219 106 | 217 616 |
| Agriculture, Fisheries and Forestry - Australia's contribution to the operation of the Australian Animal Health Laboratory National Facility | | 6 129 | 6 129 |
| Consultancies, collaboration and testing fees | | 8 121 | 8 795 |
| Publications, research products and processes | | 8 802 | 7 714 |
| Royalties and license fees | | 8 259 | 6 499 |
| | 8 | 250 417 | 246 753 |
| **5.3 Interest** | | | |
| Bank and term deposits | | 6 251 | 1 701 |
| **5.4 Dividends** | | | |
| Associate company | | 138 | – |
| **5.5 Net gains from sales of assets** | | | |
| Property, plant and equipment | | 751 | – |
| Shares | | 8 612 | 5 |
| | | 9 363 | 5 |
| **5.6 Net foreign exchange gains** | | | |
| Non-speculative | | 53 | 119 |
| **5.7 Other revenues** | | | |
| Contributions - staff and others | | 1 267 | 720 |
| Donations | | 713 | 914 |
| Rental | | 3 330 | 2 740 |
| Share of joint venture (Food Science Australia) operating surplus | 23 | 268 | – |
| Computer software brought to account as a result of a change in accounting policy | 14 | 6 325 | – |
| | | 11 903 | 4 374 |

## NOTE 6 OPERATING EXPENSES

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **6.1 Employees expenses** | | | |
| Remuneration for services provided | | 418 320 | 413 887 |
| Separation and redundancy | | 19 582 | 6 921 |
| | | 437 902 | 420 808 |
| **6.2 Suppliers** | | | |
| Supply of goods and services | | 247 074 | 242 181 |
| Operating lease rentals | | 8 172 | 5 324 |
| | | 255 246 | 247 505 |
| **6.3 Depreciation and amortisation** | | | |
| Depreciation and amortisation of property, plant and equipment | | 76 521 | 67 600 |
| Amortisation of finance leased assets | | 789 | 592 |
| | | 77 310 | 68 192 |
| **6.4 Write-down of assets** | | | |
| Receivables for goods and services | | 142 | 296 |
| Investment - associate companies | | 1 245 | 1 769 |
| | | 1 387 | 2 065 |
| **6.5 Net losses from sales of assets** | | | |
| Property, plant and equipment | | – | 4 779 |
| **6.6 Interest** | | | |
| Finance charges on lease liabilities | | 535 | 417 |
| **6.7 Other expenses** | | | |
| Contamination clean up and other | | 2 950 | – |
| Provision for refit of research vessels written back | | – | (297) |
| Abnormal item: | | | |
| Net loss due to change in method of accounting for the joint venture, Food Science Australia | | – | 4 253 |
| | | 2 950 | 3 956 |

## NOTE 7 REVENUE MEASURE – PAYMENT TO GOVERNMENT

In agreeing to CSIRO's appropriation budget for the triennium (1997/98 to 1999/2000), the Government imposed a revenue measure requiring CSIRO to provide savings through efficiency gains, asset rationalisation and other measures totalling $60 million to be paid periodically to the Government over three years. The final payment of $30 million was paid in June 2000.

## NOTE 8 REVENUE – SALES OF GOODS AND SERVICES

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **Business Units** | | | |
| Animal Health (incl. Australian Animal Health Laboratory) | | 10 954 | 9 456 |
| Animal Production | | 4 624 | 5 182 |
| Atmospheric Research | | 5 056 | 5 351 |
| Australia Telescope National Facility | | 2 745 | 4 203 |
| Building, Construction & Engineering | | 9 407 | 8 442 |
| Discovery Centre | | 55 | 530 |
| Energy Technology | | 6 815 | 8 016 |
| Entomology | | 14 560 | 15 134 |
| Exploration & Mining | | 14 276 | 16 012 |
| Forestry & Forest Products | | 8 686 | 10 177 |
| Health Sciences & Nutrition | | 5 884 | 2 373 |
| Land & Water | | 20 180 | 16 290 |
| Manufacturing Science & Technology | | 14 886 | 14 523 |
| Marine Research | | 12 317 | 14 198 |
| Mathematical & Information Sciences | | 9 134 | 8 220 |
| Mediterranean Agricultural Research | | 29 | 47 |
| Minerals | | 12 304 | 12 290 |
| Molecular Science | | 9 201 | 12 425 |
| ORV *Franklin* National Facility | | 328 | 152 |
| Petroleum Resources | | 4 750 | 5 273 |
| Plant Industry | | 25 312 | 20 865 |
| Publishing | | 6 136 | 5 618 |
| Telecommunications & Industrial Physics (incl. National Measurement Laboratory) | | 16 175 | 15 785 |
| Textile & Fibre Technology | | 9 156 | 8 903 |
| Tropical Agriculture | | 13 031 | 13 261 |
| Wildlife & Ecology | | 5 980 | 6 650 |
| Corporate | | 8 436 | 7 377 |
| **Total Sales of goods and services** | 5.2 | **250 417** | **246 753** |

## NOTE 9 CASH

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| Cash at bank and on hand | | 15 160 | 37 065 |
| Cash at bank - trust monies | | 9 464 | 16 296 |
| Deposits - at call | | 30 000 | 250 |
| **Total cash** | | **54 624** | **53 611** |

## NOTE 10 RECEIVABLES

| | | |
|---|---|---|
| Goods and services | 31 410 | 26 906 |
| Provision for doubtful debts | (535) | (634) |
| | 30 875 | 26 272 |
| Property sales | 6 986 | 520 |
| Other | 9 486 | 5 497 |
| **Total receivables** | **47 347** | **32 289** |
| | | |
| Ageing of gross receivables are as follows: | | |
| Not overdue | 39 239 | 25 252 |
| Overdue by: | | |
| Less than 30 days | 5 465 | 5 013 |
| 30 to 60 days | 1 334 | 1 503 |
| 60 to 90 days | 885 | 297 |
| More than 90 days | 959 | 858 |
| **Total gross receivables** | **47 882** | **32 923** |

## NOTE 11 INVESTMENTS

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| R&D Syndicate deposits - under contract | 25 | 89 590 | 98 283 |
| **Shares - at valuation** | **% CSIRO interest** | | |
| Unlisted associate companies (a) | | | |
| Dunlena Pty Ltd | 47.0 | 5 | 5 |
| Gene Shears Pty Ltd | 50.0 | 580 | 580 |
| Gropep Pty Ltd | 33.2 | 545 | 545 |
| Preston Group Ltd | 34.0 | – | 1 984 |
| X-Ray Technologies Pty Ltd | 37.1 | 1 290 | 875 |
| Ceramic Fuel Cells Ltd | 27.3 | 1 813 | – |
| Quantm Pty Ltd | 49.0 | 1 001 | – |
| | | 5 234 | 3 989 |
| Provision for diminution in value | 1.9 | (5 234) | (3 989) |
| | | – | – |
| Shares - at cost | | | |
| Other companies | | | |
| Listed company (b) | | 1 126 | 989 |
| Unlisted companies | | 58 | 8 |
| | | 1 184 | 997 |
| | | **90 774** | **99 280** |

| (a) Name of companies | Principle Activities |
|---|---|
| Dunlena Pty Ltd | A trustee company for an unincorporated joint venture to develop agricultural chemicals. |
| Gene Shears Pty Ltd | Conduct research projects based on the Ribozyme technology and investigate licensing and development of its commercial applications hereof. |
| Gropep Pty Ltd | Development, manufacture, licensing and sale of biotechnology products. |
| Preston Group Ltd | Development and sales of computer decision support systems with associated consulting. The company was sold during the year. |
| X-Ray Technologies Pty Ltd | Identifying applications for phase contrast imaging technology and completing the first concept development prototype of an ultramicroscope. |
| Ceramic Fuel Cells Ltd | Research and development of fuel cell technologies and analysing their market application opportunities. |
| Quantm Pty Ltd | Market and develop software product 'Align 3D', developed to optimise route alignments for road and rail projects. |

## NOTE 11 INVESTMENTS (CONT)

In addition, CSIRO has a 50% beneficial interest in an unlisted R&D company, Aries Information Services Pty Ltd. Its valuation is less than $1 000 and it is fully provided for diminution in value. In 1999, CSIRO's beneficial interest in Ceramic Fuel Cells Ltd was $352 and it was fully provided for diminution in value.

**(b)** CSIRO has shareholding in a listed company, Queensland Metals Corporation NL. As at 30 June 2000 the market value is $715 899 (1999 $962 793).

## NOTE 12 LAND AND BUILDINGS

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **Land** | | | |
| At cost | | 774 | – |
| At June 1999 valuation | | 149 330 | 165 500 |
| | | 150 104 | 165 500 |
| **Buildings** | | | |
| At cost | | 11 779 | – |
| At June 1999 gross valuation | | 1 219 665 | 1 233 425 |
| | | 1 231 444 | 1 233 425 |
| Accumulated depreciation | | (624 353) | (603 960) |
| | | 607 091 | 629 465 |
| Capital works in progress - at cost | | 23 658 | 8 347 |
| | | 630 749 | 637 812 |
| **Leasehold improvements** | | | |
| At cost | | 642 | – |
| At June 1999 gross valuation | | 77 101 | 77 125 |
| | | 77 743 | 77 125 |
| Accumulated amortisation | | (40 204) | (38 072) |
| | | 37 539 | 39 053 |
| **Buildings under finance lease** | | | |
| At June 1999 gross valuation | | 20 827 | 20 827 |
| Accumulated amortisation | | (3 786) | (3 265) |
| | | 17 041 | 17 562 |
| **Total land and buildings** | | **835 433** | **859 927** |

## NOTE 13 PLANT AND EQUIPMENT

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **Plant and equipment** | | | |
| At cost | | 81 426 | 46 991 |
| At July 1998 gross valuation | | 452 842 | 473 027 |
| | | 534 268 | 520 018 |
| Accumulated depreciation | | (317 980) | (294 955) |
| | | 216 288 | 225 063 |
| **Research vessels** | | | |
| At cost | | 654 | 275 |
| At July 1998 gross valuation | | 46 138 | 46 444 |
| | | 46 792 | 46 719 |
| Accumulated depreciation | | (23 928) | (22 180) |
| | | 22 864 | 24 539 |
| **Plant and equipment under finance lease** | | | |
| At cost | | 2 434 | 904 |
| At July 1998 gross valuation | | 100 | 100 |
| | | 2 534 | 1 004 |
| Accumulated amortisation | | (314) | (45) |
| | | 2 220 | 959 |
| **Total plant and equipment** | | **241 372** | **250 561** |

## NOTE 13 PLANT AND EQUIPMENT (CONT)

### (a) Analysis of property, plant and equipment and intangibles

Movement summary 1999/2000 for all assets irrespective of valuation basis

| Description | Land | Buildings | Total Land & Buildings | Plant & Equipment | Intangibles (Note 14) | Total |
|---|---|---|---|---|---|---|
| | $'000 | $'000 | $'000 | $'000 | $'000 | $'000 |
| Gross value as at 1.7.99 | 165 500 | 1 339 724 | 1 505 224 | 567 741 | – | 2 072 965 |
| Additions | 774 | 27 702 | 28 476 | 37 897 | – | 66 373 |
| Change in accounting policy | – | – | – | – | 15 480 | 15 480 |
| Disposals | (16 170) | (13 754) | (29 924) | (22 043) | – | (51 967) |
| Gross value as at 30.6.00 | 150 104 | 1 353 672 | 1 503 776 | 583 595 | 15 480 | 2 102 851 |
| Accumulated depreciation/ amortisation as at 1.7.99 | – | 645 297 | 645 297 | 317 180 | – | 962 477 |
| Depreciation/amortisation | – | 35 260 | 35 260 | 42 050 | – | 77 310 |
| Change in accounting policy | – | – | – | – | 9 155 | 9 155 |
| Adjustment for disposals | – | (12 214) | (12 214) | (17 007) | – | (29 221) |
| Accumulated depreciation/ amortisation as at 30.6.00 | – | 668 343 | 668 343 | 342 223 | 9 155 | 1 019 721 |
| **Net book value as at 30.6.00** | **150 104** | **685 329** | **835 433** | **241 372** | **6 325** | **1 083 130** |
| **Net book value as at 30.6.99** | **165 500** | **694 427** | **859 927** | **250 561** | **–** | **1 110 488** |

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

| Description | Land $'000 | Buildings $'000 | Plant & Equipment $'000 | Intangibles $'000 | Total 2000 $'000 | Total 1999 $'000 |
|---|---|---|---|---|---|---|
| Freehold | 126 036 | 566 424 | – | – | 692 460 | 710 975 |
| Commonwealth Crown Leases | 10 803 | 193 713 | – | – | 204 516 | 203 143 |
| Leasehold | – | 77 743 | – | – | 77 743 | 77 125 |
| National Facilities | 8 765 | 468 772 | 197 877 | – | 675 414 | 673 657 |
| Deed of Grant | – | 2 535 | – | – | 2 535 | 2 535 |
| Finance Lease | 4 500 | 20 827 | 2 534 | – | 27 861 | 26 331 |
| Capital Works in Progress | – | 23 658 | – | – | 23 658 | 8 347 |
| | 150 104 | 1 353 672 | 200 411 | – | 1 704 187 | 1 702 113 |
| Plant and Equipment | – | – | 383 184 | – | 383 184 | 370 852 |
| Intangibles | – | – | – | 15 480 | 15 480 | – |
| Gross value | 150 104 | 1 353 672 | 583 595 | 15 480 | 2 102 851 | 2 072 965 |
| Accumulated depreciation/ amortisation | – | (668 343) | (342 223) | (9 155) | (1 019 721) | (962 477) |
| **Net book value as at 30 June** | **150 104** | **685 329** | **241 372** | **6 325** | **1 083 130** | **1 110 488** |

## NOTE 13 PLANT AND EQUIPMENT (CONT)

| | |
|---|---|
| Freehold | – Held in Fee Simple - however, the majority of freehold properties are zoned "Public Purpose Commonwealth" which restricts 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 Australian Animal Health Laboratory, Australia Telescope, National Measurement Laboratory and the Oceanographic Research Vessel *Franklin* managed by CSIRO on behalf of the Commonwealth Government. |
| Deed of Grant | – Covers property that 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.

### (c) National facilities

The Australian Animal Health Laboratory (AAHL), the Australia Telescope (AT), the Oceanographic Research Vessel (ORV) *Franklin* and the National Measurement Laboratory (NML) 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.

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

| | AAHL $'000 | AT $'000 | ORV *Franklin* $'000 | NML $'000 | Total $'000 |
|---|---|---|---|---|---|
| Land | 8 765 | – | – | – | 8 765 |
| Buildings | 424 154 | – | – | 44 618 | 468 772 |
| Accumulated depreciation | (190 438) | – | – | (20 798) | (211 236) |
| | 233 716 | – | – | 23 820 | 257 536 |
| Plant and equipment | 8 209 | 151 614 | 29 657 | 8 397 | 197 877 |
| Accumulated depreciation | (6 059) | (79 984) | (17 199) | (3 994) | (107 236) |
| | 2 150 | 71 630 | 12 458 | 4 403 | 90 641 |
| **Net book value as at 30.6.00** | **244 631** | **71 630** | **12 458** | **28 223** | **356 942** |
| **Net book value as at 30.6.99** | **258 492** | **73 386** | **13 297** | **29 367** | **374 542** |

The operating expenses for the above National Facilities for the financial year amounted to $49 651 704 (1999 $48 862 135) and are included in CSIRO's Operating Statement.

## NOTE 14 INTANGIBLES

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| Computer Software | 1.8 | | |
| At June 2000 gross valuation | | 15 480 | – |
| Accumulated amortisation | | (9 155) | – |
| **Total intangibles** | | **6 325** | **–** |

## NOTE 15 INVENTORIES HELD FOR RESALE

| | | | |
|---|---|---|---|
| Books and media products - at lower of cost and net realisable value | 1.15 | 745 | 549 |
| **Total inventories held for resale** | | **745** | **549** |

## NOTE 16 OTHER NON-FINANCIAL ASSETS

| | | | |
|---|---|---|---|
| Contract research work in progress - at cost | 1.4 | 17 985 | 19 245 |
| Prepaid property rentals | | 781 | 992 |
| Other prepayments | | 510 | 95 |
| **Total other non-financial assets** | | **19 276** | **20 332** |

## NOTE 17 LEASES

| | | |
|---|---|---|
| Finance lease liability is payable as follows: | | |
| Within one year | 1 656 | 1 222 |
| Within one to five years | 5 743 | 4 828 |
| More than five years | 16 809 | 17 821 |
| | 24 208 | 23 871 |
| Service and maintenance charges | (1) | (1) |
| Minimum lease payments | 24 207 | 23 870 |
| Future finance charges | (3 810) | (4 066) |
| **Total finance lease liability** | **20 397** | **19 804** |
| Lease liability is represented by: | | |
| Current | 1 116 | 738 |
| Non-Current | 19 281 | 19 066 |
| | **20 397** | **19 804** |

## NOTE 18 EMPLOYEES

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| Accrued wages and salaries | | 12 784 | 8 365 |
| Provision for recreation leave | | 42 964 | 45 245 |
| Provision for long service leave | | 91 614 | 90 698 |
| Provision for severance pay | | 2 860 | 1 581 |
| Provision for redundancy | | 6 330 | – |
| **Total employee entitlement liability** | | **156 552** | **145 889** |

## NOTE 19 SUPPLIERS

| | | | |
|---|---|---|---|
| Trade creditors | | 28 299 | 25 839 |
| **Total suppliers' liability** | | **28 299** | **25 839** |

## NOTE 20 OTHER LIABILITIES

| | | | |
|---|---|---|---|
| Contract research revenue received in advance | | 31 274 | 32 404 |
| R&D Syndicates - under contract | | 89 740 | 98 434 |
| Other creditors | | 4 802 | 2 099 |
| Provisions - other | | 2 500 | – |
| **Total other liabilities** | | **128 316** | **132 937** |

## NOTE 21 EQUITY - MOVEMENT SUMMARY 1999/2000

| | Accumulated Surplus | | Asset Revaluation Reserve | | Total Equity | |
|---|---|---|---|---|---|---|
| Description | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 |
| Balance as at 1July | 577 960 | 597 340 | 397 824 | 252 407 | 975 784 | 849 747 |
| Surplus/(Deficit) | 119 888 | (19 380) | – | – | 119 888 | (19 380) |
| Revenue measure paid | (30 000) | – | – | – | (30 000) | – |
| Capital use paid | (112 804) | – | – | – | (112 804) | – |
| Net revaluation increase | – | – | – | 145 417 | – | 145 417 |
| **Balance as at 30 June** | **555 044** | **577 960** | **397 824** | **397 824** | **952 868** | **975 784** |

| | | |
|---|---|---|
| The net revaluation increase in the asset revaluation reserve comprises: | | |
| Revaluation increase/(decrease) | | |
| - land | – | (1 741) |
| - buildings and leasehold improvements | – | 54 132 |
| - plant and equipment | – | 93 026 |
| | **–** | **145 417** |

## NOTE 22 STATEMENT OF CASH FLOWS RECONCILIATION

| | Notes | 2000 $'000 | 1999 $'000 |
|---|---|---|---|
| **For the purpose of the Statement of Cash Flows, cash is represented by:** | | | |
| Cash at bank and on hand | 9 | 15 160 | 37 065 |
| Cash at bank - trust monies | 9 | 9 464 | 16 296 |
| Deposits - at call | 9 | 30 000 | 250 |
| R&D Syndicate deposits - under contract | 11 | 89 590 | 98 283 |
| | | **144 214** | **151 894** |
| **(b) Reconciliation of operating surplus to net cash provided by operating activities:** | | | |
| **Operating surplus/(deficit)** | | **119 888** | **(19 380)** |
| Depreciation and amortisation of property, plant and equipment | 6 | 77 310 | 68 192 |
| Increase/(decrease) in provision for refit | 13 | – | (560) |
| Increase/(decrease) in provision for diminution in value | 11 | 1 245 | 1 769 |
| (Profit)/loss on disposal of property, plant and equipment | 5 | (751) | 4 779 |
| (Profit)/loss on disposal of shares | 5 | (8 612) | (5) |
| (Increase)/decrease in receivables | 10 | (8 592) | (2 910) |
| (Increase)/decrease in intangibles | 14 | (6 325) | – |
| (Increase)/decrease in inventories | 15 | (196) | 146 |
| (Increase)/decrease in other assets | 16 | 1 056 | (2 620) |
| Increase/(decrease) in employee liabilities | 18 | 10 663 | 6 862 |
| Increase/(decrease) in liability to suppliers | 19 | 2 460 | 7 727 |
| Increase/(decrease) in debt and other liabilities | 20 | (11 452) | 7 349 |
| **Net cash provided by operating activities** | | **176 694** | **71 349** |

## NOTE 23 JOINT VENTURES

CSIRO participates in a number of joint ventures. For reporting purposes these are segregated into joint venture operations and joint venture entities:

### (a) Joint Venture Operations

(i) Co-operative Research Centres (CRCs)

The Co-operative Research Centres Program, launched in May 1990 by the Commonwealth Government, 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.

The following CRCs listed below have the characteristics of joint venture operations and are reported as such. The CRCs denoted with an asterisk (*) are incorporated bodies.

## NOTE 23 JOINT VENTURES (CONT)

During the financial year, CSIRO's total actual 'in kind' and cash contributions to CRCs from its own resources was $58.6 million; together with monies from the Commonwealth Government and external sources specifically for the CRCs, the total expended was $91 million. CSIRO's total actual contributions life to date for CRCs listed below amounted to $435 million. As the success of CRC's is dependent upon the uncertainty of R&D outcomes, the value of CSIRO's contributions do not necessarily represent equity value. As the CRC agreements include a twelve-month termination clause, this amount approximates CSIRO's forward commitment for 2000/2001. Approximately $14.5 million or 6% of CSIRO's total plant and equipment assets are used for CRC activities.

At 30 June 2000, CSIRO is a participant in 51 CRCs and CSIRO's interest in each of the CRCs is determined by the individual CRC agreement. These are:

| Names of Co-operative Research Centres | CSIRO's Equity Interest (%) (excluding Commonwealth contributions) |
|---|---|
| **AGRICULTURE AND RURAL BASED MANUFACTURING** | |
| Aquaculture | 12 |
| Australian Cotton CRC | 26 |
| Cattle and Beef Quality | 29 |
| Food Industry Innovation | 16 |
| Hardwood Fibre and Paper Science | 48 |
| Legumes in Mediterranean Agriculture | 18 |
| Premium Quality Wool | 42 |
| Quality Wheat Products and Processes | 24 |
| Sustainable Production Forestry | 32 |
| Sustainable Rice Production | 16 |
| Sustainable Sugar Production | 19 |
| Tropical Plant Protection | 27 |
| Viticulture | 24 |
| **ENVIRONMENT** | |
| Antarctica and the Southern Ocean | 15 |
| Biological Control of Pest Animals | 57 |
| Catchment Hydrology | 29 |
| Coastal Zone, Estuary and Waterway Management | 11 |
| Freshwater Ecology | 9 |
| Greenhouse Accounting | 16 |
| Southern Hemisphere Meteorology | 27 |
| Sustainable Development of Tropical Savannas | 11 |
| Tropical Rainforest Ecology and Management | 40 |
| Waste Management and Pollution Control | 8 |
| Water Quality and Treatment | 13 |
| Weed Management Systems | 31 |

## NOTE 23 JOINT VENTURES (CONT)

| | |
|---|---|
| **INFORMATION AND COMMUNICATION TECHNOLOGY** | |
| Advanced Computational Systems | 34 |
| Australian Telecommunications | 4 |
| Enterprise Distributed Systems Technology | 21 |
| Satellite Systems | 28 |
| **MANUFACTURING TECHNOLOGY** | |
| Bioproducts | 61 |
| Cast Metals Manufacturing* | 30 |
| Intelligent Manufacturing Systems and Technologies* | 7 |
| International Food Manufacture and Packaging Science | 17 |
| Microtechnology | 5 |
| Molecular Engineering and Technology | 43 |
| Polymers* | 28 |
| Welded Structures* | 49 |
| **MEDICAL SCIENCE AND TECHNOLOGY** | |
| Cellular Growth Factors | 4 |
| Diagnostic Technologies | 18 |
| Eye Research and Technology | 21 |
| Tissue Growth and Repair | 23 |
| Vaccine Technology | 26 |
| **MINING AND ENERGY** | |
| A J Parker CRC for Hydrometallurgy | 50 |
| Australian Geodynamics CRC | 34 |
| Australian Mineral Exploration Technologies | 43 |
| Australian Petroleum CRC | 50 |
| Black Coal Utilisation | 14 |
| Clean Power from Lignite | 15 |
| G K Williams CRC for Extractive Metallurgy | 56 |
| Landscape Evolution and Mineral Exploration | 44 |
| Mining Technology and Equipment | 19 |

(ii) Other Joint Ventures

CSIRO participates in a joint venture operation with the Bureau of Meteorology (BOM) in a 50/50 ownership and operation of a High Performance Computing and Communication Centre (HPCCC). CSIRO and BOM jointly own the super computer and also jointly share in the usage and operating expenses of HPCCC. CSIRO's 50% share of the super computer and other plant and equipment in the joint venture of $6.5 million written down value and its share of operating expenses are included in CSIRO's Balance Sheet and Operating Statement respectively.

CSIRO has a one third interest in the joint venture Graingene with the Grains Research and Development Corporation and the Australian Wheat Board Limited. Graingene is a collaborative research and development venture where research and industry participants work together to identify, develop and bring to market grains technology. CSIRO's one-third share of operating expenses of Graingene is included in CSIRO's Operating Statements.

## NOTE 23 JOINT VENTURES (CONT)

In addition, CSIRO has collaborative arrangements with other parties to perform research and share in the outputs (i.e. mainly intellectual property) in proportion to each participant's research input, initial intellectual property or cash contributions. These collaborative arrangements also share the characteristics of joint venture operations. The principal activities of these joint venture operations are scientific research and development with the ultimate aim of sharing in the output (ie intellectual property). The numbers of this type of arrangement make it impractical to list separately. CSIRO's contributions to these joint ventures are included in CSIRO's Operating Statements.

**(b) Joint Venture Entities**

Food Science Australia

CSIRO has a 50% interest in an unincorporated joint venture, Food Science Australia (FSA). It provides food industry clients with complete, integrated research for local training and commercial product and process levels for end services. During the year FSA made an operating surplus of $309 317 (1999 deficit $1 868 595). In accordance with the joint venture agreement the operating surplus is shared equally between the joint venture parties. CSIRO's share of the operating surplus was $154 658 (1999 deficit $934 298).

| | 2000 $'000 | 1999 $'000 |
|---|---|---|
| Investment/(liability) in FSA at 1 July | (584) | 463 |
| Share of FSA's reduction in 1998/99 operating deficit | 114 | – |
| Share of FSA's operating surplus/(deficit) for the year | 154 | (1 047) |
| | **(316)** | **(584)** |

## NOTE 24 RELATED ENTITIES

During the financial year CSIRO provided actual in-kind contributions in the form of scientific staff and research facilities totalling $2 597 894 (1999 $2 745 459) to Biomolecular Research Institute Limited (BRI). The contributions in accordance with formal agreements between CSIRO and BRI are accounted for as expenses in CSIRO's Operating Statement.

BRI is principally a research and development company involved in the development of pharmaceutical and biological products. It is a company limited by guarantee. As at 30 June 2000 CSIRO has a 60% beneficial interest in the company and its in-kind contributions to June 2000 amounted to $31 million.

## NOTE 25 RESEARCH AND DEVELOPMENT SYNDICATES

CSIRO is a party to three agreements whereby the Research and Development Syndicates have purchased intellectual properties, with an option to sell back to CSIRO at a guaranteed price, and provided funds to CSIRO to undertake further research and development to advance the intellectual properties to commercialisation.

All research and development work is now complete. The balances of deposits (Note 11) are held as security to meet CSIRO's obligations (Note 20) to purchase the intellectual property held by each Syndicate, at the guaranteed option price, should the investors elect to sell.

## NOTE 26 RESOURCES MADE AVAILABLE TO CSIRO AND NOT INCLUDED IN THE BALANCE SHEET

| | Land $'000 | Buildings $'000 | Plant and equipment $'000 | Total $'000 |
|---|---|---|---|---|
| At valuation or cost | 25 250 | 60 837 | 37 872 | 123 959 |
| Accumulated depreciation | – | (37 400) | (34 802) | (72 202) |
| **Net book value as at 30.6.00** | **25 250** | **23 437** | **3 070** | **51 757** |
| **Net book value as at 30.6.99** | **21 016** | **24 899** | **3 978** | **49 893** |

The above assets are made available to CSIRO at little or no cost in accordance with formal agreements with contributors. They have either been purchased out of contract research monies and expensed in the year of purchase in accordance with the accounting policy Note 1.7, or made available to CSIRO at little or no cost.

These assets are controlled and accounted for in the contributors' books and any proceeds from their disposal are refundable to the contributors in accordance with formal agreements on equity share. The fair value of the in-kind contributions of these assets could not be reliably determined and therefore not brought to account in the Operating Statement. Although a valuable resource, these assets can be a constraint to management decision making in that they must be operated in accordance with the terms of their provision to CSIRO.

The major contributors of the above assets are The Woolmark Company and Meat and Livestock Australia Ltd.

## NOTE 27 MONIES HELD IN TRUST

| | 2000 $'000 | 1999 $'000 |
|---|---|---|
| Monies held in trust which are not included in the Balance Sheet. They are represented by cash at bank and the following investments in equities, bank securities and term deposits: | | |
| Investments | | |
| Commonwealth Bank of Australia | 2 862 | 2 541 |
| St George Bank | – | 227 |
| M F Cash Management Fund | 725 | 713 |
| Potter Warburg Cash Management Ltd | 103 | 165 |
| One Eleven Nominees Pty Ltd | 457 | 347 |
| Members Australia Credit Union Ltd | 560 | 531 |
| | 4 707 | 4 524 |
| Cash at bank | 419 | 261 |
| **Total monies held in trust as at 30 June** | **5 126** | **4 785** |

## NOTE 27 MONIES HELD IN TRUST (CONT)

| | 2000 $'000 | 1999 $'000 |
|---|---|---|
| **(a) The components of trust funds are as follows:** | | |
| William McIlrath Trust Fund | 199 | 214 |
| David Rivett Memorial Lecture Fund | 111 | 105 |
| FD McMaster Bequest | 2 453 | 2 354 |
| Sir Ian McLennan Achievement for Industry Award | 100 | 107 |
| The Ken and Yasuko Myer Plant Science Research Fund | 818 | 962 |
| The Elwood and Hannah Zimmerman Trust Fund | 1 120 | 1 043 |
| The Australian National Wildlife Collection Foundation | 325 | – |
| **Total monies held in trust as at 30 June** | **5 126** | **4 785** |

William McIlrath 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.

The Elwood and Hannah Zimmerman Research Trust Fund - Established to fund weevil research and the curation of the Australian National Insect Collection (ANIC) weevil collection.

The Australian National Wildlife Collection Foundation - Established to advance the interests and activities of the Australian National Wildlife Collection, a national reference record of Australian vertebrate fauna.

**(b) Movements of trust funds summary**

| | Myer $'000 | McLennan $'000 | McMaster $'000 | McIlrath $'000 | Rivett $'000 | Zimmerman $'000 | ANWC Foundation $'000 | Total 2000 $'000 |
|---|---|---|---|---|---|---|---|---|
| Balance as at 1 July | 962 | 107 | 2 354 | 214 | 105 | 1 043 | 313 | 5 098 |
| Receipts during year | 13 | 2 | – | – | – | 5 | – | 20 |
| Interest and dividends | 45 | 6 | 140 | 11 | 6 | 72 | 12 | 292 |
| Expenditure | (202) | (15) | (41) | (26) | – | – | – | (284) |
| **Balance as at 30 June** | **818** | **100** | **2 453** | **199** | **111** | **1 120** | **325** | **5 126** |

## NOTE 28 RENUMERATION OF AUDITORS

| | 2000 $ | 1999 $ |
|---|---|---|
| Renumeration to the Auditor-General for: | | |
| Auditing the financial statements for the reporting period | 205 000 | 205 000 |

The Auditor-General received no remuneration for other services during the reporting period.

## NOTE 29 COLLECTIONS

CSIRO owns several collections used for scientific research. CSIRO's collections have been established over time and cover an extensive range of evolution and change in species. The collections are irreplaceable, bear scientific and historical value and are not reliably measurable in monetary terms. Therefore, CSIRO has not recognised them as an asset in its financial statements. The four main collections and other collections held by CSIRO include:

Australian National Herbarium (ANH) - The ANH is one of the largest plant collections in Australia with approximately one million preserved plant specimens. It is unique among the Australian Herbaria in having a national focus for its collections, acquisition and research programs.

Australian National Insect Collection (ANIC) - The ANIC has over 11 million specimens and is the largest research collection of Australian insects and related organisms in the world.

Australian National Wildlife Collection (ANWC) - The ANWC, with over 80,000 specimens, holds CSIRO's land vertebrate collections, including the most comprehensively documented collections of Australian-New Guinean birds in the world.

CSIRO National Fish Collection (ANFC) - CSIRO's ANFC, also known as the 'ISR Munro Ichthyological Collection', houses more than 80 000 registered adult and 40 000 registered larval specimens of almost 3 000 species from Australasia, Asia, Antarctic, and the Sub-Antarctic Islands. It is among Australia's most diverse ichthyological collections and contains one of the largest collections of sharks, rays and deepwater fishes in the Southern Hemisphere.

Other Collections - These include the Australian Tree Seed Collection, CSIRO's Dadswell wood collection, CSIRO collection of living microalgae, and wood inhabiting fungi collection.

## NOTE 30 REMUNERATION OF BOARD MEMBERS

| | 2000 $ | 1999 $ |
|---|---|---|
| Remuneration and superannuation benefits received or due and receivable by full-time and part-time Board Members are: | | |
| Board Members' remuneration | 929 667 | 461 778 |
| Payments to superannuation funds for Board Members | 93 479 | 61 466 |
| | **1 023 146** | **523 244** |

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

| $ | | | 2000 Number | 1999 Number |
|---|---|---|---|---|
| Nil | – | 10 000 | 2 | 4 |
| 20 001 | – | 30 000 | 5 | 4 |
| 50 001 | – | 60 000 | 1 | 1 |
| 350 001 | – | 360 000 | 1 | 1 |
| 480 001 | – | 490 000* | 1 | – |

*Includes termination payment for the late Chief Executive.

## NOTE 31 MEETINGS OF BOARD MEMBERS AND AUDIT COMMITTEE

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

| | Board Members' Meetings | | Audit Committee Meetings | |
|---|---|---|---|---|
| | No. eligible to attend | No. attended | No. eligible to attend | No. attended |
| D C K Allen (Chairman) | 6 | 6 | 4 | 4 |
| A J Gandel | 6 | 3 | – | – |
| R Higgins | 6 | 5 | – | – |
| D P Mercer | 6 | 6 | 4 | 4 |
| D F J McDonald | 6 | 5 | – | – |
| M K McIntosh (deceased 7/2/2000) | 3 | 2 | – | – |
| M J O'Kane | 6 | 5 | – | – |
| A E de N Rogers | 6 | 6 | 4 | 4 |
| V R Sara | 6 | 6 | – | – |
| C M Adam (appointed 10/2/2000) | 3 | 3 | 2 | 2 |

The members of the Audit Committee are Mr D P Mercer (Chairman), Mr A E de N Rogers and Ms E Alexander (independent adviser and non Board Member). Ms E Alexander attended all Audit Committee meetings held for the year.

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

## NOTE 32 REMUNERATION OF OFFICERS

| | 2000 $ | 1999 $ |
|---|---|---|
| Remuneration received or due and receivable by Officers | **1 947 580** | **1 274 295** |

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

| $ | | | 2000 Number | 1999 Number |
|---|---|---|---|---|
| Nil | – | 100 000 | 2 | 2 |
| 190 001 | – | 200 000 | 1 | – |
| 210 001 | – | 220 000 | – | 2 |
| 220 001 | – | 230 000 | 2 | – |
| 230 001 | – | 240 000 | – | 1 |
| 240 001 | – | 250 000 | – | 1 |
| 270 001 | – | 280 000 | 1 | – |
| 350 001 | – | 360 000 | 1 | 1 |
| 480 001 | – | 490 000* | 1 | – |

Officers' remuneration relates to the Chief Executive and the Deputy Chief Executives concerned with, or taking part in, the management of CSIRO.

*Includes termination payment for the late Chief Executive.

## NOTE 33 RELATED PARTY DISCLOSURES

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

| | | |
|---|---|---|
| D C K Allen (Chairman) | A J Gandel | M K McIntosh (deceased 7/2/2000) |
| M J O'Kane | R Higgins | A E de N Rogers |
| D P Mercer | V R Sara | D F McDonald |
| C M Adam (appointed 10/2/2000) | | |

Remuneration - Information on remuneration of Board Members is disclosed in Note 30.

**Board Members' interests in contracts**

Since 1 July 1999 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 30 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**

Dr C M Adam is a Director of an associate company, Ceramic Fuel Cells Ltd and other companies, Strategic Industry Research Foundation Ltd, Melbourne Enterprises International Ltd, Melbourne Information Technologies Australia Ltd and Intec Ltd. All these companies have contractual relationships with CSIRO in the field of research and development and they are based on normal commercial terms and conditions.

Mr R Higgins is the Chief Executive Officer and Secretary of the Department of Industry, Science and Resources (DISR). During the financial year a number of grants and consultancy contracts were entered into between DISR, 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, Export Finance Insurance Corporation, Australian Industry Development Corporation, Australian Tourist Commission, Rossun Pty Ltd and the Australian Sports Commission. Transactions with these entities, if any, are based on normal terms and conditions.

Mr D P Mercer is the Director of Orica Ltd, North Ltd and Australian Prudential Regulation Authority, Chairman of Australia Pacific Airports Ltd and Australian Information Economy Advisory Council, Chancellor of Royal Melbourne Institute of Technology (RMIT). RMIT is involved in a number of Cooperative Research Centres in which CSIRO is a participant. CSIRO's transactions in the field of research and development with any of these entities are based on normal commercial terms and conditions.

Professor M J O'Kane is the Vice Chancellor of the University of Adelaide. There are transactions and other arrangements between CSIRO and the University of Adelaide. CSIRO has a number of buildings on the University campus which are used by CSIRO for research and development. The University and CSIRO are partners in a number of Cooperative Research Centres. CSIRO is a tenant on various campuses of the University. In addition, Professor O'Kane is a Director of FH Faulding & Co Limited. This entity has a number of contractual relationships with CSIRO in the field of research and development based on normal commercial terms and conditions.

Mr A E de N Rogers is Chairman of Uniquest Limited, Chairman of Australian Institute of Marine Science 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.

Professor V R Sara is a full time Commonwealth Statutory Officer and a Chair of the Australian Research Council. She is also a member of the Prime Minister's Science, Engineering and Innovation Council, the Anglo-Australian Telescope Board, the Korea-Australia Foundation Board, and several other Government Committees. The transactions with these entities, if any, are based on commercial terms and conditions.

## NOTE 34 FINANCIAL INSTRUMENTS

### (a) Terms, conditions and accounting policies

| Financial instrument | Notes | Accounting policies and methods | Nature of underlying instrument |
|---|---|---|---|
| **Financial assets** | | Financial assets are recognised when control over future economic benefits is established and the amount of the benefit can be reliably measured. | |
| Cash at bank and Deposits at call | 9 | Cash at bank and deposits are recognised at their nominal amounts. Interest is credited to revenue as it accrues. | Balance of cash at bank is mainly from contract research monies received in advance and held in the Organisation's current bank account. Interest is earned on the daily balance at the prevailing daily 30-day bank bill rate less fees and is paid at month end.<br><br>Deposits at call relates to temporarily surplus funds placed on deposit with a bank. Interest is earned on the deposit. |
| Cash at bank - trust monies | 9 | Cash at bank is recognised at its nominal amount. Interest is brought to account as it accrues. | Monies held in trust for third parties. |
| Receivables for goods and services and other receivables | 10 | These receivables are recognised at the nominal amounts due less any provision for doubtful debts. Provisions are made when collection of the debt is judged to be less rather than more likely. | Credit terms are net 30 days. |
| Receivables for property sales | 10 | These receivables are recognised at the nominal amount when contracts of sale have been executed. | All these receivables will be settled by 31 December 2000. |
| R&D Syndicate deposits - under contract | 11 | These deposits are recognised at their nominal amounts. Interest is brought to account as it accrues in accordance with R&D Syndicate agreements (Notes 11 and 25). | These deposits are held as security to meet CSIRO's obligations to buy back the intellectual property held by each syndicate, at the guaranteed option price should the investor elect to sell on or before the contracted date. |
| Listed and unlisted shares | 11 | These are carried at the lower of cost or recoverable amounts. No dividends have been declared or paid by the investee. | – |

## NOTE 34 FINANCIAL INSTRUMENTS (CONT)

| Financial instrument | Notes | Accounting policies and methods | Nature of underlying instrument |
|---|---|---|---|
| **Financial liabilities** | | Financial liabilities are recognised when a present obligation to another party is entered into and the amount of the liability can be reliably measured. | |
| Finance lease liabilities | 17 | Liabilities are recognised at the present value of the minimum lease payments at the beginning of the lease. The discount rates used are estimates of the interest rates implicit in the leases. | At reporting date, CSIRO had finance leases with terms averaging 17 years and a maximum term of 25 years. The interest rate implicit in the leases averaged 4.1% (1999 3.7%). The lease liabilities are secured by the lease assets and disclosed in Notes 12 and 13. |
| Trade creditors and other creditors | 19 & 20 | Creditors and accruals are recognised at their nominal amounts, being the amounts at which the liabilities will be settled. Liabilities are recognised to the extent that the goods or services have been received (irrespective of having been invoiced). | Settlement is usually made net 30 days. |
| R&D Syndicate - under contract | 20 | These liabilities are recognised at their nominal amounts. Interest is brought to account as it accrues in accordance with R&D Syndicate agreements (Notes 11 and 25). | As above for R&D Syndicate deposits. They are held as security to meet CSIRO's obligations under the R&D Syndicate agreements, which can be exercised on or before the contracted date. |
| Research revenue received in advance | 20 | Revenue from contract research activities is recognised when work is performed. Revenue is deferred to the extent that CSIRO has not performed its contractual obligations as at 30 June 2000. | Research revenue received in advance is not recognised as revenue until work is performed. |
| Trust monies | | As above in cash at bank – trust monies. | Being monies held in trust for third parties. They are payable on demand. |

**(a) Interest rate risk**

| Financial Instrument | Notes | Floating Interest Rate | | Fixed Interest Rate | | | | | | | | Non Interest Bearing | | Total | | Weighted Average Effective Interest Rate | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 year or less | | 1 to 2 years | | 2 to 5 years | | > 5 years | | | | | | | |
| | | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 $'000 | 1999 $'000 | 2000 % | 1999 % |
| **Financial assets (recognised)** | | | | | | | | | | | | | | | | | |
| Cash at bank and cash on hand | 9 | 15 160 | 37 065 | | | | | | | | | | | 15 160 | 37 065 | 6.2 | 4.6 |
| Cash at bank - trust monies | 9 | 9 464 | 16 296 | | | | | | | | | | | 9 464 | 16 296 | 6.2 | 4.6 |
| Deposits - at call | 9 | | 250 | 30 000 | – | | | | | | | | | 30 000 | 250 | 6.5 | 4.6 |
| Receivables for goods and services | 10 | | | | | | | | | | | 30 875 | 26 272 | 30 875 | 26 272 | n/a | n/a |
| Receivables for property sales | 10 | | | | | | | | | | | 6 986 | 520 | 6 986 | 520 | n/a | n/a |
| Other receivables | 10 | | | | | | | | | | | 9 486 | 5 497 | 9 486 | 5 497 | n/a | n/a |
| R&D Syndicate deposits | 11 | | | | | | | | | 89 590 | 81 283 | – | 17 000 | 89 590 | 98 283 | 9.8 | 9.8 |
| Shares | 11 | | | | | | | | | | | 1 184 | 997 | 1 184 | 997 | n/a | n/a |
| **Total financial assets (recognised)** | | **24 624** | **53 611** | **30 000** | **–** | | | | | **89 590** | **81 283** | **48 531** | **50 286** | **192 745** | **185 180** | | |
| **Total Assets** | | | | | | | | | | | | | | **1 295 896** | **1 316 549** | | |
| **Financial liabilities (recognised)** | | | | | | | | | | | | | | | | | |
| Finance lease liabilities | 17 | | | 13 728 | 13 901 | | | 6 669 | 5 903 | | | | | 20 397 | 19 804 | 4.1 | 3.7 |
| Trade creditors | 19 | | | | | | | | | | | 28 299 | 25 839 | 28 299 | 25 839 | n/a | n/a |
| Research revenue received in advance | 20 | | | | | | | | | | | 31 274 | 32 404 | 31 274 | 32 404 | n/a | n/a |
| R&D syndicates - under contract | 20 | | | | | | | | | 89 590 | 81 284 | 150 | 17 150 | 89 740 | 98 434 | 9.8 | 9.8 |
| Trust monies | | 9 464 | 16 296 | | | | | | | | | | | 9 464 | 16 296 | 6.2 | 4.6 |
| Other creditors | 20 | | | | | | | | | | | 4 802 | 2 099 | 4 802 | 2 099 | n/a | n/a |
| **Total financial liabilities (recognised)** | | **9 464** | **16 296** | **13 728** | **13 901** | | | **6 669** | **5 903** | **89 590** | **81 284** | **64 525** | **77 492** | **183 976** | **194 876** | | |
| **Total liabilities** | | | | | | | | | | | | | | **343 028** | **340 765** | | |
| Legal claims | | | | | | | | | | | | 1 800 | 2 105 | 1 800 | 2 105 | n/a | n/a |
| **Total financial liabilities (unrecognised)** | | | | | | | | | | | | **1 800** | **2 105** | **1 800** | **2 105** | | |

## NOTE 34 FINANCIAL INSTRUMENTS (CONT)

### (c) Net fair values of financial assets and liabilities

| | Notes | 2000 Total carrying amount $'000 | 2000 Aggregate net fair value $'000 | 1999 Total carrying amount $'000 | 1999 Aggregate net fair value $'000 |
|---|---|---|---|---|---|
| **Financial assets** | | | | | |
| Cash at bank and on hand | 9 | 15 160 | 15 160 | 37 065 | 37 065 |
| Cash at bank - trust monies | 9 | 9 464 | 9 464 | 16 296 | 16 296 |
| Deposits - at call | 9 | 30 000 | 30 000 | 250 | 250 |
| Receivables for goods and services | 10 | 30 875 | 30 875 | 26 272 | 26 272 |
| Receivables for property sales | 10 | 6 986 | 6 986 | 520 | 520 |
| Other receivables | 10 | 9 486 | 9 486 | 5 497 | 5 497 |
| R&D Syndicate deposits - under contract | 11 | 89 590 | 89 590 | 98 283 | 98 283 |
| Shares | 11 | 1 184 | 774 | 997 | 971 |
| | | **192 745** | **192 336** | **185 180** | **185 154** |
| **Financial liabilities (recognised)** | | | | | |
| Finance lease liabilities | 17 | 20 397 | 20 397 | 19 804 | 19 804 |
| Trade creditors | 19 | 28 299 | 28 299 | 25 839 | 25 839 |
| Research revenue received in advance | 20 | 31 274 | 31 274 | 32 404 | 32 404 |
| R&D Syndicate - under contract | 20 | 89 740 | 89 740 | 98 434 | 98 434 |
| Trust monies | | 9 464 | 9 464 | 16 296 | 16 296 |
| Other creditors | 20 | 4 802 | 4 802 | 2 099 | 2 099 |
| | | **183 976** | **183 976** | **194 876** | **194 876** |
| **Financial liabilities (unrecognised)** | | | | | |
| Legal claims | Schedule of Contingencies | **1 800** | **1 800** | **2 105** | **2 105** |

**Financial assets**

The net fair values of cash, deposits at call, trade debtors for sale of properties, goods and services and R&D syndicate deposits approximate their carrying amounts.

The net fair values for listed equity investments is the quoted market price at reporting date, adjusted for the transaction costs necessary for realisation.

The net fair values for unlisted equity investments in associate companies are fully provided for diminution in value by the Board Members based on the underlying business of the investees in R&D and high technology industries.

## NOTE 34 FINANCIAL INSTRUMENTS (CONT)

Other than for listed financial assets, none of the classes of financial assets are readily traded on organised markets in standardised form.

**Financial liabilities**

The net fair values of finance leases are based on discounted cash flows using current interest rates for liabilities with similar risk profiles.

The net fair values for trade creditors, contract monies received in advance, R&D syndicate under contract and trust monies are approximated by their carrying amounts.

**Hedges**

Specific foreign exchange contracts to sell USD900 000 were transacted on 7 June 2000. The value dates for the contracts are: 30 November 2000 for USD400 000, 21 December 2000 for USD300 000 and 31 January 2001 for USD200 000. As at 30 June the unrecognised exchange gain for the contracts was $11 216.

### (d) Credit risk exposures

CSIRO's maximum exposures to credit risk at reporting date in relation to each class of recognised financial assets is the carrying amount of those assets as indicated in the Balance Sheet.

The economic entity has no significant exposures to any concentrations of credit risk.

# APPENDIX 1. STATUTORY REPORTING REQUIREMENTS

## COMMONWEALTH AUTHORITIES AND COMPANIES ACT 1997

The *Commonwealth Authorities and Companies Act* 1997 (Cth) (the '*CAC Act*') imposes core reporting requirements on Commonwealth authorities.

It replaces Part XI of the *Audit Act* 1901 (Cth) under which CSIRO previously had reporting obligations and can be found on the Internet at
http://www.austlii.edu.au/au/legis/cth/consol_act/caaca1997387/

Section 9 of the *CAC Act* requires directors of a Commonwealth Authority to prepare an annual report in accordance with Schedule 1 of the *CAC Act* for each financial year and give this to the responsible Minister by 15 October each year (unless another date is approved). Schedule 1 of the *CAC Act* requires the annual report of a Commonwealth Authority to contain:

1. a report of operations prepared in accordance with the *Commonwealth Authorities and Companies Order* 1998 (otherwise known as the Finance Ministers Orders or FMOs).
2. financial statements prepared in accordance with the FMOs which give a true and fair view of the matters dealt with in the Orders; and
3. a report by the Auditor-General's Report on those financial statements in which the Auditor-General must provide his opinion as to whether the financial statements have been prepared in accordance with the FMOs and give a true and fair view of the matters required by those Orders.

The FMOs are located at http://www.dofa.gov.au/pubs/fmab/fmos_cacs.pdf

## 1. REPORT OF OPERATIONS

The Board Members of CSIRO are also responsible under s. 9 of the *CAC Act* for the preparation and content of the report of operations in accordance with FMOs. Schedule 1 of the FMOs specifies the requirements for the report of operations required to be prepared. The report of operations must include:

**Reporting Requirements under Schedule 1, FMOs**

| | Page |
|---|---|
| Resolution of report of operations by Directors (that is, Board Members). | 4 |
| State CSIRO's enabling legislation and CSIRO's objectives and function as set out in that legislation, and include the name of CSIRO's Minister(s) during the relevant reporting period, including the current Minister. | 13 - 16 |
| Outline the organisational structure and location of major activities and functions. | 25 - 35 |
| Review operations and future prospects. | 36 - 103 |

| | Page |
|---|---|
| Provide particulars of judicial decisions or reviews by outside bodies which may have a significant impact on the operations of CSIRO. | NA |
| Report on the effects of Ministerial directions or general policies of the Government by the Minister, and any reason for non-compliance. | NA |
| Details of Board Members, number of Board meetings and attendance record. | 21, 137 |
| Details of the Audit Committee, number of Audit Committee meetings and attendance record. | 137 |
| Details of indemnities and insurance for officers. | 116 |
| Include any other matters required to be included in the Annual Report by the *Science and Industry Research Act* 1949 *(SIR Act)* or other legislation. | See below |

**Reporting Requirements under the *SIR Act***

| Section 51 *SIR Act* specifies that the Annual Report must set out the following: | |
|---|---|
| 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. | 7 - 12, 44 - 102 |
| A description of any developments in those policies that occurred during the year. | |
| Any determination made by the Minister during the year which deal with a specific function of the Organisation to carry out scientific research for reasons other than those listed in s. 9(1)(a)(i) - (iii) *SIR Act.* | 16 |
| Any written direction or guideline given by the Minister to the Board dealing with the functions and powers of the Board. | 16 |

## 2. FINANCIAL STATEMENTS

The *Commonwealth Authorities and Companies Orders (Amendment)* 1998 amends the FMOs by inserting a new Order 5. Order 5 provides:

*Schedule 2 of these Orders specifies the requirements for the financial statements required to be prepared by the directors of a Commonwealth Authority and included in its annual report under clause 1 of Schedule 1 of the CAC Act.*

The FMOs which set out the financial reporting requirements for CAC bodies are located at: http://www.dofa.gov.au/Pubs/fmab/fmos_cacs.pdf

The *Guidelines for the Forms of Financial Statements for Commonwealth Authorities* was released by the Commonwealth in July 1998, and sets out the format to be adopted for each of the above statements. These guidelines are located at: http://www.dofa.gov.au/pubs/finstate/cacfs97g.doc

Schedule 2 requires the following information to be included in CSIRO's financial statements:

**Reporting Requirements under Schedule 2, FMOs**

| | Page |
|---|---|
| Operating statement | 107 |
| Statement of financial position | 106 - 143 |
| Statement of assets and liabilities | 108 |
| Statement of cashflows | 109 |
| Schedule of commitments | 110 |
| Schedule of contingencies | 111 |

## 3. AUDITOR-GENERAL'S REPORT

The Auditor-General's Report on CSIRO's financial statements is on pages 104 - 105.

# APPENDIX 2. 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;

(ii) 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

(i) 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 sub-section (1) as its secondary functions.

## POWERS OF THE ORGANISATION

(1) 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 sub-section (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 3. 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 2000, CSIRO received 35 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 Appendix 2 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 6.

## 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; lists of saleable publications; information service leaflets issued by Divisions on a wide range of technical subjects attracting frequent inquiries from the general public; conditions of CSIRO post-doctoral awards; press releases; information on careers in CSIRO; and school project material.

The following CSIRO documents are available for purchase by the public by contacting CSIRO, Limestone Avenue, Campbell, ACT 2602 or CSIRO Publishing, 150 Oxford Street, Collingwood, VIC 3066: Scientific and technical publications including magazines, journals and books as well as CSIRO administrative manuals. A list of administrative manuals is available from the Freedom of Information (FOI) Coordinator.

## ARCHIVES AND DISPOSAL ARRANGEMENTS FOR DOCUMENTS

CSIRO maintains an archives collection in Canberra that has records dating from the establishment in 1926 of the Council for Science and Industrial Research, the original predecessor of CSIRO. Certain Australian Archives Regional Offices 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.

## FOI PROCEDURES AND INITIAL CONTACT POINTS

A central Freedom of Information (FOI) Coordinator is responsible for the receipt of requests, identification of relevant CSIRO documents, consultation with CSIRO authors and officers, determining access to the documents and arranging internal review. Initial enquiries should be made to:

FOI Coordinator
CSIRO
Limestone Avenue
CAMPBELL ACT 2601

or

PO Box 225
DICKSON ACT 2602

Telephone: (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 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 that may be an interference with the privacy of an individual.

During 1999-00 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 2601

or

PO Box 225
DICKSON ACT 2602

Telephone: (02) 6276 6123

## THE ADMINISTRATIVE DECISIONS (JUDICIAL REVIEW) ACT

The *Administrative Decisions (Judicial Review) Act* 1977 ('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 2000, CSIRO received 16 requests for statements of reason under the AD(JR) Act.

# APPENDIX 4. TRUST FUNDS

## WILLIAM MCILRATH FELLOWSHIP TRUST FUND

In 1996 Ms Jennifer MacDiarmid was awarded a postgraduate fellowship at the McMaster Laboratory, Prospect to conduct research on cloning, gene expression and analysis of proteins, excreted and secreted by an important nematode parasite of the small intestine of sheep.

Several proteins have been isolated, characterised and examined for their ability to elicit a variety of protective immune responses in sheep. A novel technique for generation of a monoclonal antibody against the ovine immunoglobulin (IgE) responsible for mediating allergic responses was developed. The resultant antibody was the first recorded as able to recognise native IgE, and was used to identify those antigenic proteins that could elicit an IgE response in sheep and, therefore, have potential for vaccine development.

Ms MacDiarmid has also developed a novel, rapid system to clone candidate vaccine antigens into a high level expression vector. A model antigen has been incorporated into an attenuated *Salmonella* delivery vector and adult sheep mounted a strong immune response to the parasite antigen.

Ms MacDiarmid is expected to submit her PhD thesis in July 2000.

## SIR IAN MCLENNAN ACHIEVEMENT FOR INDUSTRY AWARD

Established in 1985 the Sir Ian McLennan Achievement for Industry Award recognises outstanding contributions by CSIRO scientists and engineers to national development. The winning scientist/engineer 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.

This year's winner was Mr Paul Gottlieb of CSIRO Minerals for his development of the QEM*SEM system for mineral analysis.

## 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 1999-00, totalling $116 020. They were given to support eminent overseas scientists selected to work for a period in CSIRO Divisions.

Three Research Fellowships and four Visiting Fellowships were awarded. For the former, the Fellow is actively involved in a CSIRO research project for three to twelve 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

In June 1994 CSIRO Plant Industry received a bequest of $1 million from the estate of the late Kenneth Myer to establish a trust fund for plant science research. The Board of Trustees established to manage the Fund includes representatives from the Myer Family, industry and CSIRO.

The Ken and Yasuko Myer Plant Science Research Fund supports postdoctoral fellowships within CSIRO Plant Industry. Current fellowships include research projects directed towards innovative uses of lucerne to manage water and nutrients in cropping systems in wet landscapes, and a recent fellowship on genes to control 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. No lecture was organised during 1999-00.

## SCIENCE AND INDUSTRY ENDOWMENT FUND

The Fund was established under the *Science and Industry Endowment Act* 1926 with the Trustee of the Fund being the CSIRO Chief Executive. Applications to the fund were received from a range of sources and grants were approved totalling $11 360.

## ELWOOD AND HANNAH ZIMMERMAN RESEARCH FUND TRUST

The Trust was established in 1995 following a donation of $400 000 from Elwood and Hannah Zimmerman. This initial donation has since been matched dollar for dollar by CSIRO. Elwood and Hannah Zimmerman also contribute around $5 000 per year to the Trust. In addition, $40 000 bequested to CSIRO from the Estate of the late Mr Alan Cox was made available to the Zimmerman Trust during the 1998-99 financial year; this contribution was also matched by CSIRO.

The Governors of the Australian National Insect Collection (ANIC) Fund, together with Dr Elwood Zimmerman, are the Trustees of the Elwood and Hannah Zimmerman Research Fund Trust.

During 1999-00 research on the systematics of the Australian weevils was conducted, relating directly to the completion of the remaining volumes of the series *Australian Weevils*, begun by Dr Zimmerman in 1991, and also involving other studies of the Australian weevil fauna by Dr Rolf Oberprieler, the first appointed Zimmerman Fellow. Some fieldwork was undertaken in the Canberra and Bateman's Bay areas to collect weevils and information about their biology. The curation and enhancement of the ANIC weevil collection is ongoing, the incorporation of a major donated collection commenced, and numerous papers and reprints were added to the collection of weevil literature in the ANIC. A postdoctoral fellow from Japan has joined the weevil research project.

## AUSTRALIAN NATIONAL WILDLIFE COLLECTION FOUNDATION

The Foundation was established in 1998 to promote the charter and objectives of the Australian National Wildlife Collection.

The collection contains a representative sample of the Australian vertebrate fauna, covering bird species, mammals, amphibians and reptile species. It contributes to our understanding of biodiversity, and its conservation. The collection provides an important service to science and the community.

## APPENDIX 5. CSIRO RESEARCH

During 1999-00 Sector Research Plans were developed for the 2000-03 funding triennium. The current research components of each Sector Plan are listed below.

### MANUFACTURING, INFORMATION AND SERVICE INDUSTRIES

#### INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS

- Broadband Wireless Systems
- Networking
- Corporate Memory
- e-Matching and e-Negotiation
- Federated Information Systems
- Maximum Usability
- Tools for Distributed Systems
- Seamless Mobiles
- Dual-Use Microwave Systems
- Content Tailored on Demand

#### BUILT ENVIRONMENT

- Intelligent Transport Systems
- Infrastructure Networks
- Design and Construction
- Smart Coating Technologies
- New Building Materials
- Efficient Electricity Distribution
- Fire Science and Technology
- Infrastructure Service Life
- Urban Water Technologies
- Indoor Environment
- Low Energy Processing
- Solid Waste Reactivation
- Windows and Façades

#### MEASUREMENT STANDARDS

- Basic Standards R&D
- Primary Standards R&D
- International Recognition
- Gas Mixture Standards
- High Flow Standards
- Metrology in Medicine/Health
- Standards and Calibration Services
- Accreditation of Services
- National Measurement System
- Technology Transfer

#### RADIO ASTRONOMY

- Operate the ATNF
- Upgrade the ATNF
- Exploit Upgraded ATNF
- Developments for the Future
- Outreach Program

#### SERVICES

- Risk and Yield Management
- Information Strategies
- Health Care Delivery
- Telehealth
- Clinical Decision Support
- e-Matching and e-Negotiation
- e-Logistics
- Vision-Based Asset Protection
- Intelligent Asset Monitoring

## CHEMICALS AND PLASTICS

- Cleaner Production
- Polymer Performance
- Innovative Polymer Products
- Smart Packaging
- Speciality Chemical Products
- Chemicals for Grain Storage
- Crop Protection Products
- Bioprocessing
- Surface Engineering of Polymers

## INTEGRATED MANUFACTURED PRODUCTS

- Sustainable Manufacturing
- Transport Equipment
- Minerals-Metal Production Chain
- Manufacturing Improvements
- Measurement and Inspection Tools
- Sensing and Monitoring Products
- Micromanufacturing
- Nanoscale Building Blocks
- Enterprise Structure and Operation

## PHARMACEUTICALS AND HUMAN HEALTH

- Anti-Infectives
- Bioactive Molecule Discovery
- Biomaterials
- Cancer
- Diabetes
- Delivery of Therapeutic Agents
- Diagnostics
- Tissue Growth and Repair

## MINERALS AND ENERGY INDUSTRIES

### ENERGY

- Energy Modelling
- Coal Mining
- Coal Preparation
- Coal Safety, Health, Environmental
- Clean Coal Power
- Distributed Energy (Gas)
- Energy Storage
- Renewable Energy
- Direct Greenhouse Mitigation
- Energy End Use Efficiency

### MINERAL EXPLORATION AND MINING

- Area Selection Criteria
- Recognise Orebearing Systems
- Exploration through Regolith
- Mine Design
- Mine Operations
- Innovative Mining Systems
- Health and Safety Technologies
- Environment Technologies
- Exploration to Market Systems

### MINERAL PROCESSING AND METAL PRODUCTION

- Sustainability
- Process Improvement
- Increased Asset Utilisation
- Difficult-to-Treat Deposits
- Processing in 2010
- Differentiating Commodities

- Light Metal Production
- Enabling Science and Technology

### PETROLEUM

- Increasing Exploration Success
- Field Appraisal and Development
- Drilling Performance
- Risk and Uncertainty
- Adding Value to Gas Resources
- $CO_2$ Sequestration
- Disposal of Wastes
- Met-Ocean Conditions
- Business Development

## ENVIRONMENT AND NATURAL RESOURCES

### BIODIVERSITY

- Knowledge and Informatics
- Ecosystem Sustainability
- Regional-National Sustainability
- Conservation and Use
- Pests, Weeds and Diseases
- Sustainable Tourism
- Ecological Risks of GMOs

### CLIMATE AND ATMOSPHERE

- Human Impacts
- Global Warming
- Climate Variability
- Impacts and Adaption
- Air Pollution

### LAND AND WATER

- National Water Reform
- Coastal Rivers and Estuaries
- Urban Water
- Irrigated Areas
- Agriculture for Australia
- Degraded Landscapes
- Contaminated Environments
- Regional Development

### MARINE

- Exploration of the EEZ
- Conservation Management
- Estuaries and Coastal Waters
- Regional Marine Ecosystems
- Fisheries
- Aquaculture Impacts
- Climate Impacts
- ORV *Franklin*

## AGRIBUSINESS INDUSTRIES

### FIELD CROPS

- Gene Technologies
- Quality Crop Products
- Pests, Weeds and Diseases
- Postharvest Technologies
- Water and Nutrient Management
- Integrated Farming Systems
- Biometrics

### FOOD PROCESSING

- Consumer Issues
- Product Manufacture and Delivery
- Food and Drink Safety

- Ingredients Innovation
- Diet and Health
- Virtual R&D Centre

FORESTRY, WOOD AND PAPER INDUSTRIES

- Sustainable Native Forests
- Sustainable Plantation Forests
- Value Enhancement
- Risk Management
- Forestry Operations
- Value-Added Wood Products
- Papermaking and Paper Quality

HORTICULTURE

- Crop Improvement
- Crop Protection
- Crop Management
- Water and Nutrient Management
- Postharvest Quality
- Biometrics

MEAT, DAIRY AND AQUACULTURE

- Animal Health
- Consumers and Products
- Management Systems
- Minimising Undesired Impacts
- Animal Performance and Welfare
- Improved Production Efficiency

TEXTILES, CLOTHING AND FOOTWEAR

- Disease Management
- Animal Fibre and Leather
- Production Processing Pipeline
- Cotton
- Innovative Processing
- New Consumer Products
- Biometrics

# APPENDIX 6. SECTOR ADVISORY COMMITTEES as at 30 June 2000

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.

## MANUFACTURING, INFORMATION AND SERVICE INDUSTRIES

### INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS SECTOR

**Chairman (Acting)**

Mr John Kranenburg
Executive Director
Fujitsu Australia Ltd

**Members**

- Dr Rod Badger
  Acting Executive Director Information Technology
  Australian Department of Communications, IT & the Arts
- Dr Ian Chessell
  Director Electronics Surveillance Research
  Defence Science & Technology Organisation
- Mr J B Clarke
  General Manager Australian R&D Program
  Nortel Networks
- Mr Rob Durie
  Deputy Executive Director
  Australian Information Industry Association
- Mr David Merson
  Chief Executive Officer
  Mincom Pty Ltd

### BUILT ENVIRONMENT SECTOR

**Chairman**

Mr Alan Castleman
Chairman
Australian Unity Ltd

**Members**

- Ms Gwen Andrews
  Chief Executive
  Australian Greenhouse Office
- Mr Russell Cooper
  Managing Director
  South East Water Ltd
- Mr Michael Delaney
  Manager
  Central Engineering Services
  Leighton Contractors Pty Ltd
- Mr Richard Dinham
  Managing Director
  SJPH Design Partnership
- Mr David Evans
  Managing Director
  Hunter Water Corporation
- Mr Ian Johnston
  Chief Executive
  Government Property Office (WA)
- Mr John Murray
  National Executive Director
  Master Builders Australia

- Mr Vincent O'Rourke
  Chief Executive
  Queensland Rail
- Mr Anthony Sive
  General Manager
  Boral Recycling Pty Ltd
- Mr David Thomson
  Director RTA Technology
  Roads & Traffic Authority (NSW)
- Dr Stephen van der Mye
  Managing Director
  National Electricity Market Management Company
- Ms Yvonne von Hartel
  Senior Partner
  Robert Peck von Hartel Trethowan
- Mr Ross Wraight
  Chief Executive
  Standards Australia

### MEASUREMENT STANDARDS SECTOR

**Chairman**

Mr Chris Whitworth
General Manager, Special Projects
Transfield Pty Ltd

**Members**

- Dr Steven Anderson
  Managing Director
  Southern Pathology
- Mr Alex Baitch
  Manager, Network Capability
  Integral Energy
- Mr John Birch, AM
  Executive Director
  National Standards Commission
- Ms Vicki Brown
  General Manager, Business Environment Branch
  Department of Industry Science & Resources
- Mr Brian Frizell
  Retired
- Mr James Galloway
  Assistant Director
  Technology & Regulations
  Australian Electrical & Electronic Manufacturers
- Mr John Gerard
  Director
  Gerard Industries Pty Ltd
- Mr John Gilmour
  Chief Executive
  National Association of Testing Authorities Australia
- Dr Sandra Hart
  General Manager
  Australian Government Analytical Laboratories
- Mr John Hulbert
  Executive Director
  Joint Accreditation System of Australia & New Zealand
- Sqd Ldr Bob Phillips
  Department of Defence
- Mr Ross Wraight
  Chief Executive
  Standards Australia

### RADIO ASTRONOMY SECTOR

**Chairman**

Dr Russell Cannon
Anglo-Australian Observatory

**Members**

- Dr Brian Boyle
  Director
  Anglo-Australian Observatory
- Dr Bob Frater, AO
  Vice President
  Innovation, ResMed

- Professor Paul Goldsmith
  Director
  Cornell University, USA
- Professor Kwok-Yung Lo
  Academia Sinica
- Professor Peter McCulloch
  Director, Physics Department
  University of Tasmania
- Professor Karl Menton
  Director
  Max-Planck Institute fur Radioastronomie
- Dr Elaine Sadler
  School of Physics
  University of Sydney
- Dr Ron Sandland
  Deputy Chief Executive
  CSIRO
- Dr Peter Scaife
  Director
  Centre for Sustainable Technology
  University of Newcastle
- Dr John Storey
  School of Physics
  University of New South Wales

## SERVICE SECTOR

### Chairman

Ms Judith King
Executive Director
Australian Coalition of Service Industries

### Members

- Mr Steve Armstrong
  National Product Development
  Manager Retail
  Fujitsu Australia Ltd
- Mr Garry Campbell
  General Manager
  Information Technology Services
  Coles Myer Pty Ltd
- Mr John Craven
  Managing Director
  Craven Innovation Corporation
- Ms Carmel Gray
  General Manager Information
  Technology
  Suncorp Metway
- Mr Michael Mannington
  Director
  ID Tours
- Mr Peter Morris
  Acting General Manager
  Service Industries Coordination B
  Department of Industry Science &
  Resources
- Mr Roger Nairn
  National Australia Bank
- Mr Peter O'Grady
  Quality Consultant
- Dr John Primrose
  Senior Medical Advisor, Health Care
  Evaluation
  Department of Health & Family Services
- Mr Victor Skladnev
  Managing Director
  Polartechnics
- Dr Barry Westlake
  National Manager
  Enterprise Market
  Australian Stock Exchange

## CHEMICALS AND PLASTICS SECTOR

### Chairman

Mr Alan Seale
Consultant

### Members

- Dr Doreen Clark
  Director
  Organic Crop Protectants Pty Ltd

- Mr John Dean
  General Manager
  Industry Contact & Policy Teams
  Department of Industry Science & Resources
- Mr Andy Denver
  President
  USF Filtration & Separation Group
- Dr Greg Healy
  International Manager
  Nufarm Ltd
- Mr Leo Hyde
  R&D Manager
  Du Pont Australia Ltd
- Mr Roger Karge
  Managing Director
  Innovative Technology & Licensing Australia (Chemicals)
- Dr Margaret Matthews
  Director Business Development
  PACIA
- Professor Ian Rae
  History & Philosophy of Science
  University of Melbourne
- Dr Andrew Rath
  Research & Development Manager (Asia Pacific)
  Abbott Laboratories
- Mr Roy Rose
  General Manager Technology
  Orica Australia
- Professor John White
  Research School of Chemistry
  Australian National University
- Dr Nicole Williams
  Chief Executive Officer
  Plastics & Chemicals Industries Association

## INTEGRATED MANUFACTURED PRODUCTS SECTOR

### Chairman

Mr Robert Trenberth
Company Director & Consultant
Ernst & Young

### Members

- Mr Mark Albert
  Managing Director
  MTM Pty Ltd
- Mrs Patricia Crook
  Managing Director
  Dynek Pty Ltd
- Mr Frank Cunningham
  Manager, Technology
  BHP Safety, Environment & Technology
- Mr Keith Daniel
  Consultant
- Mr Roger James
  Industry Specialist, Aviation
  Manufacturing Technology Unit
  Business Victoria
- Mr Barry Murphy
  Corporate Development Director
  British Aerospace Australia
- Mr Victor Perkin
  General Manager, Manufacturing
  AMCOR Food Cans Australasia
- Mr Stuart Romm
  Chief Executive
  HPM Industries Pty Ltd
- Mr Victor Sidebotham
  Retired
- Mr Cec Stubbs
  Company Director
- Mr Garry Wall
  General Manager

Automotive & Advanced Manufacturing Branch
Department of Industry Science & Resources

### PHARMACEUTICALS AND HUMAN HEALTH SECTOR

**Chairman**

Professor John Funder
Director
Baker Medical Research Institute

**Members**

- Mr Malcolm Eppingstall
  Consultant
- Dr John Flack
  Director
  Pharmaceutical R&D
  AMRAD Operations Pty Ltd
- Professor Ian Gust
  Director of Research & Development
  CSL Ltd
- Ms Patricia Kelly
  Head, Services & Emerging Industries Division
  Department of Industry Science & Resources
- Dr Graham Mitchell
  Principal
  Foursight Associates Pty Ltd
- Dr Hugh Niall
  Chief Executive Officer
  Biota Holdings Ltd
- Dr Ian Pitman
  Innovation Director
  FH Faulding & Co Ltd
- Mr Graham Thurston
  Secretary
  Australian Diagnostic Manufacturers Association
- Dr Denis Wade
  Chairman & Managing Director
  Johnson & Johnson Research Pty Ltd
- Dr Des Williams,
  Group Manager, Research & Development
  Sigma Pharmaceuticals Pty Ltd
- Professor John Zalcberg
  Director
  Division of Haematology & Med Oncology
  Peter MacCallum Cancer Institute

## MINERALS AND ENERGY INDUSTRIES

### ENERGY SECTOR

**Chairman**

Mr Keith Orchison
Managing Director
Electricity Supply Association of Australia

**Members**

- Ms Margaret Beardow
  Principal
  Benchmark Economics
- Mr Robin Bryant
  General Manager, Energy Minerals Branch
  Department of Industry Science & Resources
- Mr David Cain
  General Manager
  Energy Technology
  Rio Tinto
- Dr Ted Campbell
  Deputy Director General
  Department of Mines & Energy, Qld
- Mr Philip Harrington
  Executive Manager

Sustainable Energy Group
Australian Greenhouse Office

- Mr Peter Laver
  Director
  Strategic Industry Research Foundation
- Mr Bruce Robertson
  Consulting Mining Engineer
  Shell Coal Australia Ltd
- Dr John Sligar
  Director
  Sligar & Associates Pty Ltd
- Mr Jack Taylor
  Director Marketing
  The Green Energy Corporation Ltd

### MINERAL EXPLORATION AND MINING SECTOR

#### Chairman

Mr Andrew Michelmore
Executive General Manager
WMC Resources Ltd

#### Members

- Mr Alan Broome
  Managing Director
  AMP Control Pty Ltd
- Mr Alan Castleman
  Chairman
  Australian Unity Ltd
- Mr Mark Cutifani
  Managing Director
  Sons of Gwalia
- Mr Dick Davies
  Chief Executive Officer
  Australian Mineral Industries Research Association
- Dr Geoff Dickie
  Executive Director, Resource Development Division
  Department of Mines & Energy, Qld
- Mr Phillip Harman
  Manager, Discovery Technology
  BHP Minerals Discovery
- Mr Jeff Harris
  General Manager
  Coal & Minerals Division
  Department of Industry Science & Resources
- Dr Neil Phillips
  General Manager, Geology
  Great Central Mines Ltd
- Mr Jim Torlach
  State Mining Engineer
  Department of Minerals & Energy, WA
- Mr Mark Woffenden
  Consultant
  KPMG

### MINERAL PROCESSING AND METAL PRODUCTION SECTOR

#### Chairman

Mr Dick Davies
Chief Executive Officer
Australian Mineral Industries Research Association

#### Members

- Dr Richard Aldous
  Executive General Manager
  Exploration & Development
  Iluka Resources Ltd
- Mr Roy Ames
  Consultant
- Ms Deanna Aubrey
  Resource Manager
  Policy Planning & Revenue Branch
  Department of Mines & Energy, Qld

- Mr Stephen Barnett
  Group Manager
  Technology & HSEQ
  QNI Pty Ltd
- Mr David Coutts
  Executive Director
  Australian Aluminium Council
- Mr John den Dryver
  Executive General Manager, Technical
  Normandy Mining Limited
- Mr Ian Lawrence
  Lawrence Consultants Pty Ltd
- Ms Elizabeth Lewis-Gray
  Executive Director
  Gekko Systems Pty Ltd
- Professor Malcolm Richmond
  Graduate School of Business
  Curtin University
- Dr Ray Shaw
  General Manager
  Technology Support
  Rio Tinto Ltd
- Mr Don Smale
  General Manager
  Minerals Development Branch
  Department of Industry Science & Resources
- Mr David Sutherland
  General Manager
  Technical Services
  Nabalco Pty Ltd
- Dr Bob Watts
  Chief Scientist
  BHP

PETROLEUM SECTOR

**Chairman**

Dr Agu Kantsler
General Manager, New Ventures
West Australian Petroleum Pty Ltd

**Members**

- Mr Dave Agostini
  Agostini Consulting Pty Ltd
- Mr Charles Balnaves
  Group Manager, Petroleum Engineering
  BHP Petroleum Pty Ltd
- Mr Michael Frost
  General Manager, Exploration
  Santos Ltd
- Dr Rodney Halyburton
  Vice President, Special Projects
  BHP Petroleum Pty Ltd
- Mr John Hartwell
  Head of Petroleum & Electricity Division
  Department of Industry Science & Resources
- Mr John Hebberger
  Manager, Exploration & Earth Science
  West Australian Petroleum Pty Ltd
- Mr Doug Hodson
  Well Construction Manager
  Woodside Energy Ltd
- Mr Leif Larsen
  General Manager
  Schlumberger Oilfield Australia Pty Ltd
- Mr Rob Male
  Principal Development Engineer
  Woodside Energy Ltd
- Mr Kees Van Gelder
  Principal Development Engineer,
  Technology,
  Woodside Offshore Petroleum Pty Ltd

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

## ENVIRONMENT AND NATURAL RESOURCES

### BIODIVERSITY SECTOR

**Chairman**

Ms Robyn Kruk
Executive Director, Director General's Unit
NSW Premiers Department

**Members**

- Ms Leith Boully
  Consultant
- Ms Karen Grady
  Assistant Director
  Business Council of Australia
- Mr Stephen Hunter
  Head, Biodiversity
  Environment Australia
- Mr Ian Kennedy
  Director
  Ian Kennedy & Associates
- Dr Ray Nias
  Director of Conservation
  World Wide Fund for Nature
- Professor Henry Nix
  Centre for Resource & Environmental Studies
  Australian National University
- Mr Graeme O'Neill
  Freelance science writer
- Mr Ian Thompson
  First Assistant Secretary
  National Resources Management Policy Division
  Agriculture, Fisheries & Forestry Australia

### CLIMATE AND ATMOSPHERE SECTOR

**Chairman**

Mr Oleg Morozow
Manager, Environmental Affairs
Santos Ltd

**Members**

- Dr Stephen Corbett
  Director, Environmental Health
  NSW Health Department
- Dr Doug Gauntlett
  Retired
- Mr Mark McKenzie
  Regional Manager ACT & Southern NSW
  National Roads & Motorists Association
- Mr Michael Rae
  Program Leader, Resource Conservation
  World Wide Fund for Nature
- Dr Peter Scaife
  Director
  Centre for Sustainable Technology
  University of Newcastle
- Dr Roslyn Taplin
  Principal Analyst
  Acil Consulting
- Mr Frank van Schagen
  Executive Director
  Resource Science & Knowledge
  Department of Natural Resources, Qld

### LAND AND WATER SECTOR

**Chairman**

Dr John Langford
Executive Director
Water Services Association

**Members**

- Mr Donald Blackmore
  Chief Executive
  Murray-Darling Basin Commission
- Mr Andrew Campbell
  Executive Director
  Land & Water Resources R&D
  Corporation
- Mr John Corrigan
  Chief Executive
  Filtra Ltd
- Dr Wendy Craik
  Executive Director
  National Farmers Federation
- Ms Rhondda Dickson
  Assistant Secretary
  Sustainable Landscapes Branch
  Environment Australia
- Mr Jock Douglas, AO
  Pastoralist
- Mr Denis Flett
  Chief Executive
  Goulburn-Murray Water
- Dr Graeme Robertson
  Chief Executive Officer
  Agriculture WA
- Ms Kathryn Tayles
  General Manager, Environmental Policy
  Rio Tinto Ltd
- Mr John Wilson
  Chief Executive Officer
  Indigenous Land Corporation
- Mr Bernard Wonder
  Executive Director
  Competitiveness & Sustainability Group
  Agriculture, Fisheries & Forestry Australia

MARINE SECTOR

**Chairman**

Mr Peter Cochrane
Director National Parks & Wildlife
Environment Australia

**Members**

- Mr Bernard Bowen
  Chairman
  Environment Protection Authority WA
- Mr George Kailis
  Director
  MG Kailis Group
- Dr Geoff Love
  Deputy Director, Services
  Bureau of Meteorology
- Mr Ted Loveday
  President
  Queensland Commercial Fishermens
  Organisation
- Mr Rob Male
  Principal Development Engineer
  Woodside Energy Ltd
- Professor Helene Marsh
  Professor of Environmental Science
  James Cook University
- Dr Conall O'Connell
  First Assistant Secretary, Marine Group
  Environment Australia
- Dr Nicholas Schofield
  Program Manager, Water Resources,
  Land & Water Resources R&D
  Corporation
- Mr Sandy Wood Meredith
  Managing Director
  Wood Fisheries Pty Ltd
- Mr Peter Yuile
  First Assistant Secretary
  Fisheries & Forestry Industries Division
  Agriculture, Fisheries & Forestry Australia

## AGRIBUSINESS INDUSTRIES

### FIELD CROPS SECTOR

**Chairman**

Mr Trevor Flugge
Chairman
Australian Wheat Board

**Members**

- Mr Harry Bonanno
  Chairman
  Australian Cane Growers
- Dr Anthony Gregson
  Consultant
- Mr Michael Hedditch
  Executive Director
  Rice Growers Association of Australia
- Mr Chris Henderson
  Farmer, seed producer, feed grain supplier
- Professor Chris Hudson
  Research & Development Director
  Goodman Fielder Ltd
- Professor Emeritus John Lovett
  Managing Director
  Grains R&D Corporation
- Professor Don Marshall
  Director, Plant Breeding Institute
  University of Sydney
- Mr Douglas Rathbone
  Chief Executive
  Nufarm Pty Ltd
- Mr Brendan Stewart
  President
  Grains Council of Australia

### FOOD PROCESSING SECTOR

**Chairman**

Mr Steve Marshall
Group Director Corporate Technology
Goodman Fielder Ltd

**Members**

- Dr Geoff Annison
  Scientific & Technical Director
  Australian Food Council
- Professor Ken Buckle
  Department of Food Science & Technology
  University of New South Wales
- Ms Robyn Charlwood,
  Executive Director, Victorian Division
  National Heart Foundation
- Dr Paul Donnelly
  Managing Director
  Dairy R&D Corporation
- Dr Alan Grant
  Vice President, Technology Asia/Pacific
  Kraft Foods Ltd
- Dr Marion Healy
  Chief Scientist
  Australia New Zealand Food Authority
- Dr Jan Mahoney
  Program Manager, Agriculture Industries
  Department of Natural Resources, Vic
- Mr Hans Sidler
  General Manager Petrol
  Woolworths Supermarkets
- Mr Dan Southee
  Scientific Liaison Officer
  Nestle Australia Ltd
- Mr Tony Wharton
  Chief Executive Officer
  Q-Meat

## FORESTRY, WOOD AND PAPER INDUSTRIES SECTOR

### Chairman

Mr Angus Pollock
General Manager, Forest Resources
Australian Paper

### Members

- Mr Ronald Adams
  Managing Director
  Bunnings Forest Products
  Sotico Pty Ltd
- Dr Tony Flowers
  Development Manager (Australia)
  Fletcher Challenge Paper
- Mr Kevin Lyngcoln
  Chief Executive Officer
  Plywood Association of Australia
- Mr Ian Millard
  General Manager
  Forestry SA
- Ms Vanessa Ranken
  Company Director
  Egaline Nursery
- Mr Richard Rawson
  Deputy Secretary, Operations
  Department of Natural Resources & Environment, Vic
- Mr James Witham
  Managing Director
  Treecorp Pty Ltd
- Mr Peter Yuile
  First Assistant Secretary
  Fisheries & Forestry Industries Division
  Agriculture, Fisheries & Forestry Australia
- Mr Peter Zed
  National Resource Manager
  CSR Timber Products

## HORTICULTURE SECTOR

### Chairman

Mr David Pullar
David Pullar & Associates

### Members

- Mr Laurence Ah Toy
  Director
  Koolpinyah Station Pty Ltd
- Mr Anthony Biggs
  Director & Horticultural Consultant
  Cardinal Horticultural Services Pty Ltd
- Mr Phillip Fitch
  Director
  New Industries Enterprise Competitiveness
  Agriculture, Fisheries & Forestry Australia
- Mr Phillip Laffer
  Director of Viticulture & Winemaking
  Orlando-Wyndham Pty Ltd
- Mr Brian Newman
  Executive Director
  Ausveg Board
- Mr Peter Pokorny
  General Manager, Fresh Foods
  Woolworths Ltd
- Mr Rob Robson
  Managing Director
  Harvest FreshCuts Pty Ltd
- Mr Paul Ziebarth
  Member
  Queensland Fruit & Vegetable Growers Board

## MEAT, DAIRY AND AQUACULTURE SECTOR

### Chairman

Dr Ted Christie
Barrister at Law

**Members**

- Mrs Teresa Allen
  Farm Manager
- Mr Gordon French
  Queensland Dairy Farmers Organisation
- Mr Robin Hart, AM
  Chairman
  Kerwee Pastoral Company
- Mr Pheroze Jungalwalla
  Manager R&D
  Tassal Ltd
- Dr Rod Kater
  Chief Medical Officer
  AMP Life Ltd
- Dr Gardner Murray
  Consultant

## TEXTILES, CLOTHING AND FOOTWEAR SECTOR

**Chairman**

Mr John Blood
Textile & Garment Consultant

**Members**

- Mr David Anthony
  Chief Operating Officer
  Auscott
- Mr David Boyd
  Managing Director
  Clyde Agriculture Ltd
- Mr Trevor Dawson
  Managing Director
  Rocklea Spinning Mills Pty Ltd
- Mr Guy Fitzhardinge
  Livestock Producer
  Thring Pastoral Company
- Ms Collette Garnsey
  General Manager, Buying
  David Jones Ltd
- Ms Katherine Kennedy
  Group Manager
  Technical Strategy & Textile R&D
  The Woolmark Company
- Ms Margaret Moroney
  Principal
  Margaret Moroney Pty Ltd
- Mr Lindsay Packer
  Managing Director
  Packer Tanning
- Mr Colin Sleep
  Portfolio Manager (Rural)
  National Mutual Funds Management
- Mr Brian van Rooyen
  Managing Director
  Australian Country Spinners
- Associate Professor Andrew Vizard
  Veterinary Clinical Centre
  University of Melbourne

# APPENDIX 7. COOPERATIVE RESEARCH CENTRES PROGRAM

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

At 30 June 2000 CSIRO was involved in 51 of the 65 current CRCs. The Organisation makes a major contribution to the Program through its experience in collaborating with industry and in applying its research management skills.

Full details of CRC activities are available through their annual reports and publications and from the Internet on http://www.isr.gov.au/crc/index.html

## COOPERATIVE RESEARCH CENTRES IN WHICH CSIRO IS A PARTICIPANT

### MANUFACTURING TECHNOLOGY

- CAST Metals Manufacturing
- Bioproducts
- Intelligent Manufacturing Systems and Technologies
- International Food Manufacture
- Welded Structures
- Molecular Engineering and Technology
- Polymers
- Microtechnology

### INFORMATION AND COMMUNICATION TECHNOLOGY

- Advanced Computational Systems
- Enterprise Distributed Systems Technology
- Satellite Systems
- Australian Telecommunications

### MINING AND ENERGY

- AJ Parker CRC for Hydrometallurgy
- Australian Geodynamics CRC
- Australian Mineral Exploration Technologies
- Australian Petroleum CRC
- Black Coal Utilisation
- GK Williams CRC for Extractive Metallurgy
- Landscape Evolution and Mineral Exploration
- Mining Technology and Equipment
- Clean Power from Lignite

### AGRICULTURE AND RURAL BASED MANUFACTURING

- Aquaculture
- Australian Cotton CRC
- Cattle and Beef Quality
- Food Industry Innovation
- Hardwood Fibre and Paper Science
- Legumes in Mediterranean Agriculture
- Premium Quality Wool
- Quality Wheat Products and Processes
- Sustainable Rice Production
- Sustainable Sugar Production
- Sustainable Production Forestry

- Tropical Plant Protection
- Viticulture

ENVIRONMENT

- Antarctica and the Southern Ocean
- Biological Control of Pest Animals
- Catchment Hydrology
- Freshwater Ecology
- Southern Hemisphere Meteorology
- Sustainable Development of Tropical Savannas
- Tropical Rainforest Ecology and Management
- Waste Management and Pollution Control
- Water Quality and Treatment
- Weed Management Systems
- Coastal Zone, Estuary and Waterway Management
- Greenhouse Accounting

MEDICAL SCIENCE AND TECHNOLOGY

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

## APPENDIX 8. CSIRO POSITION ON GENE TECHNOLOGY

CSIRO believes there is a window of great opportunity for Australia, its community and industries, in the adoption of biotechnology research, particularly gene technologies. These give Australia scope to improve our health, create a safer and more secure food supply, generate prosperity and attain a more sustainable environment. Our position on this issue is:

1. CSIRO will continue to play a valuable, ethical and responsible role in Australian and international efforts to develop beneficial new products and processes from gene technology.
2. CSIRO will help to provide a clean, safe food supply, novel materials and products and a sustainable environment for all Australians through the use of appropriate biotechnology including gene technologies.
3. CSIRO recognises and respects public interest and concerns on issues surrounding genetically modified organisms. We will continue to consult with the community, industry and government, listen to and recognise their concerns, and help inform Australians about gene technology. We recognise that values and opinions about these issues may change over time.
4. CSIRO helps Australian industries to be world competitive in biotechnology and gene technology. We will commercialise our research in the most effective way in accord with our social responsibility, and promote the growth of local biotechnology companies. CSIRO will continue to conduct world class research and train our scientists to the highest standards.
5. CSIRO sees safety as a top priority in gene technology research. We set high internal biosafety standards and comply with relevant Government legislation and guidelines.
6. CSIRO is committed to the ethical, lawful, transparent and accountable conduct of gene technology research.
7. CSIRO supports the responsible protection of intellectual property rights in gene technologies as a means to stimulate further public research and innovation.
8. CSIRO undertakes to investigate both the benefits and risks of gene technology research. We will help to enhance Australia's capability for environmental risk assessment.

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