CSIRO

Annual Report

2000-2001

www.csiro.au

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 located at 60 sites 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.

Enquiries

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75 years of Australian Science
CSIRO

Letter of Transmittal >>

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-third 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

Geoff G Garrett

Chief Executive

September 2001

Board resolution >>

The 2000-01 CSIRO Annual Report has been approved for presentation to the Minister for Science, Industry and Resources.

Signed this 3rd day of September 2001 in accordance with a resolution of the Board Members.

D Charles K Allen, AO

Chairman of the Board

Geoff G Garrett

Chief Executive

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1: Views and Information

Chapter 1
Chairman's Foreword

At the start of the new millennium CSIRO embarked on an ambitious strategy to help build Australia as an innovative society, in partnership with industry, government and other research bodies. This Report describes our first steps in this strategy.

2001 is the 75th Anniversary of CSIRO and its predecessor CSIR. We have given 75 years of service to Australia through research, with an amazing record of achievement. The Anniversary is being celebrated by a number of activities, including a book recording significant events, a pictorial history, an anniversary website and open days around the country.

It is also the year in which we welcomed Dr Geoff Garrett as the new Chief Executive of CSIRO, bringing with him a wealth of experience from our counterpart in South Africa. Dr Garrett has already unfolded his vision for the future of the Organisation after completing a significant review of CSIRO's operations.

During the year, Ms Catherine Livingstone, former Managing Director of Cochlear Ltd joined the Board and two Deputy Chief Executives, Dr Colin Adam - who so ably steered CSIRO for a year after the death of Dr Malcolm McIntosh - and Dr Chris Mallett, left the Organisation. Both had been deeply involved in the mid-nineties in the major reorganisation that introduced the matrix structure in 1996 and we thank them for their great contribution over many years.

In the field of science, CSIRO continued to be recognised at the highest level with Dr Jim Peacock and Dr Liz Dennis being awarded the inaugural Prime Minister's Science Prize in October 2000 for their work in plant molecular biology and Dr Rob Evans winning the international Marcus Wallenberg Prize (our second) for his work in forest products technology. These are just two of many major awards gained this year which recognise the excellence of the work of CSIRO researchers. Chapter 8 lists our key awards and recognition.

During the year CSIRO established an annual lecture which has been sponsored by the Members Australia Credit Union (MACU) to commemorate our former Chief Executive, Dr Malcolm McIntosh. The first Malcolm McIntosh Memorial Lecture was given in Canberra on 23 April 2001 by Dr Peter Raven, Director of the Missouri Botanical Gardens, USA.

In August 2000 the Prime Minister, the Honourable John Howard MP, opened *Discovery*, the first science centre dedicated to Australian research and innovation. Discovery, based on Black Mountain in Canberra is a unique concept, housing an interactive exhibition of leading edge CSIRO research as well as the Science Education Centre, a lecture theatre, café and glass-walled laboratories through which visitors can see scientists at work. Discovery is sponsored by Cable and Wireless Optus, CSIRO and the ACT Government.

In other initiatives during the year CSIRO established a multi-Divisional project bringing together several strands of biotechnology research focused on improving our understanding of the ecological implications of genetically modified organisms. The $3 million, 3-year project is one of the activities under the Government's National Biotechnology Strategy, being partially funded by the Federal Government to allow better informed and more factual debate on the use of genetically modified organisms.

CSIRO was involved in the Olympics as a member of the Olympics Co-Ordination Committee in the earliest planning stages for the games right through to the closing ceremony. CSIRO was an original contractor to the Mirvac/Lend Lease consortium that had responsibility for the design and development of the Athlete's Village. CSIRO's advice and technologies were used in many other ways throughout the Olympics.

In January 2001 the Federal Government introduced its Innovation Action Plan *Backing Australia's Ability*. The Plan, which was warmly welcomed by CSIRO, addresses three issues vital to Australia's future: substantially increasing investment in research, boosting incentives for industry to innovate, and further encouraging team-based consortia approaches based on merit. We look forward to enhancing the level of our cooperation with the universities through this program, helping to build Australia's innovative capacity by greater involvement with small-to-medium firms.

As reported last year, a Government Property Review determined that CSIRO must sell six of its properties. To ensure these sales have no adverse impact on CSIRO's research activities, the Government agreed that CSIRO will receive Government funding for additional sale and ongoing rental costs as part of its budget appropriations. The first sale, of our North Ryde property *Riverside Corporate Park*, was concluded very satisfactorily in June 2001 for a price described as a record for the North Ryde area.

In November 2001 my five year appointment as CSIRO Chairman ends. They have been five very exciting years. Following the sadness of Malcolm McIntosh's illness and death last year the Organisation has been reinvigorated by the arrival of our new Chief Executive, Dr Geoff Garrett.

In 1996, my first year as Chairman, CSIRO's matrix structure was formally implemented, since then great progress has been made in bringing stronger interactive teams together. It is the ability of CSIRO to bring such teams of outstanding scientists together in a managed structure to focus on a particular problem which is one of its unique strengths.

There has also been an increased emphasis on trying to commercialise more of our technology but no one should ever believe that this is other than a very difficult exercise. The balance between our role as research scientists doing fundamental but focused research and the commercialisation of our discoveries will continue to be a major challenge. There will always be pressure on the allocation of our funds between pure research and initial development of our ideas but I believe it is important that CSIRO grows over the coming years, not only through increased appropriation but also through our commercial links.

CSIRO is a focused and structured research Organisation, which has a legitimate and important role to undertake for Australia. There is close interaction with the universities with whom we collaborate so much both directly and through the over 40 CRCs in which we are major participants. This year marks the expenditure in total of $1 billion by CSIRO on the CRC Program, evidence of our strong commitment to CRCs. Each of us, CSIRO and the universities, has its own important but primarily different role; together these two roles provide a great intellectual advantage to Australia.

The years ahead for CSIRO and its new Chief Executive will be exciting, hard work and rewarding. The new vision for CSIRO will require many changes but I believe these changes are essential if CSIRO is to continue to serve national needs effectively.

My best wishes go to the Organisation and to all who serve in it under its new management teams.

D Charles K Allen, AO

Chairman of the Board

Chapter 2
Chief Executive's foreword

Trailblazing the Future >>

Dateline: October 2010. *Australia is emerging as a global leader in sustainable solutions to world and regional challenges. Its know-how is reversing desertification, deforestation and salinity round the globe. It has an international name for safe, nutritious foods, finding and processing minerals cleanly and efficiently, unleashing new sources of clean energy.*

Australians are living longer, healthier and more productive lives. We are at the leading edge in the global information and communication revolution. Our forests, soils, waters and landscape are regenerating their richness and diversity. Air pollution and greenhouse emissions are dwindling.

Knowledge exports now earn $25 billion a year and have created over one and a quarter million new jobs. Leading the transformation is Team Australia, a partnership of the nation's universities, CRCs, CSIRO and high tech firms, with 10 000 of the nations best minds linked at lightspeed in a revolutionary network.

This forecast isn't fiction. It's a snapshot of our future, the logical outcome of Australia's national investment in science, technology and innovation, a decade from today. The foundations are laid. The process has begun. Firm national will and a commitment to growth in these areas will make it a reality.

In this annual report for 2000-01, CSIRO details achievements and work in progress, as our partners and we help to reshape Australia as a knowledge economy of the future. We also celebrate 75 years as the national science agency - a foundation of remarkable Australian science and technology on which we are building the future.

At the heart of this is our own reinvigorated vision, expressed in our strategic action plan *A New CSIRO for a New Century*. (See Chapter 9).

This plan describes our purpose: *"By igniting the creative spirit of our people, we deliver great science and innovative solutions for industry, society and the environment."*

We envision CSIRO helping Australia in the achievement of three great national goals:

- a healthy country - for both our environment and people
- winning industries - competitive with the world's best, and providing better jobs
- a know-how nation - founded on the discovery and practical application of Australian knowledge.

This report, and its partner document *Creative Solutions*, highlights scores of cases in which this vision is becoming real, such as the commercialisation of our award-winning Align 3D technology for planning national highway and rail systems by the cheapest, most effective routes. Our intelligent freight transport system, ITS Connect, is designed to cut the $5 billion cost of traffic congestion and freight delays.

Our hybrid energy project is demonstrating the potential to power Australia's great cities with natural gas and sunlight, while banishing pollution and greenhouse emissions. Our hybrid cars, Axcess II and the ECOmmodore, are also blazing a trail towards clean, green transport.

The $US300 million sale of Sydney firm, Radiata Pty Ltd, to US giant Cisco highlights the value of CSIRO's world-leading integrated wireless network technology, while our multibeam antennas have been bought by Germany for the European satellite network.

The anti-flu drug Relenza, developed from a CSIRO discovery, is approved for use in 51 countries. Work is advanced on a new treatment for hepatitis B, and with Virax Holdings Ltd we are partners in an international project to develop an AIDS vaccine.

We have helped the NSW Sustainable Energy Authority identify rich new areas of wind energy, and are continuing to develop and test state-of-the-art fuel cells as a new source of domestic and transport power.

In support of the minerals sector, CSIRO is well advanced in developing the 'Glass Earth', a complex of technologies to help Australia's miners 'see' into the top kilometre of the earth's crust and find huge new mineral bodies.

We've developed and commercialised one of the world's most sophisticated oil well management packages.

We're working with farming groups, regional communities and rural companies in the fight against salinity, to revegetate and reafforest our landscape and to develop new, sustainable industries. The discovery of the flowering switch gene by CSIRO's Dr Jim Peacock, Dr Liz Dennis and their team, could help boost grain production by millions of tonnes. It won the 2000 Prime Minister's Prize for Science.

In Australia's oceans we've discovered a wealth of new species, declared war on introduced marine pests and helped develop more sustainable fisheries management systems. On land, we are gaining fresh insights into our rivers, lakes, estuaries, groundwaters and wetlands so Australians can protect and use them far into the future. In our cities we're helping to devise better ways to save, use and distribute precious water.

CSIRO has more than 700 research partnerships worldwide, including with giants like Japan's US$114 billion Itochu company. We're leveraging these to create new opportunities for exports and joint ventures by Australian companies.

We are helping put new wines, like Tyrian and Rubian, on the world's dining tables, designing safer, tastier and more nutritious foods, developing better eucalypts for silviculture, outsize prawns for aquaculture and healthier sheep for agriculture.

These are just some of the many research projects now under way through CSIRO and its partners in industry, government and academia. At their core is our belief that, through investing in partnerships, know-how and great people, we can help deliver a prosperous, sustainable and dynamic Australia.

And the cost of CSIRO to the average Australian? Less than ten cents a day.

After reading this report and its companion *Creative Solutions*, I hope you'll agree that Australia is getting real value from its science.

Geoff Garrett

Chief Executive, CSIRO

Chapter 3
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 4.

Responsible Minister >>

From 1 July 2000 to 30 June 2001, 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 2000-01.

The CSIRO Board (2000-01) >>

Chairman

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

Members Current at 30 June 2001:

Dr Geoff Garrett
BA(Hons) MA PhD
Chief Executive
8 January 2001
— 7 January 2006

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

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

Professor Mary O'Kane
BSc PhD Vice-Chancellor
University of Adelaide
28 May 1997
— 31 December 2000
1 January 2001
— 27 May 2002 (reappointment)

Mr Russell Higgins
BEc(Hons)
Secretary, Department of Industry, Science and Resources
7 April 1997 — 30 June 2000
10 August 2000
— 7 April 2002 (reappointment)

Mr Norbury Rogers
BCom FCA
Senior Consultant Ernst & Young
28 May 1997
— 31 December 2000
1 January 2001
— 27 May 2002 (reappointment)

Ms Catherine Livingstone
BA(Hons)
Company Director
1 January 2001
— 31 December 2005

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

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

Terms completed during year:

Dr Colin Adam
BEc(Hons) PhD FIEAust FTSE
Chief Executive (Acting)
10 February 2000
— 7 January 2001

CSIRO Service Charter >>

Our purpose

By igniting the creative spirit of our people, we deliver great science and innovative solutions for industry, society and the environment.

Who we are

CSIRO is Australia's Commonwealth Scientific and Industrial Research Organisation. We are one of the world's largest and most diverse scientific research organisations.

What we do

CSIRO maintains an uncompromising focus on delivering service to our customers and stakeholders from world-class science. We provide:

- advanced technologies to businesses to enable them to compete more effectively in domestic and international markets; and
- knowledge-based services to governments and businesses to help make Australia a better place in which to live.

Our customers

Our customers are essential to our success. They include:

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

Customer services

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

- work with the customer to develop an in-depth understanding of their needs;
- 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 value-based contract with the customer; and
- 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 international, national and regional economic, social and environmental priorities;
- submissions to enquiries and working parties where scientific and technical advice is required; and
- 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 and innovation in which CSIRO has expertise; and
- where the enquiry is outside CSIRO's expertise, direct the enquirer to institutions which may be able to provide the information.

Our service standards

Our performance can be measured against the following standards:

- in our 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 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 where they relate to matters of science or our behaviour.

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; and
- 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.

How to give us feedback

CSIRO greatly welcomes feedback on its performance. Should you wish to contact us in this regard, the first port of call would normally be the CSIRO officer with whom you have been dealing; alternatively senior management in the relevant Division or Business Unit, or CSIRO Customer Relations at:

PO Box 225
Dickson ACT 2602

Tel (02) 6276 6789
Email customer-relations@its.csiro.au

We will deal with feedback quickly and effectively, passing on credit in the case of compliments and striving hard to make amendments and improve where concerns are expressed about our performance.

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. In the reporting year, he was supported in this role by four Deputy Chief Executives, who together with the Chief Executive, constituted the Executive Committee that oversaw CSIRO's operations. From 1 July a new management structure consistent with the objectives of the 2001 Strategic Action Plan comes into being, see Chapter 9.

CSIRO's research has been 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. In the reporting year each Deputy Chief Executive oversaw 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 structure up to 30 June are in the Organisation Charts following. (Chart 1: Corporate responsibilities; Chart 2: 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 2001 CSIRO had a total staff of 6 511, which has an equivalent full-time value of 5 928.

The numbers of staff employed in different job categories are shown below. More than 1 700 CSIRO staff have a PhD and approximately forty-six per cent of CSIRO staff have attained postgraduate level of education.

Staff by gender and principal functional area

	FEMALE	MALE	TOTAL
Research Scientists	228	1 290	1 518
Research Project staff	964	1 563	2 527
Senior Specialists	4	32	36
Research Management	12	197	209
Technical Services	104	604	708
Communication & Information	232	123	355
General Services	86	64	150
Administrative Support	696	237	933
Corporate Management	14	61	75
TOTAL	**2 340**	**4 171**	**6 511**

Chart 1: Corporate Responsibilities as at 30 June 2001

(See Chapter 9 for the new Senior Management Structure from 1 July 2001)

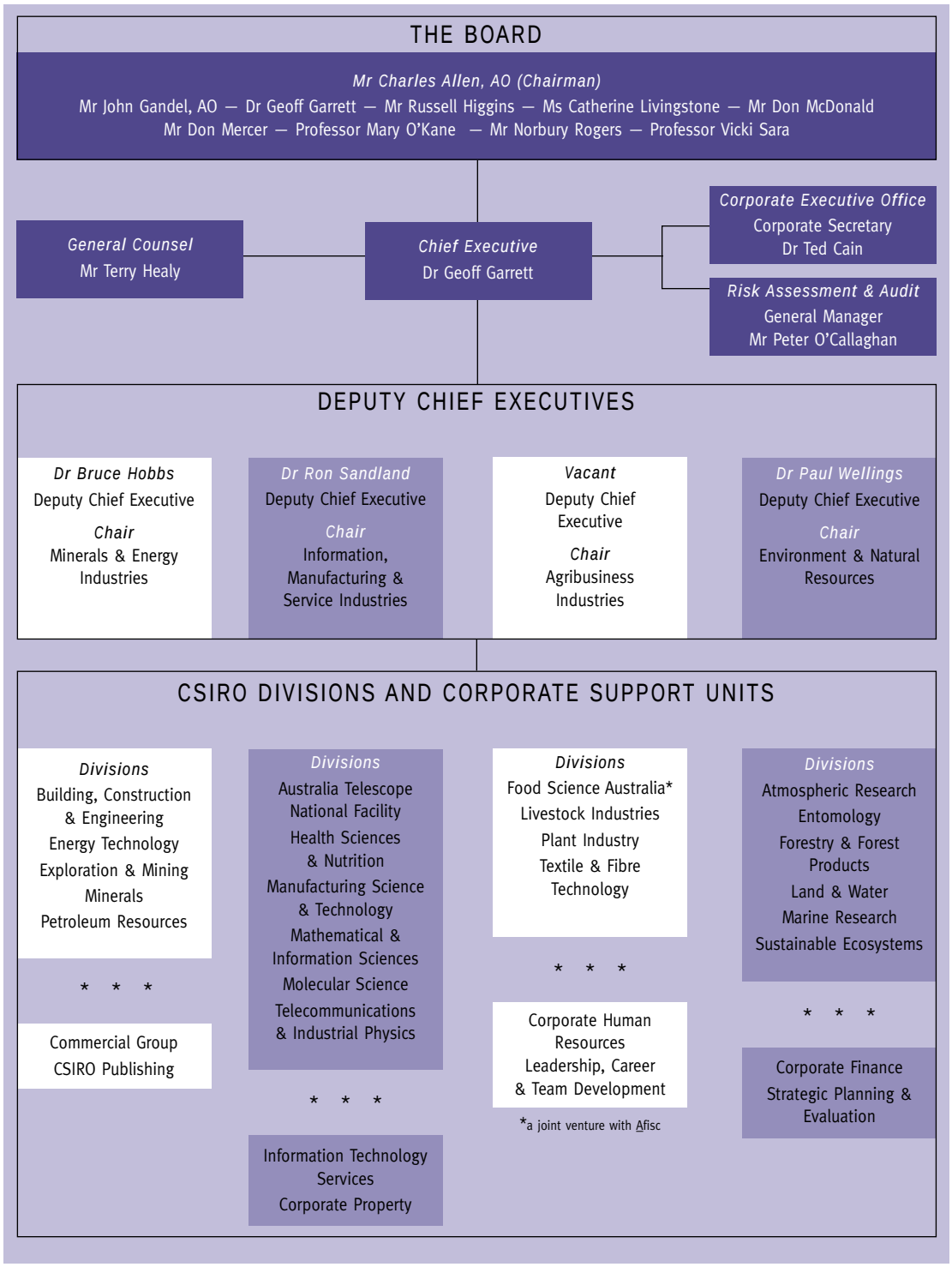
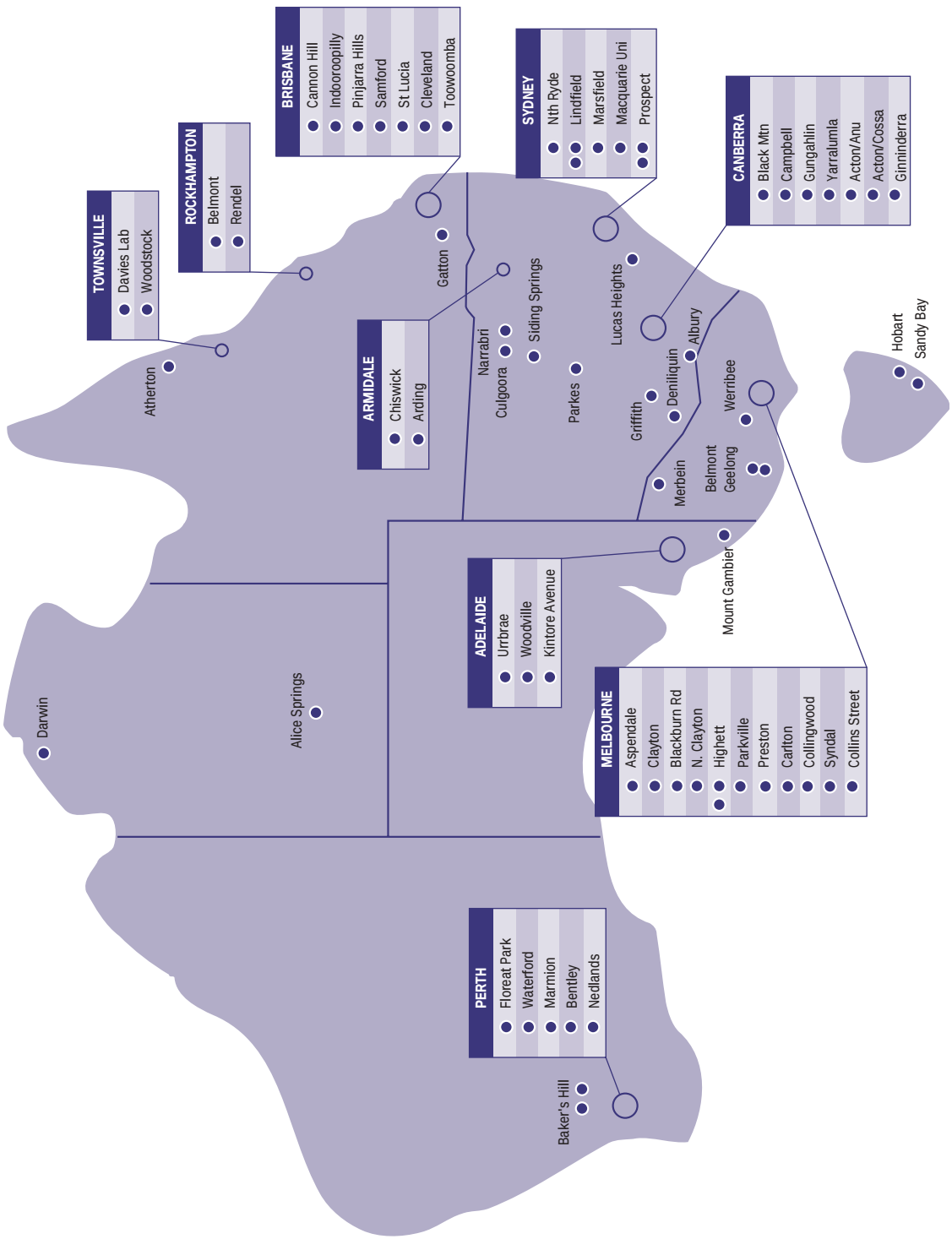


Chart 2: Operational arrangements as at 30 June 2001

DIVISIONAL GROUPS	ALLIANCES and SECTORS: Agribusiness						Environment & Natural Resources				Information, Manufacturing & 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	Built Environment	Chemicals & Plastics	Information & Communication Technologies	Integrated Manufactured Products	Measurement Standards	Pharmaceuticals & Human Health	Radio Astronomy	Services	Energy	Mineral Exploration & Mining	Mineral Processing & Metal Production	Petroleum
Agribusiness																						
Food Science Australia	●	●		●	●							●										
Forestry & Forest Products			●				●	●	●		●								●			
Livestock Industries		●			●	●	❍	●		❍						❍						
Plant Industry	●	●	●	●	●	●	●	●														
Environment & Natural Resources																						
Atmospheric Research								●											❍			
Entomology	●		●	●	●	●	●	●	❍		●	●				●						
Land & Water	●			●	●		●	●	●		●					●				●	●	❍
Marine Research					●		●	●		●									●		❍	❍
Sustainable Ecosystems	●		●		●	●	●	●	●	●								❍	❍	❍		
Information, Manufacturing & Service Industries																						
Australia Telescope National Facility																	●					
Building, Construction & Engineering							❍	●	❍		●	●		●							●	●
Health Sciences and Nutrition	●	●			●											●						
Manufacturing Science & Technology											●	●		●				●	●	●	●	
Mathematical & Information Sciences	❍	●	●	❍	●	❍	●	●	●	●	●		●	●			❍	●		●	●	●
Molecular Science											●	●				●					●	●
Telecommunications & Industrial Physics								●			●		●	●	●			●	●	●	●	
Textile & Fibre Technology						●																
Minerals & Energy Industries																						
Energy Technology								●	●	●									●	❍	●	
Exploration & Mining																			●	●		●
Minerals																			●		●	●
Petroleum Resources																			●			●

● and ❍ indicate Sectors to which a Division plans to contribute in 2001-02. An open circle indicates a contribution of less than $300 000

CSIRO locations - *as at 30 June 2001*



Senior staff and addresses (as at 30 June 2001) >>

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Chief Executive

Dr Geoff Garrett

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Deputy Chief Executives

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Dr Ron Sandland

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Dr Paul Wellings

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Corporate Secretary

Dr Ted Cain

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Chief Dr Graeme Pearman, AM

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Web www.dar.csiro.au

The Australia Telescope National Facility

Director Professor Ron Ekers

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Web www.atnf.csiro.au

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Chief Mr Larry Little

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Chief Dr John Wright

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* Joint venture between the Australian Food Industry Science Centre (Afisc) and CSIRO Food Science & Technology

Forestry and Forest Products

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Petroleum Resources

Chief Dr Adrian Williams

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Plant Industry

Chief Dr Jim Peacock, AC

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CANBERRA ACT 2601

Tel (02) 6246 4911
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Web www.pi.csiro.au

Sustainable Ecosystems

Chief Dr Steve Morton

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CANBERRA ACT 2601

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Email steve.morton@csiro.au
Web www.cse.csiro.au

Telecommunications and Industrial Physics

Chief Dr Warren King

PO Box 76
EPPING NSW 1710

Tel (02) 9372 4222
Email warren.king@csiro.au
Web www.tip.csiro.au

Textile and Fibre Technology

Chief Dr Brett Bateup

PO Box 21
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2: Outcome, Outputs and Performance

In the first three chapters of this section (Chapters 4, 5 and 6), CSIRO reports on its performance in accordance with requirements of the Commonwealth's accrual-based outcomes and outputs framework and the performance indicators agreed with Government as part of triennium funding arrangements.

Under the outcome-outputs framework, CSIRO's core business is defined in terms of the outputs to be provided and the outcomes to be achieved in consultation with key stakeholders and in recognition of government priorities. By definition, outputs are goods and services produced by CSIRO for external organisations or individuals, and outcomes are the impacts or consequences flowing from the production and use of those outputs.

This information is supplemented in Chapter 7 with reports on the results of seven 'Chief Executive's Special Projects' established in December 1997, and in Chapter 8 with a record of national and international awards recognising the excellence of CSIRO's performance in many areas of research and its application.

Chapter 4
CSIRO's Outcome

The primary functions of CSIRO are to carry out scientific research and to encourage or facilitate the application or utilisation of the results of such research in order to assist Australian industry, further the interests of the Australian community, or contribute to the achievement of Australian national objectives or the performance of the national and international responsibilities of the Commonwealth (*Science and Industry Research Act, 1949 - paraphrased*). Under the accrual-based outcome-output framework, CSIRO receives funding from the Commonwealth to carry out these functions in contributing to the following outcome:

Enhanced innovation, productivity and competitiveness in Australian industry with improved understanding and management of the environment and natural resources in the interests of the Australian community.

This statement reflects the Government's desire that Australians continue to enjoy the benefits of our unique natural environment and the fruits of a robust, internationally competitive economy. For CSIRO, it encompasses the recognition that - on local, national and global scales - the pace of economic change and the challenges of environmental management bring with them a growing reliance upon the insights and application of advances in science and technology.

Some examples of CSIRO's contribution to the outcome, achieved by adopting a variety of strategies to bring about crucial advances in knowledge and its application, include:

- **progress toward solutions to strategically important issues for the nation**, like the pilot hybrid energy plant to power Australia's cities without greenhouse emissions or pollution;
- **new opportunities for small and medium enterprises**, like our low-emission car project that brought together more than 95 industry partners and which has helped generate an extra $500 million in new export business potential for the local car components industry;
- **world-leading breakthroughs in basic research**, like our internationally-acclaimed discovery of the flowering switch gene, which could add billions of dollars worth of grain to the global harvest;
- **new technologies to assist industries and create new export markets**, like CSIRO's wireless chipset, that led to the sale of Australian company Radiata PL to Cisco Systems for US$300 million, as well as a boost for local R&D;
- **environmentally friendly products and processes**, like our Windscape energy mapping software tool for finding the richest wind areas for power generation;
- **new technologies and management systems that improve safety in industry**, like robot devices to help reduce the loss of life and injuries in Australia's mines; and
- **environmental monitoring and management technologies**, like our atmospheric sampling technology to help cut air pollution in Australia's cities.

More information about CSIRO's various contributions to its Outcome are given in Chapter 6 and in the companion document to this Report, *Creative Solutions*, published in August 2001.

Chapter 5
CSIRO's Outputs

As discussed in the previous chapter, CSIRO's activities are directed toward a national outcome of 'Enhanced innovation, productivity and competitiveness in Australian industry with improved understanding and management of the environment and natural resources in the interests of the Australian community'. CSIRO contributes to this outcome through the production and delivery of research products and services - CSIRO outputs - for a wide range of private and public organisations and individuals.

For convenience, CSIRO's outputs are clustered into four groups that represent four broadly defined target groups:

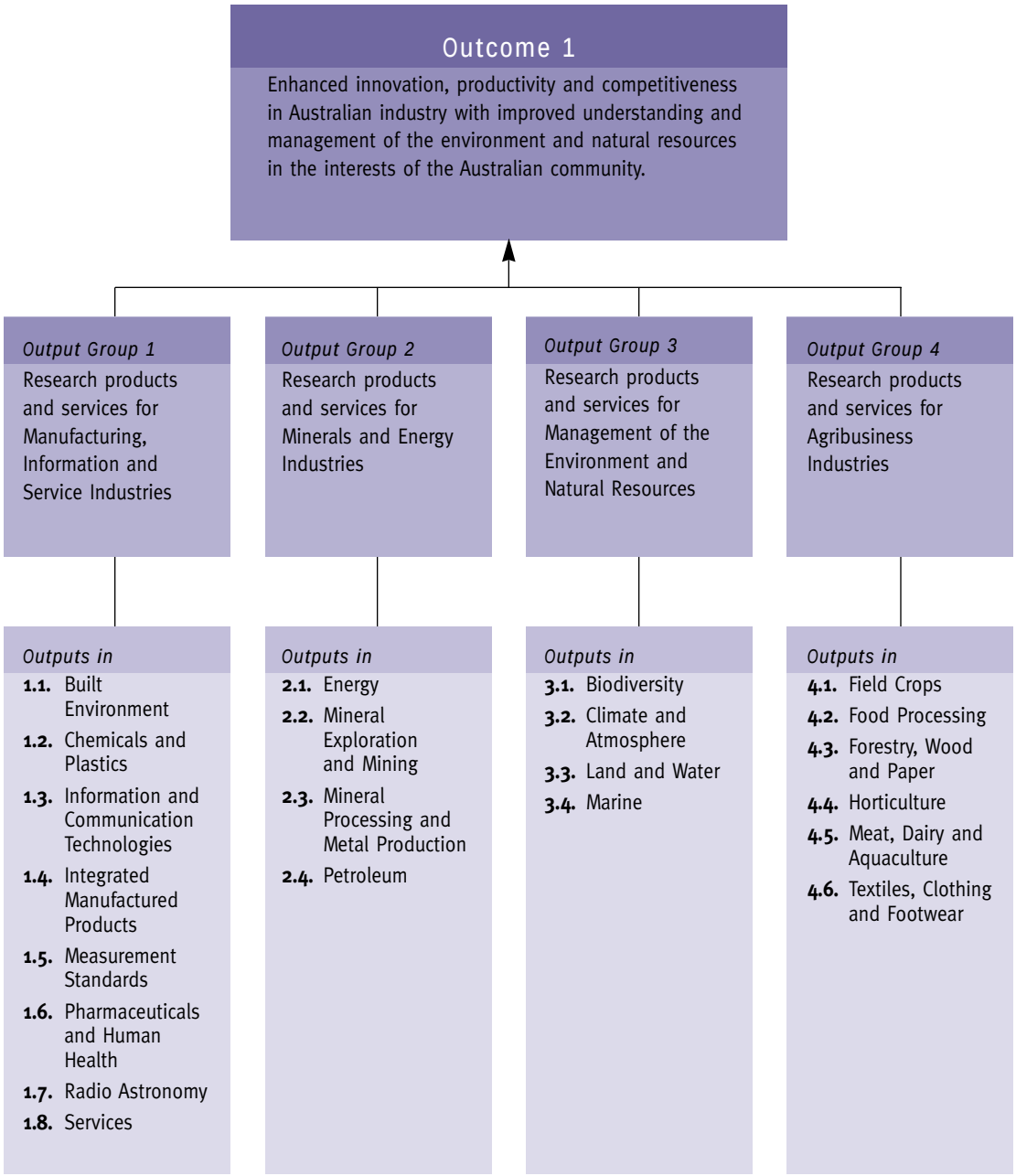
- Research products and services for the Manufacturing, Information and Service Industries
- Research products and services for the Minerals and Energy Industries
- Research products and services for Management of the Environment and Natural Resources
- Research products and services for Agribusiness Industries

These four output groups comprise the 22 Sectors which form a key element in the planning and conduct of CSIRO's research. With input from an external Sector Advisory Committee and other sources of advice, CSIRO develops a research plan for each Sector. The plan addresses the key strategic issues for research in the Sector and identifies specific outputs and outcomes that will address those issues and contribute to the overarching CSIRO outcome.

The relationship between the CSIRO outcome, the four output groups and the 22 Sectors is illustrated in the following chart.

A selection of key outputs delivered during the past year is listed in the table below and described in more detail on pages 35-75 (Performance Indicator No.6: Adoption and Impact of CSIRO outputs).
More achievements covering the last three years are described in the companion document to this Report *Creative Solutions*, published in August 2001.

Contributing Outputs TABLE



CSIRO OUTPUTS 2000-01

Manufacturing, Information and Service Industries	— Commercialisation of Align 3Droute planning technology — Creation of CSIRO Urban Water Technologies company — Development of stormwater screening technology — ITS Connect: a new national freight system using smart technologies — Improved management of termite attacks on buildings — Biodegradable food packaging — Improved export packaging for table grapes — Commercialisation of boron technology to produce pharmaceuticals and new materials — Commercialisation of new grain fumigant, carbonyl sulfide — Pre-commercialisation of SICOR polymer bonding technology — Successful trials of product for bioremediation of chemical pesticides — Formation of Quickstep Technologies company to commercialise Quikstep™ fast fabrication method for making composite products used in aerospace, boat and car industries — Development of scalable vector graphics viewer for pocket PCs — Radiata wireless network sold to world markets — Sale of multibeam antennas to Europe — Design of interactive exhibit for Gallery of First Australians, National Museum — Middleware technology evaluation reports for e-commerce — Further hybrid-engine technology for ECOmmodore car — Welding technology for aerospace aluminium castings — Corrosion prediction models for aircraft — Patenting of replacement for sulfur hexafluoride (used in magnesium processing) to reduce greenhouse emissions — Commercialisation of gas-tungsten arc welding technology — Innovative spectacle lens design — Process to treat coloured industrial effluents — Successful trials of magnesium diecasting technology — Production of atomic mirrors for new field of atom optics — Establishment of facility to prepare reference gas mixtures for chemical metrology — Further developments in establishing an improved frequency standard — Development of portable ultrasound standard — New drug to treat hepatitis B in clinical trials

	— Licensing of sheep virus-based gene delivery technology for human uses
	— Relenza flu vaccine sales increase
	— Structures of major disease target proteins revealed
	— High-speed monolithic microwave integrated circuits designed for Australia Telescope
	— First successful millimetre wavelength astronomical observations
	— New evidence of greater age of the universe
	— Parkes radio telescope surveys used in international studies
	— Tests of Einstein's warped space
	— Electronic travel planner, TRIPS, prototype completed
	— Face recognition technology undergoing trials
	— Statistical studies of compliance behaviour for Taxation Office
	— Data mining of health data to improve health care
Minerals and Energy Industries	— Method to reduce greenhouse emissions from coal mines
	— Studies of impact of power station waste ash on environment used in developing mitigation processes
	— Commercial uptake in USA of CSIRO's Highwall Mining Guidance System
	— Life cycle analyses of greenhouse gases and air pollutants emitted by diesel fuels
	— Improvements to power station efficiencies
	— Commercial release of WindScape wind energy prediction tool
	— New facility to test polymer electrolyte membrane fuel cells
	— First sub-surface sampling of an active deep-ocean ore-forming environment
	— Contribution to new software for processing gravity and magnetics data
	— TEMPEST airborne electromagnetic system being deployed by mineral industry and in National Action Plan for Salinity
	— Tool to improve assessment of pit wall stability in underground mines
	— New environmental monitoring techniques for Ranger minesite
	— Computation Fluid Dynamics being used to increase profitability of mineral processors
	— Successful development of Australian Magnesium process
	— New probes to measure complex gas flows in a smelter
	— Research support provided to MIM to improve lead-zinc concentrator performance
	— Method of reducing dust emissions from electrostatic precipitators
	— Commercialisation of Genesis 2000 software for analysing well data

	— Reduction of exploration costs at drill site by risk assessment advice
	— Enhancement of sedsim petroleum basin modelling process
	— Wellbore stability technology used to overcome major problems for a site in South China Sea
Management of the Environment and Natural Resources	— Methods developed to halt native vegetation decline
	— Biological control of bridal creeper succeeding
	— Report on sustainable harvesting of firewood assisting in developing national policy
	— *Business and Biodiversity* Report produced to raise awareness of industry about conservation
	— Inventory of ecosystem services for Goulburn-Broken Catchment
	— Software for managing tourism in Douglas Shire
	— Commercial release of BioLink biodiversity software
	— Recovery plans for golden sun moth
	— Successful clearing of water hyacinth from Lake Victoria, central Africa
	— Contributions to international climate change science
	— Seasonal climate forecasting models and climate projections for Australia
	— Forecasting systems for agriculture and Australian air quality
	— Export of CSIRO-designed rainwater and atmospheric particle samplers to 17 countries
	— Commercialisation of volcanic ash cloud detector for aviation industry
	— Case studies of salinity management in Murray-Darling Basin
	— Successful interaction with 3 communities to plan for rural and regional sustainability
	— Improved efficiency of irrigated agriculture demonstrated
	— Technologies developed to remediate soil and groundwater
	— Input to new national guidelines for fresh and marine water quality
	— Methods to define fairer ways of allocating water resources
	— Feasibility of physical economy modelling demonstrated for national financial flows
	— Resource survey of south east marine region
	— Advice on conservation of deep sea marine environments
	— Software to help control marine pests and improve estuary health
	— Recommendations for managing expansion of aquaculture industry
	— Measurement of impact of trawling on bycatch species
	— Tiger prawn assessments helped restructure Northern Prawn Fishery

	— Technologies to use marine resources to enhance health value of food
	— Predicting effects of climate on fisheries productivity
Agribusiness Industries	— Discovery of flowering switch gene
	— Successful mouse plague predictions in Victoria
	— Decision support software for sugarcane industry
	— Measurement of extent of nitrate contamination of groundwater
	— Canadian leafcutter bees introduced to boost lucerne seed production
	— Confirmation that growing lucerne can prevent waterlogging
	— New wheat varieties developed resistant to Barley Yellow Dwarf Virus
	— Commercialisation under way for Barleyplus™ variety with health benefits
	— Economic benefits of stored grain research measured
	— Improved methods developed to manage root disease in broad acre crops
	— Innovative Foods Centre established
	— Improved food coating (microencapsulation) patented
	— Specialty dairy powders developed for export
	— Software to aid in transporting perishable foods
	— Meat processing equipment for exports
	— Detection of foreign bodies in foods
	— New whey protein isolate technology
	— Demonstration plant to produce energy and activated carbon
	— Mew test developed to predict best fertiliser results for pine plantations
	— Planting trees to control waterlogging and salinity
	— Sustainability of pine plantations demonstrated
	— Airborne imagery to show forest health
	— Workshops conducted for Australian Greenhouse Office
	— Assessing threat of Asian Gypsy Moth
	— Strategic tree planting to sustain rice growing areas
	— Eucalypt posts used as vineyard trellises
	— Testing thinning options for eucalypt plantations
	— Plantations to preserve macadamia varieties
	— Launch of website describing wasps in Australia
	— Development of improved varieties of cashew nuts
	— Development of new dried grape variety

- Providing risk assessments for horticultural imports
- Genetic improvements to prawn stocks
- Vietnam prawn workshops to reduce disease threat
- Launch of GeneSTAR beef marbling test
- Cheaper environmental land assessment
- Recommendations for better management of grazing lands
- Use of Pondman software expands to 80 per cent of Australian prawn farms
- National redistribution of biocontrol agents for pastoral weeds
- More improved cotton varieties released to market
- Development of new 'easycare' technology for wool garments
- Industrial trials of SiroLock textile carding technology
- Launch of SelectGene software to help Merino breeders select sheep most likely to produce fine wool
- World marketing of Australian Medical Sheepskin
- Improved oral delivery of therapeutics to livestock
- Benchmarking studies of Chinese and Indian wool processing mills
- Animal production from saline land initiative commenced

Chapter 6
CSIRO's Performance

Introduction >>

This performance report is structured around the six performance indicators negotiated with government. Information on the 'adoption and impact' indicator is presented by the four output groups (disaggregated into 22 Sectors) described in the previous chapter. The performance indicators paint a picture of strong performance, delivering good value for money from the nation's investment in CSIRO.

CSIRO's performance has been achieved against the background of an increasingly competitive international research community. To maintain our recognised position as one of the world's leading research organisations, and to further enhance our contribution to Australia into the future, CSIRO will need an increased level of resources.

Consequently the new Executive Team has put in place an ambitious plan to seek a 50 per cent growth in turnover by 2005, commencing in 2001-02. An overview of the plan is presented in Chapter 9 of this Annual Report and the initial results should begin to be evident in next year's report.

CSIRO's performance indicators are set in the context of CSIRO's overall planning and evaluation framework as shown in Figure 1. The framework incorporates the government's outcomes and outputs philosophy within a broader 'opportunities to outcomes' context, and also features the criteria employed in CSIRO's priority setting methodology (first developed in 1990).

As illustrated in the diagram, and elaborated below, the six current performance indicators include two input indicators, two output indicators and two outcome indicators. While it is likely that these performance indicators will be revisited and reformulated in discussions with government during the course of the next financial year, they presently provide the evaluation framework within which CSIRO's performance is assessed. Taken together, these performance indicators provide information on CSIRO's *effectiveness* in contributing to the achievement of the planned outcome, and on performance in relation to the *price, quantity and quality* of outputs.

Input (Price) Indicators

- Sector Profile (the shift of resources in accord with priority decisions over the triennium).
- External Earnings (amounts and sources of external earnings for research and related services).

Output (Quantity and Quality) Indicators

- Publications, Reports and Patents (the number of patents, reports and other publications annually; quality assessment through external citation analysis on a five-yearly basis).
- Research Training (the number of research students supervised or co-supervised by CSIRO staff).

Outcome (Effectiveness) Indicators

- Customer Satisfaction (measured by customer feedback and repeat business).
- Adoption and impact of CSIRO outputs (evidence of the uptake of research results and advice together with estimates of the consequent economic, social, environmental or policy impacts).

CSIRO Planning and Evaluation Framework

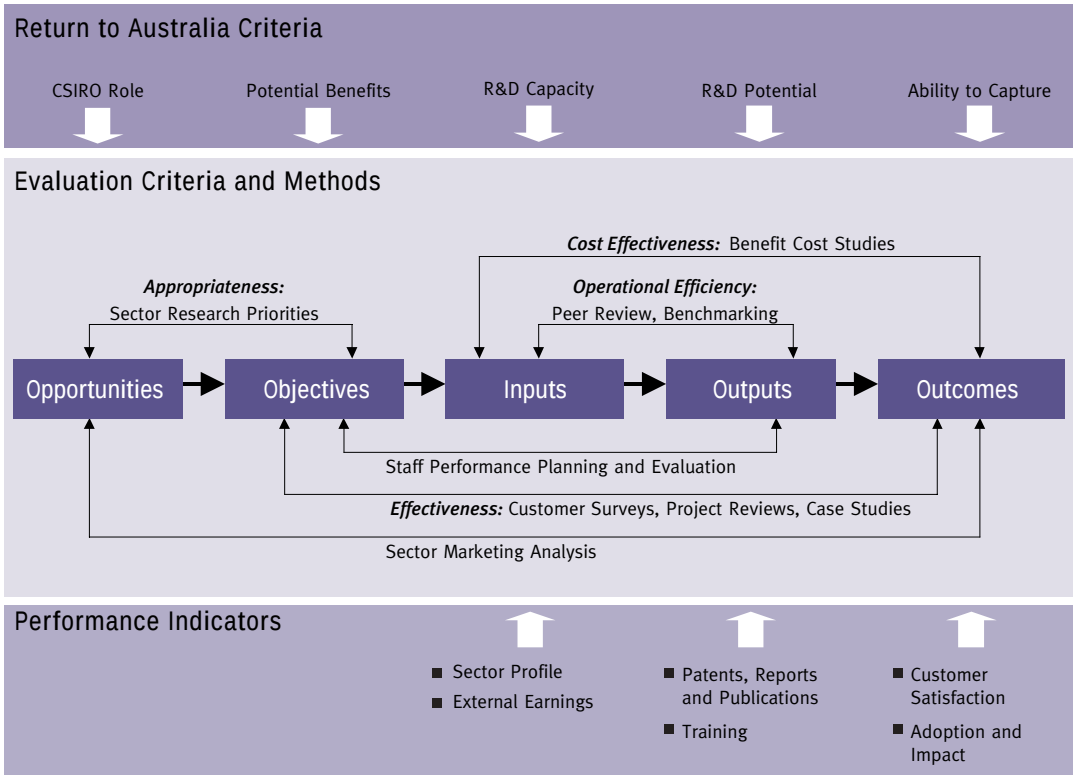


Figure 1 CSIRO Planning and Evaluation Framework

Indicator 1: 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 relative attractiveness and feasibility of research opportunities in 22 customer-focussed Sectors. Thus Figure 2, which charts actual expenditure in 2000-01 against the planned level of investment in each Sector, is an indicator of CSIRO's performance in allocating resources in accordance with identified priorities at the Sector level on an annual basis. Total expenditure includes expenditure from both appropriation and external income, and is therefore subject to the uncertainties of market conditions in any given period.

The enhanced effort for the Land and Water and Meat, Dairy and Aquaculture Sectors was due to higher than expected external revenue from those Sectors. The largest shortfall in external revenue occurred in the Pharmaceuticals and Human Health Sector, although total expenditure was maintained at about the planned level and a successful float of GroPep, a company in which CSIRO has substantial equity, took place in 2000. It should also be noted that the chart reflects an estimate of CSIRO's operational activities in Food Science Australia (a joint venture with the Australian Food Industry Science Centre, Afisc) that differ from the legal interest.

Another aspect of the 'shift of resources in accordance with changing priorities' is reflected in CSIRO's priority decisions for the current triennium. As part of its strategy to exploit the strongest links between market demand and the opportunities offered by science and technology, CSIRO has allocated additional resources for research in the Mineral Exploration and Mining, Land and Water, Marine, Food Processing and Radio Astronomy Sectors, and reduced investment in certain components of the Forestry Wood and Paper Industries, Meat Dairy and Aquaculture and Built Environment Sectors.

CSIRO has also recognised the unique role that information and communication technologies (ICT) play across all Sectors by forming an ICT Strategy Team. The Team has members drawn from across the Organisation and is chaired by a Deputy Chief Executive (Ron Sandland). The overall objective of the Team is to develop strategies and implementation plans to maximise the scientific and commercial impact of CSIRO's ICT research. An ICT research strategy will be developed by the end of 2001.

Biotechnology is another area of technology recognised as of key importance in its cross-cutting influence across a range of industry sectors. Both Commonwealth and State governments are developing a range of strategic initiatives to nurture what is also a rapidly emerging industry sector in its own right. Approximately half of CSIRO's research units contribute to or utilise advanced biotechnologies. In recognising the significant potential for economic growth, the need to strengthen the research and development base and to successfully commercialise research outcomes, a CSIRO Biotechnology Strategy Team, chaired by a Deputy Chief Executive (Paul Wellings), has been formed to prepare a CSIRO-wide biotechnology strategy in the first half of 2001-02.

In addition to the major shifts of resources between Sectors referred to above, CSIRO's external Sector Advisory Committees (SACs) played a key role in advising CSIRO on changing priorities within Sectors. In total, some 30 per cent of the CSIRO research portfolio was changed in planning for the current triennium. The bulk of these changes occurred through the process of redesigning the research portfolios within the individual sectors.

CSIRO Expenditure by Sector, 2000-01, $'000

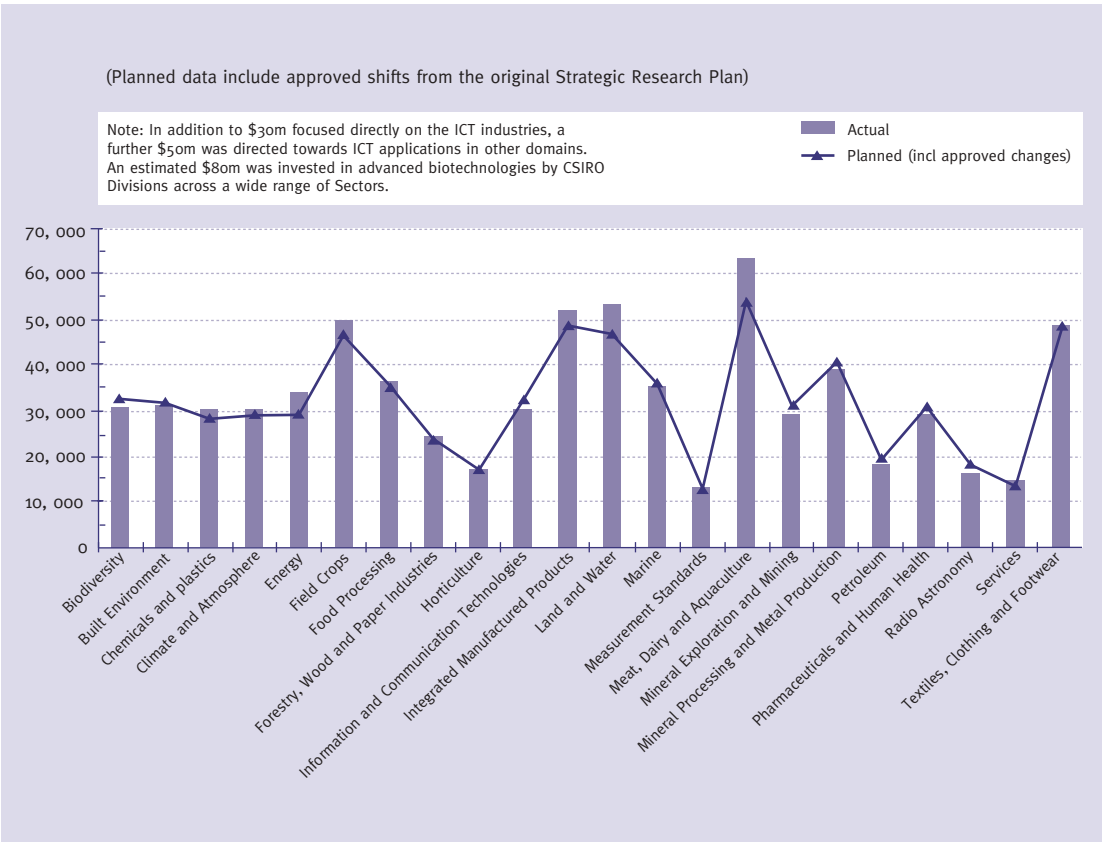


Figure 2 CSIRO Expenditure by Sector, 2000-01

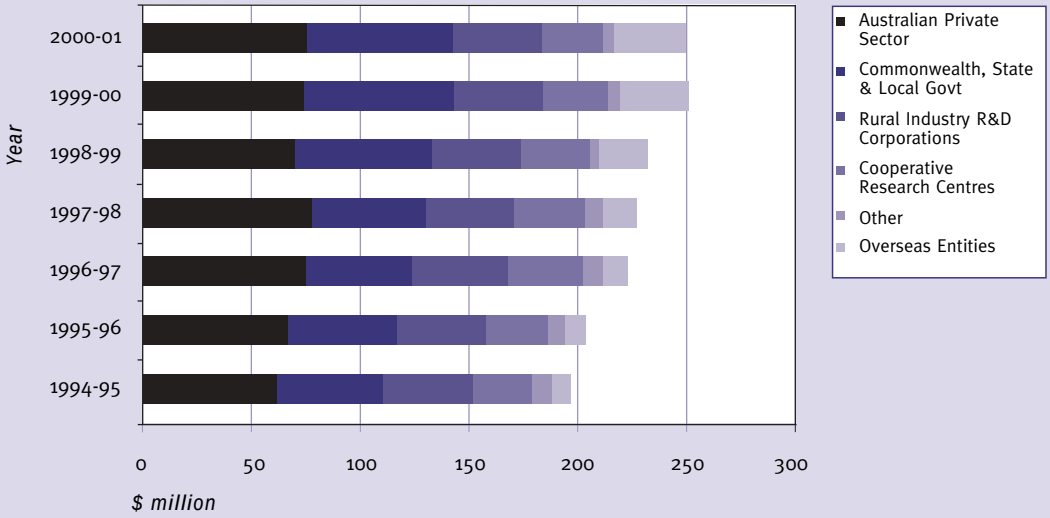
Indicator 2: External Earnings

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 achieving 32.3 per cent ($241.3 million) of revenue from research and services in 2000-01. Trend data are shown in Figure 3.

The recent strong growth in overseas earnings has steadied at around $32 million of which about $26 million (80 per cent) is from private sector sources. Allowing for the fact that half of Rural R&D Corporation investment is from industry levies, 48 per cent of CSIRO's external earnings (or 15 per cent of turnover) is from the private sector. Private sector investment in R&D in Australia has declined in each of the last four years (as a percentage of Gross Domestic Product), based on data from the Australian Bureau of Statistics, but CSIRO's share of that investment has remained steady in absolute terms.

Trend in external earnings by source, $ million



Source	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
	$m	$m	$m	$m	$m	$m	$m
Australian Private Sector	61.2	66.4	74.7	77.5	69.4	74.0	75.2
Commonwealth, State & Local Govt	49.0	49.8	48.4	52.3	63.1	68.6	66.8
Rural Industry R&D Corporations	41.1	40.8	44.2	40.3	40.8	40.7	40.8
Cooperative Research Centres	26.9	28.4	34.0	32.5	31.3	30.0	27.6
Other	9.1	7.9	9.2	8.1	4.1	4.9	5.2
Overseas Entities	8.3	8.9	11.0	15.5	21.9	31.4	32.7
	195.6	202.1	221.6	226.1	230.6	249.5	248.3
Net adjustment - work in progress and deferred revenue	(0.8)	6.6	2.0	10.7	(9.3)	(0.1)	(7.0)
External Earnings Performance Indicator	194.8	208.7	223.6	236.8	221.3	249.4	241.3

The definition of external earnings for performance indicator purposes excludes items deemed to be unrelated to the conduct of research, eg interest received.

Figure 3 Trend in external earnings by source, $ million

Indicator 3: 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.

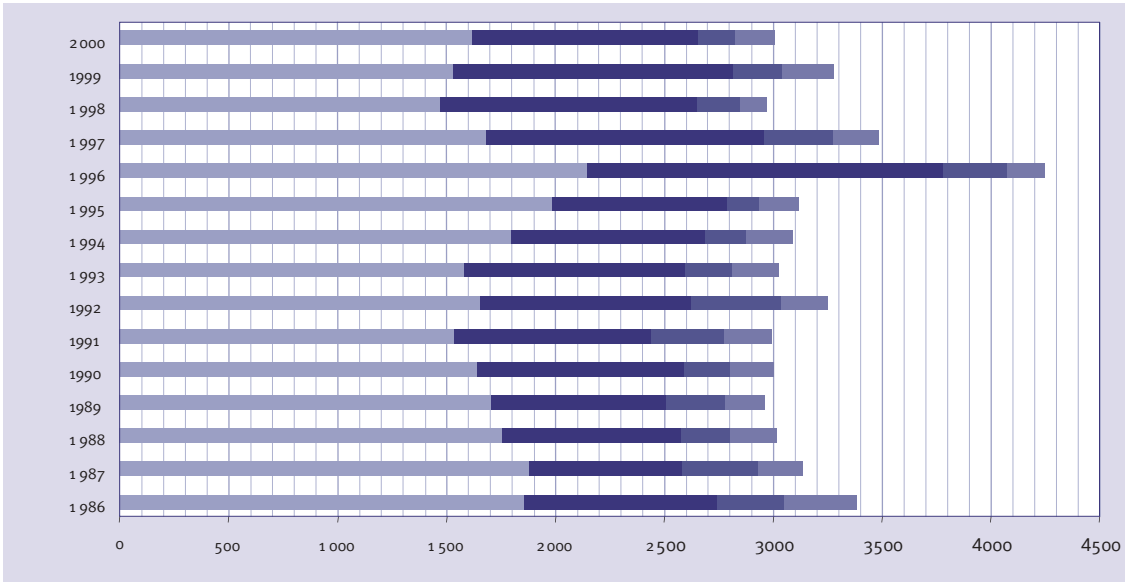
Summary

CSIRO's outputs of publications and patents in 2000-01 reflect the long-term average whilst the number of reports produced in 2000-01 has shown a dramatic increase. Citation rates for CSIRO's scientific publications remain very high, reflecting their strong impact and quality. A recent analysis by the Institute of Scientific Information (USA) has revealed that over the last decade, CSIRO's publications are ranked in the top 1 per cent of the world's scientific institutions in 11 of the 22 disciplinary fields assessed. In two of these fields, environment/ecology and agricultural sciences, CSIRO ranks as one of the top five institutions in the world. CSIRO performance is particularly strong in the key areas of information and communication technologies, and biotechnology, citations per publication being one-third higher than the Australian average.

The number of client reports produced in 2000-01 reached a record high of 8 936.

World Intellectual Property Organisation (WIPO) figures indicate that in the year 2000 CSIRO filed the most Patent Cooperation Treaty applications of an Australian entity. CSIRO is currently filing applications for around 90 new inventions per year, which is marginally above the 5-year average of 88 new inventions per year.

Trend in CSIRO publications



NUMBER OF PUBLICATIONS															
YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Books and Chapters	332	203	209	184	199	216	211	216	213	179	175	207	123	236	178
Technical Reports	308	348	226	269	212	331	414	214	186	148	295	318	194	229	175
Conference Papers	889	707	823	805	949	910	970	1016	891	805	1630	1278	1183	1280	1035
Journal Articles	1855	1877	1756	1705	1643	1534	1655	1582	1799	1984	2149	1682	1472	1535	1619

Figure 4 Trend in CSIRO publications

Publications

The publications data are shown in Figure 4. Overall levels are on par with long-term trends and there has been a small growth in the patent portfolio, and a marked increase in client reports. This indicates increased organisational productivity, given that there has been a reduction in total staff over the past several years.

In terms of impact or quality of the publications, as measured by citation analysis, CSIRO exhibits a strong citation performance in world terms in all disciplines in which CSIRO has 10 per cent or more of all Australian publications - agricultural, veterinary and environmental sciences, earth sciences, engineering and technology, and physical sciences. Its overall citations per publication (cpp) rate is at least 30 per cent higher than the world average, and also higher than the Australian cpp rate by a considerable margin.

Reports

The number of client reports recorded in 2000-01 increased to 8 936 from 7 339 in the previous year and is also up from the previous high of 8 099 in 1998, compared to 7 095 in 1997 and 5 076 in 1996. Around half of the reports relate to project activity while the other half are reports resulting from the provision of testing and calibration services by Divisions.

Patents

As at 30 June 2001, CSIRO had 77 Patent Cooperation Treaty (PCT) applications in place, up from 63 as at 30 June 2000, and compared to an average of 78 since June 1995. The total number of Australian and foreign patents and applications held at 30 June 2001 is 3 505, up from 3 436 last year, and reflects a steady growth from June 1995 when the total was 2 867. The decision to file, prosecute and/or maintain a patent takes into account the technical considerations, patent attorney and legal advice, market and business conditions, and the input of commercial partners.

Overseas patent applications represent 84 per cent of the above portfolio, and this compares with 76 per cent in June 1995. Currently CSIRO is filing applications for around 90 new inventions per year (5-year average, 88). These trends reinforce CSIRO's strategy of ensuring its patent portfolio is commercially relevant.

World Intellectual Property Organisation (WIPO) figures indicate that in the year 2000 CSIRO filed the most PCT applications of an Australian entity. On a world scale CSIRO was ranked No 118.

Growth in Net Income from Intellectual Property held by CSIRO

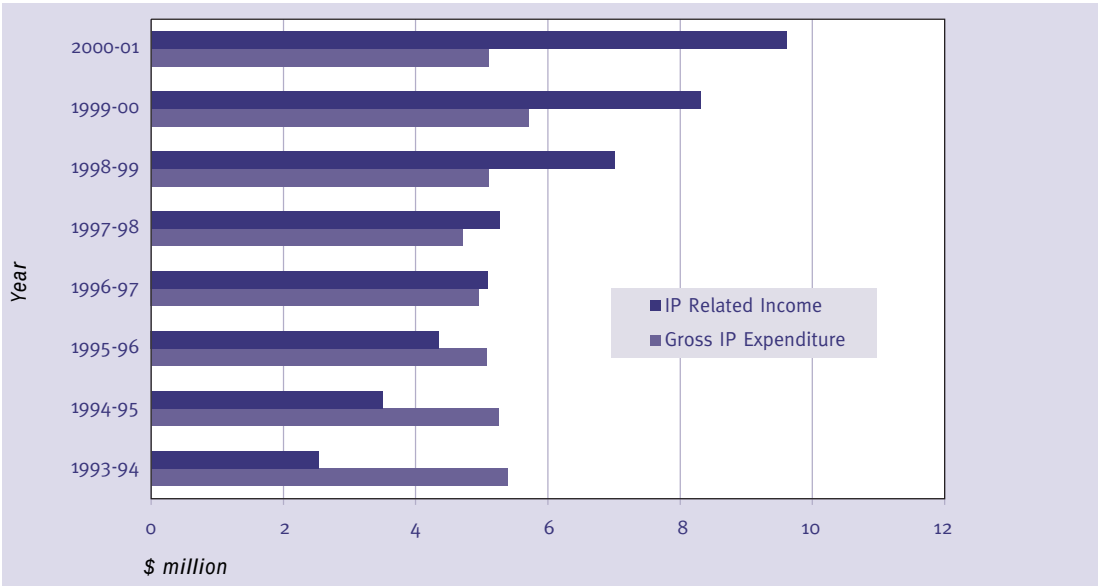


Figure 5 Growth in net income from CSIRO's patent portfolio

Income from royalties and licence fees in 2000-01 was $9.3 million (excluding Food Science Australia) against an expenditure of $5.1 million for legal and portfolio management costs. This income represents 1.5 per cent as a percentage of appropriation revenue. Trend data are shown in Figure 5, illustrating the continuing improvement in earnings from the patent portfolio.

Indicator 4: Research Training

This indicator reflects CSIRO's contribution to the development of the Australian skills base.

In 2001, CSIRO jointly supervised a total of 609 postgraduate research students, including 475 PhD students, 57 Masters students and 77 Honours students; 23 per cent of these students were supervised through the Organisation's involvement in the Cooperative Research Centres (CRC) Program.

The overall number of students supervised is 17 per cent higher than in 2000, with the number of PhD students supervised being 25 per cent higher. The proportion via the CRC Program is lower than in previous years (which was approximately 30 per cent).

At 30 June 2001 CSIRO was a core participant in 44 CRCs still in operation. In addition to these CRCs, CSIRO is a participant in 14 of the 19 successful Round 7 CRCs that were due to commence operation on 1 July 2001. This puts CSIRO's future involvement at 49 of 63, which is consistent with CSIRO's past involvement in the Program.

In 2001, CSIRO is sponsoring 128 postgraduate students. This includes full scholarships for 35 PhD, 4 Masters and 3 Honours students and partial scholarships for a further 75 PhD, 4 Masters and 7 Honours students. The total number of students sponsored shows a 27 per cent increase on 2000.

This represents a significant contribution (about 10 per cent) to the training of Australia's researchers and science-based professionals. CSIRO is developing strategies to improve linkages with universities further, including through increased training of research students, and also to increase its training of post-doctoral researchers.

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

Indicator 5: 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.

Satisfaction in CSIRO among its industry and government partners remained at high levels, as illustrated by formal surveys, commissioned evaluations, repeat business evaluation, and by way of anecdotal feedback.

Across CSIRO various measurement techniques were used to gauge customer satisfaction. The most widely used method (by 75 per cent of CSIRO Divisions) was formal surveys and questionnaires. Data obtained from formal surveys and questionnaires are often supplemented with data collected by more informal methods such as phone interviews, steering committee and project management meetings, measures of repeat business and customer testimonials.

The size and duration of a contract quite often determines whether customer satisfaction is measured and the type of method used. More than half of the customers who had completed a contract with CSIRO within the last financial year were approached to measure their satisfaction, and although not all customers responded, those that did generally expressed high levels of satisfaction.

The level of repeat business continues to remain high at approximately 70 per cent for all contracts across the Organisation. The range of variability of repeat business across Divisions remains similar to the previous year, from 40 to 99 per cent.

CSIRO's 22 Sector Advisory Committees, involving a total of over 235 clients, stakeholders and partners from both the private and public sectors, also provide an important feedback mechanism.

Steering committees or similar means of joint project management were used for approximately 44 per cent of contracts. Where it is not practical to have a steering committee every effort is made to establish and maintain an ongoing rapport with the customer.

A sample of comments from customers includes:

"We got what we agreed; when we wanted it; in an acceptable form. Professional look."

"There are no other organisations in Australia who have the range of expertise and knowledge in the research area."

"Relationship with CSIRO has been great. We don't have any other issues with CSIRO like we do with a lot of others. An ability to actually go to you and talk is excellent."

"Project proposals have been very high quality, they always have been and continue to be one of the best that is received. A lot of forethought goes into them."

"Regarding overall reporting and outcomes, you just can't fault it. For the two projects that I have been closely involved with, we have a model that is state of the art."

"Commercialisation and exploitation is very well done."

"CSIRO's input into this area has probably resulted in an extra $200 million in revenue (to the industry) each year based largely on its delivery of the world's highest yielding cotton varieties with very competitive quality attributes."

Where adverse comments were made, two issues stood out - the need for timeliness and appropriate reporting styles to meet the needs of the client. Some customers also perceived the price as being too high and that costs are sometimes prohibitive compared with other research providers.

These issues are being addressed in various ways including specific actions detailed in the new Strategic Action Plan. The outcomes from the Pricing Review, which forms part of the Government's Reform Agenda, will also have a bearing on how CSIRO will address cost and pricing issues with its customers in the future.

A pilot study to test a new approach to measuring customer satisfaction using the Comparative Value Analysis approach was conducted during the latter part of the year and will be rolled out through the whole of CSIRO in the 2001-02 financial year. One aspect of this program will focus on improving key account management and customer relationship building; the other will focus on overall customer satisfaction with the quality and price of CSIRO's offer versus that offered by other R&D suppliers.

Indicator 6: Adoption and Impact of Research

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.

From the world-class hybrid car and clean, green electricity to new foods, pharmaceuticals and environmental care, CSIRO's latest research is making a real difference to Australia's quality of life. The research achievements listed in this Report all occurred during the financial year 2000-01. A complementary publication *Creative Solutions* describes a number of CSIRO's significant achievements and outcomes over the last three years.

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 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.

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Manufacturing, Information and Service Industries >>

Built Environment Sector

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 pressures of human settlements (environmental noise, poor air and water quality, transport congestion and end use energy inefficiency);
- national water supply is facing severe population and environmental pressure and there is failure to re-engineer stormwater and wastewater as a resource;
- 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;
- performance-based design codes and standards are critical to innovation in building design and materials selection;
- a large sectoral balance of trade deficit in built environment services indicates a need for greater development and application of IT and automation locally;
- the health and productivity effects of poor indoor environments;
- environmental sustainability is driving the construction industry to increase recycling of construction material and reduce waste; and
- the effect of e-business on movement of people and goods.

CSIRO's Strategic Response

CSIRO's response is focussed on sustainable principles that aim to achieve economic growth and improve living standards, while protecting and enhancing the environment. This has followed a comprehensive review of the business environment to address the effects of globalisation of supply chains and R&D, the path to market, market reform and deregulation, environmental imperatives and the requirements for particular research skills. Particular attention has been given by the Sector Advisory Committee and CSIRO to the issue of weaknesses on the demand side affecting the paths to market, in particular the lack of receptiveness to R&D among many Built Environment Sector industries.

Research areas are consequently focused strongly on the intended path to market. These include:

- intelligent transport systems;
- optimising infrastructure networks;
- integrated design and construction;
- smart coating technologies;
- new generation building;
- fire science and technology;
- infrastructure performance and service;
- urban water;
- indoor environment;
- low energy accelerated processing;
- solid waste reactivation; and
- re-engineering windows and facades.

Research Achievements

Commercialisation of award winning technology. Successful commercialisation of the Align 3D technology was achieved with the sale to a 'spin-off' company, Quantm Ltd. The Align 3D technology is vertical and horizontal route optimisation software, which helps cut project planning time by up to a third. Alignment construction cost savings are in the order of 20 per cent or higher. The technology won the Australian Technology Award for the best public sector new technology in 2001.

Two new Cooperative Research Centres. CSIRO has provided support for the creation of two new Cooperative Research Centres. The new Cooperative Research Centre in Construction Innovation will be located in Brisbane and will operate in partnership with Queensland University of Technology.

The new Cooperative Research Centre for Innovative Wood Manufacturing will be located in Melbourne and have links with CSIRO's Materials Engineering Laboratories, which support research in surface engineering, smart coatings and new composite materials.

CSIRO urban water initiative. Following a two-year national feasibility study, CSIRO Urban Water Technologies has been created with strong support from the Water Services Association of Australia, to provide urban water consulting, research services and technologies to industry. Major contracts have been signed with water authorities in Australia and New Zealand and initiatives have commenced in Asia in conjunction with leading Australian construction and engineering firms.

An intelligent freight transport system. Problems of traffic congestion and transport delays are estimated to cost $5 billion a year in extra travel time and vehicle operating costs. The first phase of an extensive multi-divisional program to develop a national freight strategy is now underway. ITS Connect provides for a pilot corridor in a major city to use advanced ITS technologies and techniques to study freight movements and develop new information-based products and services for the transport industry. This will provide benefits to State and commercial transport operators in saved time and cost, reduced wear and tear on vehicles and infrastructure and greater predictability in their business operations as they enter the e-business era.

New fire, science and technology laboratory. Approval was received for the construction of a new $14 million facility at North Ryde in Sydney. This will enable CSIRO to provide one of the world's few fully integrated fire facilities. It will offer planners, architects, engineers, designers, builders and regulators comprehensive solutions to the challenges posed by public safety and fire issues in commercial and public buildings and industrial plants, and Australia's bushfire-prone environment.

Termite management breakthrough. CSIRO's termite group has played an active role in the research and development into alternatives to prevent termite attack in built structures, and baiting methods that attempt to eradicate a colony. Alternative chemical barriers now include non-repellent insecticides that kill termites while they burrow, but which are non-toxic to vertebrates. Physical barriers include a choice of termite resistant polymers for communication cables, pipes and sealants, and systems that prevent them getting through concrete slabs.

A major achievement has been the identification of a pheromone, a chemical attractant, that the termites use in communication and foraging. The ubiquity of this pheromone among termite species makes it suitable as a feeding stimulant for baiting systems. Physical and chemical cues that promote tunnelling behaviour have been identified, with potential use in baiting system design and are being tested in commercial bait stations.

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Chemicals and Plastics Sector

Industry Context

The chemicals and plastics industry produces both household products that are directly supplied to consumers and a broad range of materials that underpin Australia's manufacturing, agriculture and mining sectors. The industry has three distinct segments with opportunities in each for investment and growth: the innovator segment which comprises new firms supplying high-tech products to a large global market; an existing brownfield manufacturing commodity chemicals segment; and lastly a greenfields world-scale export-focused petrochemical segment.

We believe that the future of the chemicals and plastics industry in Australia, to which CSIRO research can contribute, lies with the innovator segment of the sector.

The industry sector in Australia overall involves 2 500 firms ranging from large companies supplying established commodity products, to small formulators, plastics processors and high-tech start-up companies with fewer than 30 staff supplying specialised downstream market needs. Currently 40 large foreign and 20 large Australian firms supply 70 per cent of Australia's chemicals and plastics market.

There are three key strategic drivers for the industry:

- sustainability of resource production and manufacturing, recognising the need for environmental protection, economic viability and social responsibility;
- the impact of new developments in biotechnology and nanotechnology; and
- the nature and pace of technical improvements and competitive changes.

The chemical industry worldwide is therefore continuing its hundred-year history of major innovation with a marked trend towards biotechnology developments, life science initiatives and to products and processes based on nanotechnology. Industry restructuring in Australia and overseas is continuing with the formation of traditional chemical firms, vertically integrated life sciences companies and emerging new high-tech firms, the latter both as start-up companies and as affiliates of established multi-nationals. Increased focus on the adoption of biotechnology and nanotechnology heralds a marked shift in R&D from the more mature segments of the industry.

CSIRO's Strategic Response

We envisage a sustainable and dynamic high-tech chemicals and plastics industry in Australia - one that will underpin industrial growth and capture significant domestic and export markets. In line with this vision and within this industry context, our primary intent will be to support the innovator segment of the sector by further building our strategic research capability in selected high-potential areas including nanotechnology, biotechnology and polymer engineering.

These core capabilities provide three technology platforms for future research and development of improved products and processes:

Biodiscovery - examples include biodegradable polymers, biostable materials, crop protection products, biosourced raw materials, animal feed and health, pharmaceuticals and fine chemicals, enzymes, bioremediation, biomining, energy cropping.

Sustainable production and manufacturing - examples include water treatment, specialty chemicals, clean chemical production and processing, fumigant replacements, recycling, food processing, product life extension, desalination, functional fluids.

Molecular engineering/architecture - with applications in diagnostics and health care (eg drug delivery and biomedical devices), advanced materials (eg security devices, composite materials, smart coatings, tailored resins), and nanotechnology (eg flat screen displays, energy storage, biological sensors, micromachines and plastics additives).

Research Achievements

New biodegradable packaging. CSIRO, in partnership with the University of Queensland and Swinburne University of Technology in the Cooperative Research Centre for International Food Manufacture and Packaging Science, has successfully developed new biodegradable packaging materials based on starch. The raw material is derived from a renewable resource and the products will degrade in compost heaps. Further improvements have been made with the inclusion of nanocomposite additives to the starch-based film. This aids in the processing and gives increased strength and clarity. The technology is in the process of being licensed to a company, which will produce the biodegradable materials locally and develop the technology globally.

Export packaging for table grapes. CSIRO, in collaboration with the Department of Natural Resources and Environment, and the Cooperative Research Centre for International Food Manufacture and Packaging Science, has developed a new slow release packaging for the export of table grapes. During shipment overseas, table grapes are currently treated with in-package fumigation of sulphur dioxide to retard the growth of mould. This new plastic liner minimises the unsightly bleaching damage and sulphite residues in the grapes. Thus the grapes arrive in a better condition and should attract higher prices for Australian exporters. International commercial marketing of the product is planned for next year with a local licensee of the technology.

Commercialisation of boron technology. CSIRO's strong intellectual property position and in-house knowledge in boron chemistry has led to a licensing agreement between CSIRO and a start-up company, Boron Molecular Pty Ltd. The technology license focuses on boron chemistry and involves using new methods to produce pharmaceuticals, fine chemicals, new materials and catalysts.

New fumigant. Progress has been made in commercialising carbonyl sulfide, a new fumigant for grains developed by CSIRO. The new fumigant has the potential to replace many uses of methyl bromide, a chemical being phased out under the Montreal Protocol because it contributes to destruction of the ozone layer.

SICOR company. SICOR™ is a revolutionary new technology developed by CSIRO to engineer the surface of polymers and polymeric composites; it demonstrates a number of key advantages over current technologies. A spinoff company will be formed later in the year to commercialise the SICOR™ technology.

Cleaning up pesticide residues. Major progress has been made in the development of a commercial product for the bioremediation of chemical pesticides. Trials have achieved a significant reduction in pesticide residues in both contaminated run-off from irrigated cotton operations and in surface contaminated horticultural commodities. The cotton trial, conducted by CSIRO's licencee Orica Pty Ltd on a cotton farm in New South Wales, was successful, reducing residue levels in more than 80 000 litres of contaminated water by 90 per cent in just 10 minutes.

Quickstep Technologies. The Quickstep™ process is a fast fabrication method for making very high quality composite products without using an autoclave. This groundbreaking Australian technique looks set to revolutionise the aerospace, boat and car building industries by making advanced polymer composite technology affordable. CSIRO has completed trials of the technology in conjunction with a local aerospace manufacturer, which confirmed the quality of parts produced by the process, and the capacity of the technology to reduce the costs of manufacture. This success in the development and validation stage has led to the formation of a new start-up company, Quickstep Technologies, which is further developing and commercialising this revolutionary process. The company is now in negotiation with several major international aerospace and automotive companies, with the aim of integrating the process into production lines within the next 2-3 years. CSIRO is a major equity partner in the company, as well as the primary R&D subcontractor.

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Information and Communication Technologies Sector

Industry Context

The Information and Communication Technologies (ICT) Sector encompasses telecommunications and computer networking, mobile communications, electronic content management and processing, electronic commerce, and more generally all forms of electronic communication, computer and software systems.

Globally, the ICT Sector continues to be one of the fastest growing industries. Medium term predictions include:

- continuation and acceleration of 'Moore's Law' (which predicts a doubling in computer power every 18 months) drawing large investments with short life cycles in the technologies underlying enhanced ICT infrastructure;
- increasing penetration of computer systems, communication access and internet connectivity for business, entertainment, travel and social interaction;
- increasing importance of electronic content as an economic driver;
- internet and enhanced Internet Protocols replacing other network solutions;
- roll-out of third generation mobile systems and always connected devices;
- rapid development and deployment of automation in e-business integration; and
- market transformation flowing from automated speech understanding systems.

At the local level, the most significant recent development has been the review of innovation in Australia leading up to the Government's investment through *Backing Australia's Ability*. The report of the working party established by the government to review the ICT Sector advised:

> *"As ICT is so fundamental to competitiveness it is essential that Australia act to strengthen its investment in ICT research, training and technology transfer infrastructure to ensure our weakness does not constrain the country's economic growth potential."*

The report noted that the ICT Sector plays a crucial role in supporting the global move towards the knowledge economy and delivers 'first mover' advantages across industry in general. It proceeded, however, to document a falling trend in Australian R&D investment in ICT, the difficulties with transferring R&D resource to the sector against traditional needs and the ICT investment gap that is developing between Australia and other first world countries.

Within CSIRO, research in this Sector also contributes to many of the projects carried out in the 21 other Sectors.

CSIRO's Strategic Response

In considering the above, CSIRO has evaluated options relating to its R&D position in the market. A buoyant ICT industry would support export growth, improve the balance of trade, lift our technology leadership reputation, attract investment and secure a share of future markets. Australian Industry expends significantly in ICT R&D but focusses on product enhancement more than medium term and sustained breakthrough research efforts. Universities and the proposed new Centre of Excellence have a role to pursue breakthrough research. CSIRO aims then to undertake medium term research (on a 3-5 year timeline) to create market transforming intellectual property developed and delivered in concert with commercial interests.

While CSIRO is reviewing its research directions given this role, we expect the following broad areas to play a prominent part in our future work.

- mobile connectivity;
- broadband applications;
- high bandwidth components;
- electronic content, interaction and automation;
- e-business and e-market systems; and
- future internet.

Research Achievements

Wireless network to the world market. Radiata Pty Ltd completed the development of integrated circuits that support a wireless local area network based on CSIRO patents. This technology will enable the wireless connection of computers, video cameras, televisions and other consumer devices. In November 2000 the USA networking equipment company CISCO Systems Inc announced that it had acquired Radiata for $US300 million from its Australian owners. CSIRO will receive royalties from worldwide sales of CISCO products that apply this technology. CISCO will also retain the research and development team located in Sydney. This is a first class example of how CSIRO technology and skills can create wealth and jobs in Australia.

Great graphics for pocket PCs. CSIRO, as part of its work with the world wide web consortium, has created a Scalable Vector Graphics Viewer (SVGV) for pocket computers - bringing high-quality, sharp and colourful renditions of maps and pictures to these popular devices. The software provides the building blocks for new mobile applications such as interactive street directories, building plans or any drawing data. Being a vector format, SVGV images remain clear and detailed, no matter how much they are zoomed or rescaled.

Multibeam antennas, save space and money. TST Kommunikations-technik GmbH, Germany, has purchased four, 4.5 metre diameter multibeam antennas developed by CSIRO. This advanced antenna technology targets the European direct TV satellite market. The first three multibeam antennas and 15 feed systems will be delivered to Société Européenne des Satellites (SES), the operator of ASTRA, Europe's leading direct-to-home satellite system, and installed at SES-ASTRA's satellite control facilities at Château de Betzdorf, Luxembourg. From this location, each antenna will communicate with many satellites at the same time, substantially reducing base station infrastructure and maintenance costs.

First Australians Gallery. The curators of the Gallery of First Australians, at the National Museum of Australia, required an innovative design for their Welcome Space. The design had to handle 300 people per hour and provide a compelling, immersive, interactive experience of diverse aspects of Aboriginal culture. Together with the curators and artistic consultants, CSIRO developed a unique system incorporating song, dance and imagery from the Museum's collection with position and motion sensors, surround-sound and a wide range of customised special effects. The result combines a premier showcase of Australia's advancement in technology with an emotionally engaging interactive experience of welcome songs and dances, leading to a better appreciation of an important aspect of Australia's heritage.

Middleware technology evaluation reports. In cooperation with product vendors, CSIRO has produced a set of reports on the computer system technologies that support internet-based computing and business-to-business e-commerce, called middleware. The reports represent a rare source of independent advice and are required reading for software architects, project managers and developers struggling with the many features and capabilities of different middleware technologies. These reports facilitate the choice of suitable products for business needs, helping to eliminate the risk of critical failures and increase the overall satisfaction level of customers with the products they buy. The reports are available through CSIRO Publishing on the world wide web at: http://www.publish.csiro.au and have been widely promoted through industry seminars around Australia in association with Software Engineering Australia.

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Integrated Manufactured Products 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; and
- 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 major local and global companies as well as small and medium enterprises (SMEs). Many Australian manufacturers are primarily interested in incremental improvements in products and processes.

Our research is directed to assisting the growth of Australian industry by targetting 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; and
- reduce costs of existing micromanufactured products and develop new, differentiated high-value products based upon small-scale physical system manufacturing.

Research Achievements

ECOmmodore. CSIRO has developed an advanced hybrid petrol-electric drive train for the Holden ECOmmodore. The car uses a modified, 2 litre, petrol engine in parallel with a switched reluctance electric motor drive. The motor drive is connected to super capacitors, and batteries. The car body is based on a Holden Commodore that features improved aerodynamics, low rolling resistance tyres, and a lighter weight construction. The hybrid technology, with the improved car body, can reduce fuel consumption to half that of the equivalent conventional car, without loss of performance or drivability. Urban air pollution is reduced by as much as 90 per cent compared to the equivalent production car with only a small cost increase.

Welding of aluminium castings for aerospace applications. Welding repair procedures have been developed by CSIRO for the reworking of large aluminium castings. An exhaustive mechanical testing program provided data to support the adoption of high quality repair procedures in manufacturing processes. The technology transfer included a week of training for aerospace personnel in the CSIRO laboratory.

Corrosion prediction modelling. The CSIRO, Defence Science and Technology Organisation and BAE SYSTEMS are developing software to predict the time to onset of corrosion on aircraft. A highly innovative model has been developed and validated against corrosion chamber tests.

CSIRO signs Memorandum of Understanding. Australian Magnesium Corporation Ltd (AMC) and CSIRO signed a Memorandum of Understanding in December 2000 under which AMC will outsource a large part of its future research and development requirements to CSIRO. Full implementation of the MOU will depend on the successful raising of investment funds for a proposed $1.3 billion commercial plant. Two major research areas are involved, magnesium process and production technologies. Additionally, CSIRO will provide technical marketing support to AMC. The MOU builds on a decade of collaborative research between CSIRO and AMC in magnesia and magnesium product related research. It follows a decision by the Australian government (dependent on the commercial plant going ahead) to financially support CSIRO's late stage research and development directed towards the refinement and commercialisation of AMC's magnesium producing technology, which is jointly owned by AMC and CSIRO.

Reducing greenhouse gas emissions. CSIRO and the University of Queensland researchers have identified a replacement for sulfur hexafluoride, the worst greenhouse gas known, for its use as a protective cover gas in the processing of molten magnesium metal. Working within the Cooperative Research Centre for Cast Metals Manufacturing and in association with Australian Magnesium Corporation, these researchers have patented a new technology based on a common refrigerant gas that is cheaper and more effective than sulfur hexafluoride. This technology could reduce greenhouse gas emissions by over 5 million tonnes of carbon dioxide equivalent per year worldwide. The cover gas technology will be offered to Australia's emerging magnesium industry. Commercialisation opportunities are currently under evaluation.

Innovations in welding technology. CSIRO has developed and commercialised a new gas tungsten arc welding technology, known as key-hole gas tungsten arc welding. This technology is now available on the market to provide full penetration welding for the food and beverage, transport, and oil and gas industries. This patent-protected technology has been taken up by Australian industry where it is delivering major savings. The technology has been licensed to Meanderlyn Pty Ltd, and is being marketed globally.

Clearer vision. Millions of people worldwide now have clearer vision due to pioneering work on spectacle lens design. Unique tools for designing spectacle lenses have allowed SOLA International to develop innovative new lenses, including better progressive glasses and wrap-around prescription sunglasses. This work done in conjunction with CSIRO, has contributed nearly $1 billion worth of lens sales per year for SOLA.

Treating industrial effluents. CSIRO has developed a catalytic process for treatment of coloured industrial effluents. The process has been tested and found effective for a wide range of effluents, including that from the pulp and paper, alumina, textile and tannery industries. A pilot plant trial commenced at PaperlinX Pulp Mill in Morwell, Victoria in May 2001.

Improved magnesium diecasting technology. CSIRO's advanced magnesium diecasting technology is the subject of commercial plant trials in the US and the UK where production cost savings have been demonstrably better than predicted. Three commercial applications are now in production and a further eight components are under development. Six new potential companies are considering full license take-up of the technology. License agreements are in place with all industrial participants. A spin off company InMag Pty Ltd has been formed initially to establish a comprehensive business plan and ultimately to commercialise the technology.

Atomic mirrors. CSIRO scientists, in collaboration with the University of Melbourne, have fabricated a high quality, atomic magnetic mirror, an essential component of their innovative design for an atom interferometer. This research is at the forefront of the burgeoning new field of atom optics. The team has transferred to Swinburne University to bring together Australia's expertise in Atom Optics & Ultrafast Spectroscopy.

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Measurement Standards Sector

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 (MRA) 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;
- primary standards R&D;
- international recognition;
- gas mixture standards;
- high flow standards;
- metrology in medicine and health;
- standards and calibration services;
- accreditation of calibration services;
- leadership in the national measurement system; and
- technology transfer and Asia Pacific cooperation.

Research Achievements

Chemical metrology. Australia needs accurate reference gas mixtures on which to base the analysis of the energy content of natural gas, which forms a major export commodity. CSIRO has established a facility that enables it to prepare reference gas mixtures with an improvement in accuracy of approximately a factor of 10 over current commercial capabilities. CSIRO participates at the highest level of accuracy in international comparisons of gas mixture preparation. A comparison of reference mixtures of carbon monoxide in nitrogen is presently being conducted with leading international laboratories.

Frequency standard. A two-year comprehensive study of the temperature behavior of the laser-cooled ion cloud at the heart of the CSIRO's trapped ion microwave frequency standard has recently been completed. The system is now being reconfigured for regular operation as a frequency standard.

Portable ultrasound standard. A portable measurement standard for ultrasonic power is required for the proficiency testing of the calibration services for some 14 000 ultrasound physiotherapy devices in use in Australia. The first prototype of this standard is close to readiness for evaluation tests by the user community.

Major study in South Africa. CSIRO participated in an Australian-South African team which was engaged by the South African government to evaluate the standards, quality, accreditation and metrology infrastructure in South Africa. This major international study provided comparative data on standards and conformance infrastructure in sixteen nations and is the most comprehensive current analysis of the subject.

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Pharmaceuticals and Human Health Sector

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 four 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 and biotechnology processes;
- diagnostics, biomarkers and the changing patterns of disease; and
- 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

An International review of the research conducted in this Sector has been undertaken. The reviewers reported that the quality of the science was excellent but suggested that the activities should be re-focussed, with a reduction in the number of components from eight to four. As a result of staff returning to CSIRO from the Biomolecular Research Institute the final outcome was to focus the research effort into the five components shown below. The process to implement these changes is now being finalised.

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

- diagnostics technologies;
- biomaterials for ophthalmics and orthopaedics;
- gene therapy for cancer;
- structure for therapeutic design; and
- protein targets and therapeutics.

Research Achievements

Hepatitis B. A research collaboration with AMRAD Operations Pty Ltd has produced AM365, a promising new compound for the treatment of hepatitis B virus (HBV) infection. Phase 1 clinical trials with AM365 were successfully completed in late 2000 with good results. Phase 2 clinical trials in persons with chronic HBV infection recently commenced in both Australia and Asia.

Gene therapy. After a successful evaluation of CSIRO's sheep virus-based gene delivery technology, a European biotechnology company is currently negotiating a research and development agreement to co-develop the technology for vaccination against certain infectious diseases, pancreatic cancer and liver disorders, liver cancer and metabolic diseases. This technology has also been exclusively licensed to a major Australian pharmaceutical company for use in developing a gene therapy for prostate cancer. This company is currently supporting CSIRO and the Oncology Research Centre at the Prince of Wales Hospital in Sydney to finalise preclinical evaluations of the therapy in mouse models and to assist the company in seeking regulatory approvals from the US Food and Drug Administration to trial the therapy in humans.

Relenza™. The anti-influenza drug Relenza was launched in Japan in December 2000, and is now approved for treatment in 51 countries, including major markets in the United States, the European Union and Japan. These three markets alone account for about 85 per cent of the world's pharmaceutical market, with Japan representing approximately 20 per cent.

Structures of major disease target proteins revealed. The three dimensional structures of four key proteins that are targets for the development of new therapeutic agents against diseases such as cancer, psoriasis, arthritis and respiratory ailments, have been solved during the past year. In collaboration with the Ludwig Institute for Cancer Research, the Biomolecular Research Institute, the Cooperative Research Centre for Cellular Growth Factors, and the Walter and Eliza Hall Institute, CSIRO scientists have determined the structures of the two members of the epidermal growth factor receptor family as well as a cytokine receptor to atomic resolution. In a separate project, in collaboration with the Biomolecular Research Institute and the pharmaceutical company Biota Holdings Limited, the structure of the protein that facilitates the infection process by paramyxoviruses was determined. The determination of these structures was assisted by the monocapillary X-ray optics developed by CSIRO in collaboration with the University of Melbourne. These structures will provide the basis for structure-based drug design programs which will be facilitated by a supercomputer facility installed at CSIRO this year.

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Radio Astronomy Sector

Context

CSIRO's effort in this Sector centres on the Australia Telescope National Facility (ATNF), which has 'advancement of knowledge' as its primary goal. The Facility has produced a steady stream of internationally recognised discoveries, and both the publication rate and the citation rate continue to increase. 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 first round of the Major National Research Facilities program are providing state-of-the-art millimetre-wave receiving systems and extending the Australian network of telescopes used for Very Long Baseline Interferometry. These upgrades will be completed by 2002. The new capabilities they bring will dominate the operations and science of the National Facility.

Internationally, radio astronomy is carried out primarily through National Facilities, which support university-based users. International facilities will become increasingly important over the next decade.

CSIRO's Strategic Response

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; and
- 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 Achievements

CSIRO instrument enhances telescope in Chile. A Memorandum of Understanding between the Onsala Space Observatory and the ATNF gives Australian astronomers access to the Swedish-ESO Submillimetre Telescope (SEST) in Chile. As part of the arrangement, Australia has provided observing support and the ATNF has built for SEST a signal-processing system - a wideband 'digital correlator' - to enhance the telescope's ability to observe molecules in space. The correlator has now been delivered to SEST and commissioned by ATNF staff.

Monolithic microwave integrated circuits. CSIRO engineers have designed high-speed circuits to use in Australia Telescope instruments, as part of a broader program to develop a range of such circuits for advanced communications systems. The circuits are made from Indium Phosphide, a new material that works extremely well at high frequencies. Some of the ATNF circuits have been incorporated into instruments and are now being used on the telescope. Others have had only preliminary tests, but with promising results: one, made with a new process, operates five times faster than conventional circuits. The project has confirmed that it is feasible to mass-produce high-performance circuits for high frequencies.

Australia Telescope 'opens its eyes' at millimetre wavelengths. In November 2000 the Australia Telescope Compact Array had its first successful observing tests at millimetre-wavelengths, using new millimetre-wave technology developed specifically by CSIRO for this purpose. The tests were a milestone in the upgrade of the telescope being carried out under the Major National Research Facilities program: this upgrade will make the Compact Array one of the few telescopes of its kind able to work at millimetre wavelengths. CSIRO now leads the world in applying millimetre-wave integrated circuits to astronomy. Trial millimetre-wave observing will start in mid 2001 and routine observing in 2003.

Parkes surveys feed further international studies. Since 1997 the Parkes radio telescope has used a CSIRO-designed 'multibeam' receiving system to survey the whole southern sky for neutral hydrogen gas, which reveals the presence of otherwise unseen galaxies. The major survey for galaxies was completed in 2000. It identified faint and small galaxies and shows how galaxies are distributed in the local universe. Survey data were released to astronomers world-wide last year and are now being used as a foundation for many further studies, such as a program of the US National Optical Astronomy Observatory to examine the rate and pattern of star formation in nearby galaxies. A major pulsar survey being carried out with the Parkes multibeam system has now found more than 600 new pulsars. About thirty of them may help solve a long-standing puzzle by turning out to be the sources of some of our Galaxy's gamma-ray emission.

Galaxy may push back time of earliest stars. The earliest stars of the Universe may be much older than previously thought. Using CSIRO's Australia Telescope and the Hubble Space Telescope, scientists have found the strongest evidence so far for an entirely new kind of galaxy in the early Universe. A small patch of the southern sky has been imaged by both instruments. One faint red dot in the Hubble picture corresponds to a strong radio source seen with the Australia Telescope. The distance of the source, and other characteristics, suggests that it may be a galaxy undergoing much more rapid star formation than we see in the Universe today. Other evidence suggests that such galaxies may be faint, but extremely common in the early Universe. If so, that pushes back the epoch of maximum star formation - when the Universe really got active - by a long way.

'The Dish' tests Einstein's warped space. In the most precise astrophysics experiment ever made, Australian and US astronomers have used CSIRO's Parkes radio telescope to measure the distortion of space-time near a star 450 light-years (more than 4 000 million million kilometres) from Earth, confirming a prediction of Einstein's general theory of relativity. They used a pulsar - a small, rapidly spinning star that gives off a stream of radio pulses - measuring the arrival times of its pulses on Earth to within a tenth of a millionth of a second. The pulsar orbits a companion star. According to Einstein, this star curves the space-time around it. The curved space-time should slightly delay the pulsar's pulses. The effect was found. Previous astrophysical experiments have shown that general relativity is a self-consistent theory, but this is the first independent test using geometry.

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Service Sector

Industry Context

The activities of the Service Sector are diverse, encompassing wholesale and retail trade; health services; finance and insurance; travel and tourism; and government and professional services.

Australia's economy is now very much service-based. Recent data show that service industries are growing much faster than traditional sectors like manufacturing, mining and agriculture. Finance and insurance is the biggest sector by revenue generation in 2000-01 ($304 billion). The service sector is the biggest employer and generator of new jobs.

Growth and innovation in services are therefore increasingly crucial to economic performance. While, overall, services are not very R&D intensive, services account for an increasing share of total Australian business R&D, presently about one-third.

The main technology base for the Service Sector lies in information and communications technologies (ICT). Acquisition of technology is an important aspect of innovation. ICT 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 and cost of ICT components. Examples are data mining, personalised services and electronic service delivery.

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.

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:

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

Research Achievements

Electronic travel planner. CSIRO has completed a prototype electronic travel planner in collaboration with Viator, a travel technology small to medium enterprise. The travel planner, known as TRIPS, creates detailed itineraries based on user preferences, constraints and conditions. TRIPS assembles transportation, accommodation and day tours to produce a complete itinerary best matching the user's requests. The TRIPS software prototype has attracted strong interest from Sabre, WorldSpan and Galileo, major international software and service companies in tourism.

Face recognition. Face Identification and Capture (FIAC) combines System for Quick Image Search (SQIS) face recognition with very rapid face location in live video. A cost-effective, PC-based technology for automatically tracking and recognising individuals, FIAC has potential significant applications in area surveillance and the retail industry. Several trials of the system are currently underway with government agencies and private industry.

Bioinformatics. CSIRO signed individual collaboration agreements with Axon Instruments and Proteome Systems Limited (PSL) for major new research initiatives in bioinformatics. Bioinformatics is the application of advanced information technology, mathematical and statistical methods to convert raw biological data into significant results. These agreements aim to develop new high speed, high throughput instruments and software systems for drug discovery and diagnostics for the pharmaceutical industry, biotechnology companies and academic researchers in medicine and agriculture. CSIRO's image analysis specialists will enhance the precision of these instruments and develop ways of analysing their output to extract meaningful biological data from visual information. This will make the laborious process of identifying and screening new pharmaceuticals more efficient and more reliable.

Integrated compliance study. CSIRO worked with the Australian Taxation Office (ATO) to investigate compliance behaviour of individual (non-business) taxpayers. The aim was to assist the ATO to better understand its individual clients by examining taxpayer characteristics and selected life events that might impact upon compliance. Such understanding is directed at identifying taxpayers potentially in need of ATO assistance. CSIRO statisticians analysed the data held on the tax system and modelled the likelihood of timely lodgement and payment, and accurate reporting. The project also identified potentially useful relationships between previous and current year behaviour.

Investigating health care. CSIRO is helping the Commonwealth Department of Health and Aged Care to discover useful public health information from their massive collections of health care data. Using advanced data mining techniques to analyse Medicare and Pharmaceutical Benefits Scheme data, the team discovered which types of patients were most likely to miss out on the full range of treatments. The information allows the Department to measure quality indicators for the Australian health care system, to plan cost effective public health campaigns, and to provide information to medical staff. The technique is also being applied to investigate effectiveness, access and financing of public health. The technique allows many hypotheses to be rapidly tested on massive linked data sets and employs statistical algorithms for identifying patterns in the provision of care.

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Minerals and Energy Industries >>

Energy Sector

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; and
- 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

CSIRO continues to increase its investment and commitment to energy R&D through its support for the new CSIRO Energy Centre to be built at Newcastle and through an initiative to bring together industry partners into a Centre for Distributed Energy and Power to be based at the new Energy Centre.

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, particularly gas-based technologies;
- development of high efficiency, cost effective energy storage;
- development and utilisation of renewable energy;
- direct mitigation of greenhouse gas emissions; and
- enhanced energy end use efficiency.

Research Achievements

Greenhouse mitigation. A CSIRO study has shown that Greenhouse emissions from Australia's coal mines could be reduced by five per cent. CSIRO has identified a method using supplementary fuel to manage irregularities in mine gas flow, and allow economic use of the methane to generate power. Agreements to license the technology have been arranged.

Highwall mining guidance system. Commercial up take of the Highwall Mining Guidance System has been extended to mines in the USA, resulting in foreign exchange for the Australian company that has commercialised the CSIRO technology. The system provides navigation and control of coal mining machines that tunnels into a coal seam from the surface, where it has been exposed by excavation.

Impact of power station waste ash. Following a study on the long-term leaching of trace elements from power station waste ash, CSIRO is applying the outcomes of this work to determine economic processes for reducing the release of environmentally sensitive trace elements in ash dam waters. The work is being carried out with funding from the Australian Coal Association Research Program (ACARP) and the Cooperative Research Centre for Black Coal Utilisation. Considerable interest has been expressed by major electricity generators as the work is seen as an essential aspect of sustainability of energy production based on fossil fuels.

Energy modelling - comparison of transport fuels. CSIRO and collaborators have completed two life-cycle analyses of the greenhouse gases and air pollutants that are emitted when using alternative diesel fuels in transport. These studies provided quantitative information designed to assist regulators determine the most appropriate fuels for the 'Diesel and Alternative Grants Scheme'.

Improving power station efficiency. CSIRO, and the Cooperative Research Centre for Clean Power from Lignite, has developed a new model to improve the efficiency of power stations. A complex model of mill duct flows has been designed to provide a modification for Yallourn Power Station in Victoria. The modification was installed to provide improved control of the fuel split and hence to improve furnace combustion.

Wind energy prediction. Wind energy yields from anywhere in the world can now be predicted. CSIRO has released its innovative WindScape regional wind energy mapping tool onto the market and is attracting considerable interest from wind farm developers. WindScape enables wind energy yields to be predicted at high resolution anywhere on the earth's surface. CSIRO has also undertaken a wind energy resource survey of some 25 sites in New South Wales on behalf of the Sustainable Energy Development Authority of New South Wales.

Fuel cell. CSIRO has opened a Polymer Electrolyte Membrane Fuel Cell (PEMFC) facility which will be used to test and evaluate PEMFC stacks from commercial suppliers and is designed specifically for investigating fuel quality issues from a range of fuel sources. Fuel cells are an environmentally friendly technology that converts fossil fuel or hydrogen with high efficiency, low pollution and reduced greenhouse gas emissions.

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Mineral Exploration and Mining Sector

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 30 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 80 mining industry companies) and Austmine Ltd (which comprises some 102 service and manufacturing companies with exports of mining equipment and services around $1.5 billion per year).

The minerals industry is in the process of recovering from a deep cyclical low in mineral prices and has maintained its focus on cost reduction and diversified markets. Spending for future growth continues to be 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 service role in the Australian industry by providing niche products.

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; and
- 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 without short or long-term damage to the environment or social fabric of the community.

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; and
- optimise exploration to market systems.

Research Achievements

Active ore-forming environment. CSIRO research into modern seafloor mineral deposits has led to the first subsurface sampling of an active, deep-ocean, ore-forming environment. The samples were collected from a submarine volcano, some 400 metres below the floor of the Bismarck Sea, as part of the international Ocean Drilling Program. The success of the expedition will add to the understanding of ancient orebodies found on land and assist in developing exploration techniques for future discoveries.

Processing software for the mining industry. Fractal Graphics Pty Ltd has incorporated an edge detection technique developed by CSIRO into FracWormer, a software package for processing gravity and magnetics data. The resulting three-dimensional images are easily interpretable by field geologists and geophysicists involved in mineral exploration and mine planning. The technique has contributed to a significant gold discovery at Belle Isle, Western Australia, and is continuing to provide further drill targets in the area.

TEMPEST maps salinity. The TEMPEST airborne electromagnetic system developed as a collaborative venture between CSIRO and World Geoscience Corporation (now Fugro Airborne Surveys Pty Ltd), under the auspices of the Cooperative Research Centre for Australian Mineral Exploration Technologies, has seen extensive use for the mineral exploration industry in the past year. The system is also being deployed as part of the Federal Government's National Action Plan for Salinity in the Salt Mapping and Management Support Program. Several large airborne surveys to map salinity are now under way in the Murray-Darling Basin.

Pit mapping. With support from the mining industry, CSIRO has developed a cost-effective system, based on the use of electronic (digital) cameras, to enable mine personnel to map the position and structure of a rock mass quickly and reliably. The three-dimensional images obtained with the new tool enable more effective assessment of pit wall stability and optimisation of blasting, leading to improvements in both productivity and safety. The system is being introduced into operations by Newcrest Mining Ltd and at the Ernest Henry mine and is being trialled at other mines around Australia.

Environmental monitoring at the Ranger minesite. CSIRO, in collaboration with EWL Sciences Pty Ltd, has successfully adapted a range of geophysical methods to detect seepage from tailings dams and other waste storage structures at the Ranger uranium mine in the Northern Territory. Mapping with electrical and electromagnetic methods decreases the need to drill expensive boreholes to monitor any seepage from the storage structures.

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Mineral Processing and Metal Production Sector

Industry Context

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

The Sector has demonstrated a high appetite for technology, and Australian industry over the years has been a receptive developer and adaptor of technologies. However, 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 low commodity prices and low 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 will remain relatively low and this will continue to place pressure on companies, though the fall in the Australian dollar has helped over the last year. The pressure to reduce operating costs and to maximise return on assets in the short to medium term is driving both innovation, which tends to be relatively short term in nature, and amalgamations. The innovation driver has not as yet translated to increased R&D expenditure by Australian companies and this remains at historically low levels.

There are indications, however, that South African and North American companies are increasing R&D expenditure and there is a window of opportunity for Australian minerals technology as a result, particularly since government and university laboratories in North America have been significantly down-sized.

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; and
- 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; and
- development of enabling technologies in chemical, biochemical, physical, mathematical and engineering disciplines for access by industry.

Research Achievements

Computer simulations reduce risk and improve performance. Computational Fluid Dynamics (CFD) modelling is assisting mineral processing companies to meet the challenge of improving profitability in a highly competitive environment. CSIRO, in collaboration with WMC Resources Ltd, has predicted the possible effects of proposed burner design changes and process modifications at the Kalgoorlie Nickel Smelter. This has contributed to improvements in burner efficiency and increased smelter throughput.

Magnesium metal - made in Australia. A large multi-disciplinary team from CSIRO and the Australian Magnesium Corporation has been successful in the development of technology for the Australian Magnesium Process. The revolutionary process has been patented and debt/equity arrangements are being explored to build a $1.3 billion commercial plant. The proposed plant will produce magnesium products valued at $300 million to $400 million each year and employ over 300 staff and will herald the beginning of a new industry for Australia.

Cobra Probes - making complex gas flow measurement easy. CSIRO staff recently installed and successfully commissioned the first of six Cobra Probes at Pasminco's Port Pirie Smelter. The probe is performing extremely well in this rugged environment and is unique due to its ability to measure accurately gas direction as well as volumetric flows. The probe enables Pasminco to detect air leaks quickly and to improve furnace control - thus increasing energy efficiency and lowering operating costs.

Assessing process performance on-site. As part of the commissioning team on the George Fisher Project, CSIRO staff worked closely with Mount Isa Mines (MIM) Limited to assess the performance of modifications to their lead-zinc concentrator. CSIRO provided MIM with continuous research support and assisted in optimising the various components of the new flotation circuit. CSIRO then surveyed the completed modifications and demonstrated that the concentrator's performance had significantly improved.

Ductwork changes slash dust emissions. Joint research by Queensland Alumina Ltd (QAL) and CSIRO has clearly demonstrated how environmental emissions can be slashed with relatively inexpensive changes to the ducting in electrostatic precipitators (ESPs). CSIRO and QAL proved the accuracy of their ESP research models with extensive testing at QAL's Gladstone plant. The results offer a 50 per cent reduction in dust emissions - which translates to 60 tonnes less dust each year from each ESP.

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Petroleum Sector

Industry Context

The oil and gas industry delivers to Australia a competitive and secure supply of oil and gas, together with a growing revenue from gas exports. Although Australia's demand for energy is increasing, the outlook for oil in Australia suggests a declining self-sufficiency from approximately 80 per cent now to just below 70 per cent by 2010. The outlook for gas supply is strong, and forecast to increase, largely at the expense of coal for electricity generation. This is driving an increased focus on oil exploration, and the development of a viable gas to liquids capacity, especially offshore in the North West Shelf.

The key drivers for the industry are:

- to improve the Australian exploration performance. Increased resources and competitive discovery 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;
- to maximise value to Australia from its oil and gas resources. This requires capture of the value of natural gas resources, and increasing the fraction of the total oil-in-place that can be economically produced;
- to minimise the impact on Australia's marine environment; and
- to accommodate the greenhouse gas mitigation requirements needed to achieve best practice international standards and to maintain a viable industry.

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; and
- predicting extreme ocean conditions as input to the design of offshore facilities.

Research Achievements

Knowledge management system. CSIRO has finalised a strategic alliance with Noble Drilling Corporation, one of the world's largest offshore drilling contractors, who will commercialise Genesis 2000 - a knowledge management technology applied to the drilling of oil and gas wells. Researchers, in conjunction with six major international oil companies, consultants and an international collaboration of scientists, developed Genesis 2000 as a tool for drilling engineers, rig personnel, managers and financial controllers to assess risk, cost wells or modify well plans on the basis of experience with similar wells or wells previously drilled. This results in savings in the order of 4-5 per cent in rig days valued at $300 000 per well. Under the alliance, CSIRO retains ownership of its intellectual property in order to develop the technology through its internal and external scientific network. Noble Drilling has the exclusive right to commercialise the product. The benefits to Australia include a stream of royalties to CSIRO and the creation of two new Perth-based companies: Spektl, who will maintain the software, and an agency involved with the commercialisation. The alliance will reinforce CSIRO and Australia as the South East Asian hub for developing new knowledge management tools for the petroleum industry.

Pore pressure risk assessment. A CSIRO risk evaluation technique to identify overpressures and their impact on drilling decisions changed Chevron's perception of the risk and drilling cost in one of their permits. This change in perspective led to a reduction in their expected exploration costs for three prospects of $30 million, and also provided greater flexibility in their exploration strategy in that area. The process has since been applied by Chevron to a deep water prospect in Brazil with similar success. The technology is now being incorporated in a decision-support template for use by industry.

Stratigraphic forward modelling: Sedsim, a sedimentary process modelling program originally developed by Stanford University in the US, has been further developed and enhanced by CSIRO. Sedsim simulates the filling of a sedimentary basin over time and can be used to predict the regional distribution of reservoir sandstones that are important targets in oil exploration. Sedsim can now simulate the effects of sub-marine landslides and deep water depositional processes, as well as the formation of carbonate reefs. In collaboration with CSIRO, Sedsim has been used by a range of international oil companies including PDVSA, Texaco and the Tarim Oil Company to help find oil. In Australia, the major application is the prediction of more subtle oil traps (many of the more obvious trap structures having already been targeted).

Wellbore stability solutions. CSIRO's wellbore stability and drilling fluid optimisation technology is used to evaluate wellbore stability in terms of the principal mechanical, physico-chemical and thermal mechanisms, and determine solutions to mitigate problems. The technology has been adopted in Australian-led ventures to develop fields in the North West Shelf and the Timor Sea where savings of up to $10 million per well with major problems have been realised. The technology has also helped PETRONAS, the Malaysian National Petroleum Corporation, to overcome major wellbore instability-related problems in the South China Sea and provided them with the understanding and capability to design drilling fluids for managing shale instability. Research agreements and collaborative projects are being discussed with several overseas research centres that seek to adopt the technology.

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Environment and Natural Resources >>

Biodiversity Sector

Industry Context

Recognition of the importance of biodiversity and ecosystem sustainability is growing, and this is reflected in many recent policy initiatives at international, federal, state and local levels. In the private sector, industries are seeking new ways of managing biodiversity and ecosystems in order to obtain or maintain their 'license to operate'. Industry groups are also recognising biodiversity and developing biodiversity strategies. In the community sector, biodiversity has become integrated into Landcare objectives and the Natural Heritage Trust supports community actions to protect and restore biodiversity.

There is a growing recognition of biodiversity's value in sustaining human life by providing:

- tangible products, like food, medicines and timber;
- ecosystem services, including purification of water, pest control, waste disposal and nutrient cycling; and
- aesthetic surroundings and cultural and spiritual wellbeing.

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 Biodiversity Sector has a multidisciplinary approach to achieving positive biodiversity outcomes for Australia, with a focus on large-scale integrated solutions to biodiversity issues at regional or national scales. Scientists work closely with community, industry and government groups and organisations.

The most significant areas of research include:

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

Research Achievements

Farmers act to halt native vegetation decline. An innovative approach to native plant revegetation in one of Australia's top cropping districts is set to reverse the region's trend of declining native vegetation. A database, developed by the Centre for Plant Biodiversity Research and the Harden Murrumburrah Landcare Group with funding from the Natural Heritage Trust, was developed to provide information to the landholders. This information is currently being used to plan the revegetation of areas that have less than three per cent native vegetation remaining.

Bridal creeper - the rust sets in. Researchers from CSIRO and the Weeds Cooperative Research Centre have released a rust fungus in New South Wales, South Australia and Western Australia to bring one of Australia's most damaging and persistent environmental weeds, bridal creeper, under control. The rust disease has established well and is beginning to spread. Damage from this fungus and a small leafhopper released a year earlier is beginning to look spectacular in some areas.

Sustainable harvesting of firewood. A CSIRO report is playing an important role in developing a national policy for sustainable firewood harvesting. The removal of firewood is having a significant impact on a wide spectrum of biodiversity and ecosystem processes, such as nutrient cycling and plant establishment. The report *Impact and Use of Firewood in Australia* was delivered to Environment Australia and the Australian and New Zealand Environment Conservation Council (ANZECC) Firewood Taskforce. The report found that 4.5-5.5 million tonnes of firewood has been burned in Australian households over the past year, much of it fallen timber from low rainfall woodlands.

Business and biodiversity. The Earthwatch Institute, in conjunction with BP Australia and New Zealand, Rio Tinto Australia and the CSIRO, has produced a 33-page booklet titled *Business and Biodiversity*. The publication shows how to examine a company's environmental impact, and will raise awareness and involvement of Australian business in conservation and maintenance of biodiversity.

Inventory of ecosystem services. A detailed inventory of ecosystem services in the Goulburn-Broken Catchment has been produced to give an insight into what services are currently provided, and forms the basis for a more detailed assessment of what might happen to those services under a set of scenarios for the future. This inventory will raise awareness of the value of ecosystem services to a wide range of stakeholders. There is already strong support for this project from both the local community and catchment management authority. These groups will use the report to ensure that these ecosystem services are taken into consideration in policy development.

Tourism in Douglas Shire. CSIRO scientists worked closely with the Douglas Shire tourism industry to construct an innovative framework for evaluating the benefits and impacts of nature-based tourism in tropical north Queensland. The Tourism Futures Simulator is an interactive computer model that runs on a personal or laptop computer. Armed with this software package and its underpinning database, people in the tourism industry in Douglas Shire are assessing options and proposals to manage tourism activity, operations and development.

BioLink. BioLink is a software package used to collect, maintain, analyse, apply and disseminate taxonomic, biodiversity and environmental information. BioLink was commercially released by CSIRO in August 2000 and is currently being used by over 100 researchers in 15 countries worldwide.

Golden sun moth. The golden sun moth is a day flying moth that inhabits native temperate grasslands in south eastern Australia. Once widespread, the species has become highly fragmented due to loss of habitat, and is now restricted to relatively few small isolated patches. Genetic studies have shown that the remaining populations can be classified into five distinct groups each warranting separate management for their conservation. Results from these studies have been incorporated into recovery actions for the species.

Freeing the world's waterways. The culmination of three years' work in East Africa in collaboration with CABI (UK) and the Plant Protection Research Institute (South Africa) has seen the clearing of the world's worst aquatic weed, water hyacinth, from Lake Victoria, restoring biodiversity and the livelihood, transport systems and culture of villagers bordering the lake in Uganda, Kenya and Tanzania. This massive infestation, defeating chemical and mechanical efforts at control, has been cleared by the activity of two weevils released in 1997.

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Climate and Atmosphere Sector

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-induced climate change. Also covered are natural phenomena such as climatic variability (drought and floods), severe storms, tropical cyclones and the impact of, and responses to, climate variability and climate change.

The UN Framework Convention on Climate Change and the National Greenhouse Strategy 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 solutions to problems.

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 also underpin the activities of the Sector.

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, universities and State Departments and Agencies.

CSIRO's Strategic Response

CSIRO works closely with policymakers, contributing significantly to domestic and global policy development. The Sector's strategy has the following key elements:

- capitalise on the past decade of investment in climate process and modelling research;
- further improve longer-term seasonal forecasting abilities;
- underpin Australia's position with respect to climate change and ozone depletion, in particular providing better estimates of emissions of greenhouse gases and ozone depleting chemicals, and examining strategies for managing carbon emissions;
- provide air quality forecasting technology and seek to strengthen knowledge of the relationship between air quality and human health;
- support scientifically the Australian Government in its negotiation of climate agreements; and
- maximise the effectiveness of national expenditure on climate research by collaboration and communication with key stakeholders.

Research Achievements

International climate change science reviews and briefings. CSIRO scientists have made major contributions to a range of international science reviews, particularly those commissioned by the Intergovernmental Panel on Climate Change (IPCC). In 2001, the IPCC released its latest assessments of the likely extent of climate change. CSIRO's very significant participation in this process demonstrates the international standing of relevant Australian research. More importantly this active participation has lead to our scientists having an intimate knowledge of the current status of this rapidly developing and highly relevant field of science, and leading to CSIRO staff being regularly asked to present greenhouse science briefings to policy makers. For example, one staff member alone has made 30 such briefings to Ministers, governments, industry boards and industry bodies in the last eight months.

Seasonal climate forecasting. A CSIRO seasonal climate prediction model is now routinely producing experimental 12-month forecasts of sea surface temperatures. The predictions are publicly available at http://www.dar.csiro.au/res/cm/coca.htm and are also used by the National Climate Centre in assessing the development of El Niño and La Niña events. Predictions issued last year correctly identified the persistence of La Niña conditions and correctly implied the wet spring experienced by eastern Australia.

Forecasting for agriculture. CSIRO and five agribusiness companies have tested seasonal climate forecasts and cropping systems simulations using a statistical forecast system based on sea-surface temperature patterns. The system predicts plant growth in cropping and grazing regions. This may have applications in marketing, financial lending, insurance and portfolio management.

Climate projections for Australia. CSIRO's latest comprehensive study of climate change and impacts for Australia will assist the community to plan adaptation strategies for future climate changes. Two outputs are an eight-page brochure on future changes in Australian temperature, rainfall and evaporation, and a second brochure on possible impacts due to climate change on aspects of national life such as agriculture, coastal towns, forestry and human health.

Australian air quality forecasting system. A new air quality forecasting system developed with the Bureau of Meteorology Research Centre and the Environmental Protection Authorities of Victoria and New South Wales became operational during the Sydney Olympics in 2000. In addition, a new power-based inventory for motor vehicle emissions for the Sydney major road network was completed. The inventory will allow better assessment of the contribution of motor vehicle emissions to pollutant concentrations near roads.

Atmospheric sampling equipment. Environmental equipment firm, Ecotech Pty Ltd, has exported sophisticated rainwater samplers and atmospheric particle samplers developed by CSIRO to environmental protection agencies, consultants and industry in 17 countries. CSIRO designed both samplers, and

Ecotech sells them under licence to CSIRO, with royalties flowing back to research. The rainwater sampler accurately records rainfall and collects and stores rainwater for subsequent chemical analyses. The device is designed to run unattended in remote locations.

Detection of hazardous volcanic ash clouds by aircraft. CSIRO is collaborating with an Australian company, Integrated Avionic Systems, to commercialise a world-first detector designed to warn pilots of volcanic ash clouds in their flight paths. In the past 30 years, more than 90 jet aircraft have encountered ash clouds emitted from erupting volcanoes. Silicon compounds within these clouds can cause costly damage to aircraft, ranging from abrasion of windows and composite surfaces to engine destruction. Engine failure associated with ash cloud encounters represents a major safety hazard. The detector will give pilots five to ten minutes to take evasive action if an ash cloud appears in their flight path.

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Land and Water Sector

Industry Context

The Land and Water Sector is focussed on the ecological, economic and social issues that impact on both sustainable regional development and the provision of healthy urban environments. The key focus is on delivery of 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 investigate 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 government agencies, agribusiness, water supply, mining, petrochemical and manufacturing industries, and community-based land management groups.

CSIRO's Strategic Response

The Sector's strategic research is conducted at both a broad 'landscape' scale, directed to system-wide issues, and at a local scale where chronic contamination issues threaten land and water resources. Research is 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; and
- design of agricultural production/management systems that are better attuned to the Australian environment.

Research Achievements

Salinity management. CSIRO is involved in a number of collaborative activities with the Bureau of Rural Sciences (BRS), state agencies and consultants to develop groundwater flow systems for salinity management. An important component of this work is the documentation and analysis of case studies in which there has been intensive study. A number of case studies have been completed under the National Land and Water Resources Audit and others are in progress in a Murray-Darling Basin Commission (MDBC) funded project. Salinity potential maps have been completed, most recently for the Murray-Darling Basin. The development of models provides a stronger link between groundwater attributes and the likely success of different management options.

Rural and regional sustainability. CSIRO has worked with three rural regional communities in central Queensland, western New South Wales and the West Australian goldfields to develop new ways to plan for, and manage, natural resources to be environmentally, socially, and economically sustainable. Together with CSIRO researchers, key stakeholders from each community identified the issues critical for their region and then worked towards improving the community's capacity to manage them. This project resulted in the development of key principles needed for the development of rural planning systems, delivery of information needed for resource management, decision support tools to assist planning, and community structures to enable them to ameliorate resource conflict. Knowledge gained from these regional case studies is influencing policy and practice at local and State Government levels in participatory resource use planning.

Improving the efficiency of irrigated agriculture. CSIRO research 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. Coleambally Irrigation Cooperative Ltd is implementing a management strategy based on CSIRO research, including the application of the Salt Water and Groundwater MANagement (SWAGMAN) Farm model. They are also using guidelines developed by CSIRO to determine the eligibility and conditions under which land and water management incentives would be provided to ensure the effective management of subsurface drainage in the Coleambally region.

Soil and groundwater remediation technologies. Cost savings of up to $15 million a year have been projected for a petrochemical company due to CSIRO research that focused on the evaluation of soil and groundwater remediation technologies. Research has pointed to improved efficiencies and better remedial design, and increased the potential to produce cleaner environments. Research results on the potential impact and fate of hazardous chemicals as they move in groundwater toward riverine and marine ecosystems are also being taken up by industry and regulatory agencies.

Water and sediment quality. CSIRO has played a leading role in the development of new Australian and New Zealand Environment and Conservation Council (ANZECC) /Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) guidelines for fresh and marine water quality. These incorporate many of CSIRO's recent research advances in the assessment of varying conditions under which contaminants become available to marine plants and animals. The risk-based approach of the new guidelines is different to the conventional international guidelines. Limitations to and further advances in the application of the new guidelines are being addressed in current externally-funded research by CSIRO. This includes the development of robust methods for the measurement of metal speciation (funded by the Cooperative Research Centre for Waste Management and Pollution Control), the evaluation of pathways for sediment metal bioaccumulation and toxicity (funded by a New South Wales Environmental Trust Grant), and an evaluation of a defensible guideline for tributyltin in sediments (funded by harbour and port authorities and regulatory agencies and coordinated by the Cooperative Research Centre for Coastal Zone and Waterway Management). CSIRO is being funded by the minerals industry to prepare a handbook for the application of the new guidelines to mining activities.

National water reform. Over the last two years, CSIRO has conducted considerable research on the effectiveness of interstate water trading for the Murray Darling Basin Commission and on the development of alternative groundwater trading regimes. In areas where groundwater is over-allocated, CSIRO scientists are helping to define fairer ways to revise water resource allocations. This work is being underpinned by important work on the quantity of water that can be extracted from fractured rock aquifers for irrigation.

Physical economy modelling. CSIRO has successfully demonstrated the feasibility of developing whole-economy analytical capability and options analysis for the complete set of physical economy transactions that underpin the nation's financial flows. This has not yet been implemented in any OECD country, placing Australia at the forefront of physical economy modelling and analysis at the national scale. A recent project funded in association with Department of Immigration and Multicultural Affairs has highlighted the effects of a number of future population scenarios on Australia's environment and physical resources.

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Marine Sector

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. Australia's territory is now 68 per cent ocean. 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 (issued 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

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.

CSIRO has identified the following as priority areas:

- exploring the Exclusive Economic Zone and supporting multiple-use marine management, specifically around south eastern Australia as part of Oceans Policy implementation, on the North West Shelf in collaboration with the Western Australian Government; and in north eastern Australia in collaboration with the Great Barrier Reef Marine Park Authority, Australian Fisheries Management Authority and the Queensland Government;
- ecosystem approaches to fisheries management to assist Government and industry to achieve national policy goals and meet international obligations for sustainable fisheries;
- integrated catchment-to-coastal zone research with the Coastal Cooperative Research Centre and through other large collaborative studies such as the Ord-Bonaparte program; and
- 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.

Research Achievements

Resource assessment of South Eastern Australia. The first ever resource survey of the south east marine region was completed (with the Australian Geological Survey Organisation) for the National Oceans Office (NOO). CSIRO developed and tested a new method for assessing and predicting marine resources. It proved highly successful and enables a national seafloor-mapping program to be considered. The south east survey information will be used by NOO as the baseline data for Australia's first regional marine plan and will assist to meet a key objective of Australia's Oceans Policy.

Conserving unique deep sea marine environments. Environment Australia (EA) have used CSIRO's report on the conservation of deepwater fauna of Macquarie Island to prepare a management plan for the Macquarie Island Marine Park. CSIRO also provided valuable advice to protect unique environments in the south west Pacific and Indian Oceans.

Controlling marine pests. CSIRO has developed a software tool with funding from the Australian Quarantine and Inspection Service (AQIS) that can determine the best way to manage ships' ballast water, one of the main carriers of exotic pests into our ports. AQIS have adapted the system to their policy requirements and will introduce it for use by quarantine officers from July 2001. CSIRO has also developed a range of response options to deal with marine pests that enter Australian waters in other ways. Environment Australia will provide our product online to State and Commonwealth managers enabling them to take fast action to halt and eradicate new outbreaks.

Improving estuary health. A software tool that assesses the health of estuaries and predicts how it would change with different types of human pressure has been developed for the National Land and Water Resources Audit with funding from the Natural Heritage Trust. The software will be available online to the community and environmental and resource managers to assist in making decisions about estuarine management. A more complex tool was developed for an industry client to assess the environment risks from effluent discharged from its newsprint mill into the Derwent Estuary. It will enable the company to meet the requirements of the State Government and guide environmental management of the estuary.

Managing expansion of the aquaculture industry. A major environmental study of the Huon Estuary in Tasmania, supported by the Fisheries Research and Development Corporation and the aquaculture industry, has led to a better understanding of the estuary and the pressures of aquaculture development. The results have been used by State agencies to set targets for aquaculture expansion, which are crucial to avoid the severe problems of environmental degradation and disease experienced overseas and enable the long-term sustainability of the industry.

Ecosystem approaches to fisheries management. Ensuring the sustainability of bycatch species is an issue that most fisheries in the world must address. It is a significant challenge in many fisheries because of the diversity of bycatch species and a lack of historical and biological information. A methodology developed previously by CSIRO has been applied to the Northern Prawn Fishery (NPF) to identify the impact of their trawling practices on bycatch species. This is assisting the NPF to meet national legislative requirements and international obligations for sustainability of bycatch. The approach is now being applied to other fisheries, including the Torres Strait Prawn Trawl Fishery, East Coast Trawl Fishery and East Coast Tuna Billfish Fishery.

Ensuring the long-term sustainability of our fisheries. CSIRO's stock assessment of tiger prawn species in the Northern Prawn Fishery played an important role in the restructure of the Fishery, following the sharp decline in catches in the 1980's, and has resulted in the adoption of new management strategies that have stopped the decline in the catch. CSIRO's monitoring and assessment of the Southern Bluefin Tuna (SBT) Fishery was used by the Commission for the Conservation of SBT to set international fishing quotas and develop management strategies to recover the population, which is at a historically low level.

Enhancing the health value of food. Screening of the CSIRO collection of living microalgae, a unique assemblage of hundreds of specimens of microalgea found in marine environments from the tropics to the poles, has provided several novel polyunsaturated fatty acids that have proven health benefits for humans. The technology has been patented and commercial collaborations are being negotiated. CSIRO has also demonstrated that Omega-3 oils from tuna can be incorporated into milk, to provide the consumer with a healthier option that has benefits for preventing heart disease and aiding brain development. Discussions with commercial partners are underway.

How climate affects productivity in our fisheries. CSIRO has demonstrated how Australia's most valuable fishery - Western Rock Lobster - is affected by the El Niño phenomenon. The results were part of the documentation that made this the first significant fishery in the world to achieve international certification from the Marine Stewardship Council as a sustainable well managed resource. This enhances the fisheries ability to access export markets, particularly in Europe, where wholesale companies prefer to purchase seafood from producers who have had their operations certified as environmentally sustainable. It can also increase the price wholesalers are willing to pay for the product. The advanced method of ocean analysis developed by CSIRO and the Bureau of Meteorology Research Centre can also be used to provide information for Australia's maritime defence operations and discussions on a multi-million dollar project with the Royal Australian Navy are underway.

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Agribusiness Industries >>

Field Crops Sector

Industry Context

The prospects for growth in the Sector industries, both in commodity quantity and in product quality differentiation, are high. 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 acidification and salinity. 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 and agribusiness enterprises, ensuring rapid adoption of research into practice.

CSIRO's Strategic Response

Profitable and ecologically sustainable cropping systems research will have high priority in the Sector and is a major area of cross-Sectoral importance. Decision support tools, cropping systems models and action learning approaches are prominent in CSIRO's research. 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 that are currently limiting the growth of the grain legume industries. Improved nutritional profiles, such as protein, starch, phytochemical 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 Achievements

Flowering Switch Gene. Twenty years of research has led to the discovery of the Flowering Switch Gene, a key gene in determining when plants end their vegetative growth phase and start flowering. This discovery has implications for crops and for industries such as the horticulture and flower industries, because it has the potential to allow extensive control over the flowering schedules of particular plants and crops. The research received the inaugural Prime Minister's Prize for Science in 2000.

Mouse plague research. CSIRO's 'mouse model' successfully predicted high mouse numbers in the Victorian mallee by April 2001. The software was trialled in November 2000, using data from north-west Victoria. This is the first formal model to forecast mouse plagues in south east Australia. Linked to this work was the release in mid 2001 of MOUSER 1 - a CD-ROM to aid decision support for mouse plague management.

Operations research for the sugar industry. The altered cane harvest schedules arising from CSIRO's work are expected to improve production and profitability in the sugar industry significantly. Decision support software to implement alternative cane supply arrangements has been developed by CSIRO and the Cooperative Research Centre for Sustainable Sugar Production. This software is underpinned by statistical and optimisation modelling of productivity data from the Australian Sugar Industry.

Nitrate contamination of groundwater. A CSIRO study of the extent of nitrate contamination of groundwaters in the cane growing regions of eastern Australia, has provided the Australian Sugar Industry and its regions with useful information. While the vast majority of groundwaters meet drinking water standards, about 3 per cent of bores contain excess nitrate levels that can largely be traced to inorganic fertiliser sources. Improvement in nitrogen fertiliser management practice has been identified as the key to avoiding groundwater nitrate contamination.

Canadian leafcutter bees introduced. To boost lucerne seed production through better pollination, CSIRO has been involved in the safe introduction of Canadian leafcutter bees into Australia. These bees are smaller than honey bees and more effective at pollinating lucerne flowers, thereby increasing seed production. Following research aimed at developing effective importation procedures that met Australia's strict quarantine requirements, and sourcing a disease-free population of bees in Canada, releases have been made, and managed populations of the leafcutter bees are now established in Australia.

Lucerne a perennial performer. Research at CSIRO shows there is an advantage in incorporating deep-rooted perennial pastures like lucerne to prevent waterlogging, reduce dryland salinity, combat herbicide-resistant weeds, and increase soil organic matter. Waterlogging is a major cause of productivity loss for grain growers in parts of New South Wales, Victoria and Western Australia. Perennial pasture plants like lucerne are effective at removing water from the soil because of their deep rooting nature and perennial growth habit. This characteristic enables lucerne to continue to use water when annual crops and pastures have finished their growth cycle. Lucerne increases the feed available for grazing stock, and improves nitrogen availability to the following crops. The higher water use in lucerne-based rotations also lowers the risk of dryland salinity.

Barley Yellow Dwarf Resistant wheat. CSIRO scientists have bred two wheat varieties resistant to Barley Yellow Dwarf Virus (BYDV). The varieties are the first to be bred that are resistant to BYDV; it is the most important cereal virus in Australia and internationally, significantly reducing yields of susceptible varieties. Seeds of the new varieties are currently being produced in commercial quantities. The first variety, a premium milling wheat, is expected to be available to growers in 2001. The second, a forage and feedstock wheat, will be available to growers in 2002.

Barleyplus™. CSIRO scientists have identified a new line of barley that has a combination of constituents that offer significant health benefits. CSIRO has filed patent applications on Barleyplus™, and negotiations have been initiated to develop a business system for global commercialisation. Barleyplus™ is the result of a joint effort between the CSIRO's Field Crops and Food Processing Sectors.

Economic analysis demonstrates the benefits of stored grain research. An external cost benefit analysis of the Stored Grain Research Laboratory, commissioned by industry, has shown enormous benefits from the work of the Laboratory, ranging from a most pessimistic scenario benefit/cost ratio of 8:1 up to 20:1.

Managing root disease in broad acre crops. CSIRO and the Grains Research and Development Corporation have developed DNA-based markers to detect and quantify levels of the root pathogenic fungi, take-all disease and Pythium root rot in agricultural soils. This research has the potential to refine disease prediction and risk assessment models by quantifying these pathological variants in agricultural soils and therefore identifying the crop species most likely to be at risk. Growers will continue to benefit by making informed decisions on the selection and timing of specific crop rotation strategies to suppress fungal root disease, and thereby increase the profitability and sustainability of cropping systems.

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Food Processing Sector

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;
- ***changing demographics*** - changing food requirements of an ageing population; 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 has developed five primary research components that address the key drivers for the industry listed above.

Activities include:

- 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 along the complete food supply chain;
- identifying foods with specific health attributes and developing public information programs; and
- understanding consumer demands and preferences for food products.

Research Achievements

Innovative Foods Centre For Emerging Technologies. Food Science Australia, a joint venture of CSIRO and the Australian Food Industry Science Centre (Afisc) has established an 'Innovative Foods Centre' to develop alternatives to thermal processing of foods and beverages. In conjunction with a commercial partner, Flow International, Food Science Australia is developing improved techniques for Ultra High Pressure (UHP) processing, including the commercial processing of oysters. The Centre will provide easier access to emerging technologies for Australian food companies.

Microencapsulation technology. Food Science Australia has patented a coating technology to extend the shelf life and stability of food ingredients and products. Clover Corporation and Food Science Australia have reached agreement on licensing and further development of the technologies in the manufacture of encapsulated tuna oil and other functional food ingredients.

Specialty dairy powders. Food Science Australia has developed technology for the production of specialty dairy powders and has now licensed the technology to a number of dairy companies. Some of these powders have been exported to the Asian region to meet the growing demand.

Transportation of perishable foods. Scientists at Food Science Australia are developing improved methods of monitoring fresh produce transported in shipping containers. Using information providing accurate temperature logging in various parts of the container, the team is able to advise on the strategic management of a range of fruit and vegetables for maximum quality and increased export profits.

Meat processing equipment. The Wulguru Group, a Queensland based construction and equipment manufacturing company, has established an export market in Japan for a number of meat processing technologies. Wulguru and Food Science Australia have worked together to develop this market.

Foreign bodies in foods. The detection and elimination of foreign bodies in foods is a major problem in the food industry. CSIRO and Food Science Australia are continuing the development of a novel detection system, which will detect stainless steel and other foreign bodies in foods and raw materials. There is international interest in the application of the technology.

Whey protein isolate. CSIRO and Food Science Australia, in partnership with a large Australian dairy cooperative, have developed a novel whey protein isolate from cheese whey. The technology has been incorporated into a commercial processing facility with all the product being exported to global markets.

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Forestry, Wood and Paper Industries Sector

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 solid timber and composite materials, furniture, papermaking and recycled fibre processing and products. It also embraces the environmental impact of forestry and processing operations.

Some of the key factors influencing the Sector include:

- extensive restructuring within the industry, reflecting globalisation, company amalgamations, private ownership of forest resources, foreign investment, and the rise of plantation investment companies;
- declining access to native forests, expansion of plantations for wood supply, and the role of forests in carbon sequestration and potential greenhouse gas emission trading;
- recognition of the capacity of new forests to supply environmental services such as amelioration of degraded land, management of catchment water balances, and sequestration of carbon; and
- competition from wood substitutes and the need to improve performance and quality of wood-based products and materials, especially in commodity markets.

Key trends in science and technology include:

- incorporation of molecular biology into conventional tree breeding strategies to improve wood and fibre properties and environmental adaptability;
- advanced material science for development of new wood-non-wood composites;
- use of technologies to link wood properties to product properties and performance; and
- advances in downstream technologies (eg in printing and communications) on requirements for surface properties and structure of paper and paperboard.

CSIRO's Strategic Response

The Sector's research aims to contribute to Australia's ecologically sustainable development providing direct and indirect economic and community benefits through the conservation of biodiversity, remediation of degraded land, waste management, carbon sequestration, and improvement of water quality. CSIRO has adopted the following strategic research objectives:

- management systems for sustainable 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;
- value-added wood products; and
- papermaking and paper quality.

Research Achievements

A profitable landcare system. A demonstration plant to be built by Western Power, at Narrogin, south of Perth, that will produce energy and high-value activated carbon from wood was launched in November 2000. The plant will produce activated carbon and energy using a new CSIRO process. The full-scale demonstration plant, handling some 20 000 tonnes of mallee trees annually, will be completed in 2001. Designed to produce 700 tonnes of activated carbon and 200 tonnes of eucalyptus oil annually, the plant will have an electrical generation capacity of about one megawatt. The process has received a number of industry awards.

Benefits from plantation fertiliser. New findings from CSIRO are helping managers of radiata pine plantations make decisions on mid-rotation fertiliser application. Applying nitrogen or phosphorus fertiliser, or both, five to eight years before harvest can significantly boost the economic return from a plantation. While the growth response of plantations varies greatly, a new test developed by CSIRO is being used by industrial collaborators to predict where best results can be obtained.

Tree belts show their worth. Planting trees on farms can help control waterlogging and dryland salinity. Research by Agriculture Western Australia, the University of Western Australia and CSIRO has shown that water use by tree belts substantially outstrips inputs from rainfall. The study aimed at developing effective strategies for the management of waterlogging and salinity in the Western Australian wheat belt. The results will further assist the development of sustainable farming systems that more closely mimic native ecosystems in areas affected by rising watertables and salinity.

Demonstrating sustainability of pine plantations. Research by CSIRO and the Queensland Forest Research Institute has found soil fertility under mature pine plantations is at least as high as in neighbouring areas of native forest. The soils under pines store as much carbon as pasture soils. This suggests fears that replacing pasture with plantations will release large quantities of soil carbon, with adverse 'greenhouse' effects, are unfounded. The findings will assist in measuring, more accurately, changes in greenhouse gases.

Indicating forest health from airborne imagery. In collaboration with State Forests of New South Wales, CSIRO has developed a prototype indicator of forest health and vitality. The indicator is being applied to coastal mixed eucalypt forest and mountain ash forests affected by insects, and radiata pine plantations affected by needle blight. The indicator will also assist international reporting commitments.

Measuring changes in greenhouse gases and soil carbon. CSIRO has organised and facilitated two expert workshops on behalf of the Australian Greenhouse Office (AGO). The workshops brought together national experts to assist the AGO refine its methods for measuring changes in greenhouse gases absorbed or released during changes to vegetation (mainly land clearing, forest management and re-vegetation).

The threat of Asian Gypsy Moth. The susceptibility of 85 species of native trees and shrubs of New Zealand, South America and Australia to Asian Gypsy Moth was examined by assessing the insect's host range and potential distribution. The study was conducted jointly in Australia, New Zealand and France on behalf of the Australian and New Zealand Governments. Given the suitability of some Australian plants and climate for the establishment of the moth, this insect should be treated as a serious quarantine threat and managed accordingly.

Strategic tree planting to sustain rice growing areas. Recent studies by CSIRO indicate that planting trees over ancient river beds could combat rising groundwater and salinity in the rice fields of the Murray Irrigation Area (MIA) near Deniliquin, New South Wales. Rising water tables, which bring stored salt to the soil surface, threaten the long-term viability of irrigated farming. Strategic tree plantings in these areas will use groundwater and could help sustain conventional agricultural production. Currently about 10 per cent of the region's land area of 55 000 hectares is under rice while 40 per cent is used for pastures or other crops. The study indicates that about 11 000 hectares of carefully placed plantations are needed to stop rice cultivation raising water tables further.

Eucalypt posts for vineyard trellises. Posts made from plantation eucalypts irrigated with wastewater have proved successful in trials at Lindemans Wines near Mildura. The posts are extremely strong and so are less vulnerable to damage from weather or impact from farm machinery. The posts were treated with pigment emulsified creosote, a process developed by CSIRO and Koppers, with support from the Forest and Wood Products Research and Development Corporation (FWPRDC).

Testing thinning options for eucalypt plantations. Results from Eucalyptus nitens plantation trials in Tasmania indicate that the optimum stocking density after thinning for sawlog production is around 200 to 300 stems per hectare. The research, by CSIRO and the Cooperative Research Centre for Sustainable Production Forestry, found tree growth rates are near the maximum attainable at these densities. The rapid expansion of eucalypt planting in recent years, for sawlogs as well as pulpwood, has focused attention on the need to develop cost-effective thinning regimes. Cooperative Research Centre partners are now using this knowledge to modify thinning practices.

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Horticulture Sector

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 produce from Australia is 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 the 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, forming R&D partnerships and providing direct and valued input to research project steering committees. The key issues to be addressed by CSIRO research are:

- crop surety - paddock to plate (crop management) and a need for systems that can predict and manage both yield and quality;
- genetic advances (crop improvement) through molecular genetics and indirect (genetic mapping) means; and
- market access and new incursions of pests and diseases from imports accompanied by increased pressure to ensure pest and disease free status of exports.

Research Outcomes

Gene banks for Macadamia diversity. In March 2001 the first of three Macadamia germplasm collections was launched at Caboolture Shire in Queensland. The purpose of the plantation sites is to protect and preserve the diversity of wild macadamia varieties under threat from clearing of lowland rainforests and urban development. The three sites have been planted out with cuttings taken from wild Macadamia trees from across their native range along the northern east coast of Australia. They will provide a significant resource for the industry, as well as preserving the natural diversity of this rainforest species.

The key to a good wasp. An interactive, user-friendly web site on Encarsia parasitic wasps in Australia is now up and running on the internet at: http://www.ento.csiro.au/science/encarsia/. This group of wasps contains species that are important biological control agents of whiteflies and scale insects, which are significant horticultural pests in Australia and the Pacific region. The web site provides information about taxonomy, biology, and distribution of Australian Encarsia species attacking the silverleaf whitefly and the greenhouse whitefly. The pictorial key enables identification of slide-mounted specimens of Encarsia species.

New cashews, top croppers. A research program on cashew improvement and management, in collaboration with the Queensland Department of Primary Industries (QDPI), has been completed. The cashew management manual is now available to growers as part of the QDPI Agrilink series. The cashew improvement component has produced a number of new selections that are higher yielding and have larger and better-quality kernels than those currently grown anywhere in the world. They have the potential to increase grower returns in the order of 2.5 - 3.5 times and represent a very significant improvement. A licence has been granted for commercial propagation and growers of the new varieties will pay royalties on their crop.

Mini sultana takes the cake. A Plant Breeders Rights application has been submitted for a new CSIRO-bred dried grape variety. It is a high yielding, small sultana type which is resistant to rain damage and ideal for addition to breads and other food products.

Identifying risky imports. CSIRO was called upon by Agriculture, Fisheries and Forestry Australia to provide expert advice late in 2000 regarding the risk of introducing the Glassy Winged Sharpshooter, together with Pierce's Disease, in imported table grapes from the United States. Based on CSIRO's advice it was decided by the Australian Quarantine and Inspection Service that the risk to the Australian Industry was too high.

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Meat, Dairy and Aquaculture Sector

Industry Context

Australia's meat, dairy and aquaculture industries produce more than $13 billion worth of 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;
- knowledge management for better decision-making;
- integrating socio-economic and environmental 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:

- protection of Australia's animal health status to allow continued trade in and access to international markets;
- creation of new business opportunities identified through an understanding of consumer requirements in key markets;
- adoption of new management systems and policies that better integrate economic, environmental and social objectives;
- adoption of viable production and processing procedures that minimise undesirable social, human health and environmental impacts of the Sector's industries; and
- improved animal performance achieved by improving their inherent capacity to resist diseases and parasites.

Research Achievements

Better BBQ prawns. CSIRO scientists have achieved genetic improvement of prawnstocks for Australian industry. Rapid improvements in the profitability of one major commercial prawn species have clearly demonstrated the benefits of genetic improvement. Components of the approach by CSIRO and industry are now being applied to three other commercial prawn species.

A tool for farmers to breed better beef. Marbling is the development of small flecks of fat throughout the muscle of cattle - and is a highly desirable trait in beef markets like Japan and the USA, because consumers associate it with high quality, flavour and tenderness. CSIRO has developed a genetic test now commercialised as the GeneSTAR Marbling test. It allows cattle producers to test bulls - which are naturally lean - for their capacity to pass on the ability to deposit the right degree of marbling to their offspring. The genetic test is an important tool by which farmers can improve their cattle breeding programs.

Protecting Australia's prawn health status. Strengthening prawn disease and seed stock management in the region, and thereby reducing the risk of disease spreading to Australian industries, was the aim of a series of workshops and seminars presented by CSIRO in Vietnam in 2000. The workshops on disease diagnosis and health management training were supported by Australia's Industry Science and Resources Technology Diffusion Program.

Cheaper environmental land assessment. Enhanced satellite images were provided to the Environmental Protection Agency to assist in a major land resource assessment being undertaken with Natural Heritage Trust funds in the Desert Uplands region in Central Queensland. The techniques developed and supplied by CSIRO were essential in greatly reducing survey costs by enabling the survey team to identify more clearly the major land types and to select appropriate transects and representative sampling sites. The land is currently used mainly for extensive cattle grazing and the resource assessments will be used in developing future sustainable land use and management systems.

Better management of grazing land. Recommendations made by CSIRO to graziers have allowed them to achieve better land care while maintaining production levels. Resting paddocks during the wet season and using fire to control rubbervine are now being widely applied in rangelands in northern Queensland and the Northern Territory.

Pondman software package. Pondman computer software assists prawn farmers to manage their farms more effectively and profitably and is now in use on 80 per cent of Australian prawn farms. The software assists with water quality management, reducing feed waste, and management of water exchange. The software has been widely promoted, and is now attracting overseas sales.

National redistribution of biocontrol agents for pasture weeds. A national redistribution network for the biological control of Paterson's Curse and thistles was established in mid 1990. With support from the Cooperative Research Centre for Weed Management Systems and state departments of agriculture in Southern Australia, the network has distributed biocontrol agents for both of these weeds. Last year the seed weevil for thistles was reducing seed production by up to 83 per cent.

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Textile, Clothing and Footwear Sector

Industry Context

The Australian textile, clothing, footwear and leather (TCF&L) industries continue to undergo restructuring. Competition from lower cost economies such as China and the cessation in June 2000 of the Import Credit Scheme (ICS) has hastened the closure of a number of companies and forced other companies off-shore to take advantage of lower labour costs. The decline during the last year in turnover and capital investment reflects the difficult economic circumstances in parts of the industries. However, a positive sign of the changing focus and culture of the TCF&L industries is that the value of exports, as a percentage of turnover, continues to increase.

To assist the industries prepare for foreshadowed tariff reductions in 2005, the Federal Government has introduced the 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 into innovative product development.

Important issues for the industries include:

- the production of high quality specialised textiles, clothing and footwear that reflect Australia's unique climate and lifestyle;
- an increasing trend towards quality and easy care products that are perceived to be 'clean and green' and environmentally friendly;
- sustainability of natural fibre production especially in relation to land degradation and continued development of integrated pest management systems for the cotton industry; and
- investment by wool growers in management practices and technologies that increase their productivity and reduce the mean fibre diameter of the clip to enable consumer demand for lightweight clothing to be met.

Following the restructuring and privatisation of the Australian Wool Research and Promotion Organisation (AWRAP) and The Woolmark Company, two new companies have been established namely The Woolmark Company Pty Ltd and Australian Wool Innovations Pty Ltd.

CSIRO's Strategic Response

CSIRO will:

- assist the domestic TCF&L industries meet the market demand for new and niche products, through 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 and networks with industry to maximise the benefits of the Federal Government's TCF&L Strategic Investment Program;
- increase on-farm productivity by further development of enhanced decision support systems that link fertiliser, pasture growth, nutrition and wool production. Increasing on-farm productivity will be done within a framework of ecological and social sustainability;
- assist in the reduction of the mean fibre diameter of the Australian wool clip without reducing yield;
- work closely with the cotton industry to reduce the use of pesticides through integrated pest management systems and maximise better water use practices;
- improve the links between cotton and wool producers and the processing industries through enhanced measurement and prediction systems;
- diversify the research portfolio to embrace all textiles and continue to expand resources into cotton processing and technical textiles;
- increase linkages with overseas processing industries, especially in India, China and Vietnam to encourage increased exports of Australian wool and cotton; and
- continue to work to maintain the 'clean and green' image of Australian natural fibres and leather products and to ensure compliance with eco-labelling requirements.

Research Outcomes

Improved cotton varieties. Cotton varieties, developed by CSIRO, have had a considerable beneficial impact on improved fibre quality and productivity of the Australian cotton industry especially in relation to increased disease and pest resistance. These advances have been reflected in higher export earnings for Australian cotton and increased external earnings for CSIRO through royalties. More varieties are due for release in the next two years. The Cotton Research and Development Corporation (CRDC) contributed to the funding of this research.

Easycare garments. Increased demand for easycare performance is a long-term trend within both the fashion and traditional garment manufacturing industries. As the 'dry clean only' label becomes a significant disincentive to purchase, consumers are developing an expectation that garments will withstand repeated machine washing and tumble drying while maintaining their 'just pressed' appearance without the need for more than minimal ironing. To achieve total easycare performance, garments must be engineered so that after laundering, the seams remain flat and without pucker, the fabric is wrinkle free and creases or pleats remain in place. CSIRO, in projects jointly funded by Australian Wool Innovation and The Woolmark Company, has developed technologies that impart total easycare performance to pure wool garments that equals or exceeds that of similar garments manufactured from cotton, synthetics fibres or their blends. These technologies have been adapted so that, according to the requirements of the garment maker, the garment can be manufactured from pre-treated fabric or all necessary processes can be carried out on the pre-formed garment. This flexibility will broaden the range of garment makers who can apply the technologies.

SiroLock. Textile carding is an important step in the processing of all types of staple fibre for both woven and non-woven products. An important stage in the carding of fibres is the assembly of the opened and individualised fibre into webs. A new analysis of the process showed that the efficiency of this process could be significantly improved by modifying the conventional profile of the card wire by the inclusion of 'steps' on the active face. The technology has been patented and development of the technology is proceeding with the European company ECC-Platt with industrial trials under way in a number of plants worldwide. The new technology will be marketed under the tradename SiroLock.

Fining the clip. Consumer preferences are increasingly focussed on softer, prickle-free, lightweight fabrics which require wools of fine diameter. The results of extensive CSIRO studies have had a major impact on the process of fining the Australian Merino wool clip and have clearly demonstrated that breeders can move their flocks to finer wool without compromising other traits of economic importance. A software package, SelectGene, provides breeders with the capability of setting appropriate breeding goals and selection strategies. The Woolmark Company contributed to the funding of this research.

Australian medical sheepskins. Pressure ulcers cost the Australian health system in excess of $350 million per year. The new Australian Medical Sheepskin, developed by CSIRO in collaboration with hospitals and industry, is becoming recognised worldwide as a highly effective product for reducing the incidence of pressure ulcers. The product, which is expected to perform for over 50 cycles of patient use and laundering, provides a most cost effective way of reducing patient trauma. The research was supported by Meat and Livestock Australia, the National Health and Medical Research Council and the Sir Edward Dunlop Medical Research Foundation.

Improved oral delivery of therapeutics. Wool production is heavily influenced by internal parasite burdens. CSIRO has developed a technology which enables therapeutics and other actives to be administered orally to livestock in a solid formula. This technology offers increased availability of therapeutics, greater convenience of formulation, labour-saving administration and significant potential advantages in stability, packaging and storage. CSIRO is now seeking a commercial collaboration to develop the technology for the Australian sheep industry.

Benchmarking of Chinese and Indian wool processing mills. Following the signing of Government-to-Government Memoranda Of Understanding, two projects aimed at improving the processing and environmental performance of wool processing mills in China and India are well under way with the first phase of each project having been completed. The projects are being undertaken by CSIRO in concert with the Australian Centre for International Agricultural Research and AgWest. The initial phase of the projects involved detailed process and environmental audits of early stage processing mills and quantitative benchmarking of spinning mills' performance against world's best practice. These data are invaluable for designing process improvement projects for the mills.

New Centres of Excellence for Textile and Fibre Technology. The Commonwealth and Victorian Governments and CSIRO have agreed to establish two new Centres of Excellence in 'Technical Textiles' and 'Advanced Wool Products' at CSIRO, Geelong, Victoria. The initiative is aimed at stimulating advanced training, education, research and product development for the TCF&L industries. The Commonwealth is providing a grant of $1.6 million, the Victorian Government is providing $1 million in cash and $5.5 million in equipment and CSIRO $2.1 million in cash, to establish the two Centres, which will be operated by CSIRO.

Animal production from saline land. 'Animal production from saline land' is a national initiative that commenced in 2000, led by CSIRO. Its purpose is to contribute to the sustainability of Australian agricultural industries and rural communities by putting profit into saline pastures. One approach is the utilisation of such land for fine wool production. Studies have commenced on the performance of animals on saline pastures in four States. These are determining the nutritive value of new annual and perennial pasture plants.

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Chapter 7

Chief Executive's Special Projects

In December 1997, the CSIRO Executive announced a series of special research and demonstration projects to be undertaken by multidisciplinary teams at CSIRO with the goal of building a better future for Australia. These specially targetted projects also demonstrate the effectiveness of CSIRO's research capability when directed to short-term goals. From a large list of imaginative proposals, nine were selected, based on their scientific potential, the benefit to Australia and the ability to deliver results in a relatively short time.

Over $20 million, generated from the sale of assets and internal savings, was allocated to these projects.

After three years, all have now made considerable progress, many moving on to a further stage with other funding. A brief summary of the projects and their results follows.

Towards Sustainable Energy >>

Aim – to demonstrate "proof–of–concept" of a novel method for generating power from methane–containing gases (eg natural gas and coal bed methane etc) and solar energy at very high efficiency and with greatly reduced greenhouse gas emissions.

Results – a demonstration facility has been designed and built at Lucas Heights; its centrepiece is a 107 square metre thermal concentrating dish. It is currently being operated to evaluate the solar–methane reforming and gas processing steps whilst awaiting the delivery of a 10 kilowatt polymer electrolyte membrane (PEM) fuel cell from overseas. Once the fuel cell has been received, fully integrated operation of the facility is planned to assess the overall technical and economic performance of the concept.

A laboratory–scale fuel cell test facility built at Clayton is providing specialist technical data to support the power generation component of the demonstration project. It is also being used to help define CSIRO's future strategic efforts in PEM fuel cell technology R&D. There is considerable interest in the technology from a number of industrial sources and substantial spin–offs from the project are expected.

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Low Emission Transportation Technologies >>

Aim – to demonstrate an integrated group of hybrid–electric car technologies designed to improve fuel efficiency and reduce greenhouse and noxious gas emissions.

Results – CSIRO provided complete powertrains for two low–emission car projects: one for Holden Ltd to incorporate in a Commodore–size car, typical of the most common Australian family car, called ECOmmodore; the other for a concept car known as the aXcessaustralia Low Emission Vehicle, designed to demonstrate a wide range of innovations produced by the Australian automotive components industry. The CSIRO powertrains consist of electric motors and generators, supercapacitors, high performance batteries, power and control electronics, and integrated power management systems.

With the help of additional funds provided by the Federal Government, an international marketing program was put in place for the aXcessaustralia car. More than $700 million of new automotive component export business resulted from an earlier aXcessaustralia project; the new Low Emission Vehicle has already generated over $500 million of new export business potential.

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Advanced Millimetre–wave Integrated Circuits for Radio Astronomy and Telecommunications >>

Aim – To develop state–of–the–art Indium Phosphide (InP) integrated circuits (ICs) and to incorporate them in radio astronomy and telecommunications systems to demonstrate their technical relevance. CSIRO's Large Radio Telescope Array (*The Australia Telescope*) has provided an ideal demonstration platform in achieving this goal.

Results – This project has given CSIRO a world lead in the application of MMIC technology to radio astronomy instrumentation at millimetre wavelengths. The technical solutions developed for radio astronomy systems have wide applicability in the commercial world. Next–generation mm–wave radio systems for application to wireless telecommunications and to real–time thermal imaging are now under development using these InP integrated circuits.

The technical capabilities, which formed the basis for this project, were developed through an alliance with a US–based company, TRW Inc, and are based on indium phosphide (InP) high–electron–mobility transistors (HEMTs) and heterojunction bipolar transistors (HBTs). CSIRO's ultra–high performance InP HEMT–based circuit designs have extended TRW's capability in this field and represent new achievements in integrated circuit technology, exhibiting lower noise, higher frequency response, wider bandwidth and superior cryogenic behaviour to that previously reported elsewhere.

Specific achievements with HEMT–based circuits include:

- best IC amplifier above 200 GHz (world first in this band using standard foundry process);
- first time ever that cooled 75–110 GHz IC amplifiers have been installed and used for astronomical observations in an interferometer system;
- world–first wideband (40–60 GHz) bidirectional amplifier (design patented by CSIRO);
- world first bidirectional amplifier at 75–100 GHz; and
- first 100 GHz voltage–controlled oscillator using InP HEMTs.

The enhancement of the CSIRO's capabilities to include HBT technology has provided us with a very important set of new circuit designs and expertise that can be applied to the development of the next generation of mm–wave digital radios. The HBT effort has also provided CSIRO with critical experience in the design of integrated photonic systems, specifically monolithically integrated photonic/millimetre–wave interface circuits.

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Sustainable Urban Water Systems >>

Aim – to improve the sustainability of Australia's urban water systems in the context of social, economic and climate change.

Results – several alternative approaches have been developed incorporating reuse of wastewater and stormwater, and potentially operating at different scales than traditional systems. Thus it appears efficient to build small scale sewage treatment plants serving new urban developments for, say 5 000 people, incorporating reuse of storm and wastewaters, rather than continue to develop ever larger, less flexible systems. Other findings showed that peak flows in urban water and wastewater systems, and the pressures at which Australian systems often operate, are significant drivers of cost, and may inhibit the adoption of more sustainable approaches. To help transfer the outcomes of this project to users, collaborative projects have been set up with key industry groups such as the Water Services Association of Australia and Brisbane City Council.

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Novel Technologies for Feral Animal Control >>

Aim – to develop a method for producing animals that are fertile only in captivity (ie only when provided specific releasing substances).

Results – laboratory experiments with fish, oysters and mice have achieved up to 95 per cent sterility. This can be reversed by the addition of a simple compound to the rearing water (thus making possible normal rearing of the animals in captivity). A commercialisation plan for the technology, which has been patented, is being developed, and discussions are underway with overseas and Australian groups regarding licensing and the development of specific variants on the technology to fit specific market niches. A further variant on the technology appears to have considerable potential for the safe and cost–effective control of pests – such as carp. Discussions are underway with State and Commonwealth agencies regarding further development leading to potential application of the technology.

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An Integrated Approach to Sustainable Land Management in the Murray–Darling Basin (the '*Heartlands*' project) >>

Aim – to develop and test strategies to rehabilitate agricultural landscapes in the Murray–Darling Basin. This will be achieved through integrated land, water, climate, forestry, biodiversity and field crops research.

Results – *Heartlands* is run as a consortium led by CSIRO and the Murray–Darling Basin Commission (MDBC). Other groups participating include catchment management boards and authorities, State natural resource management agencies, Landcare groups, and landholders.

After extensive community, agency and science consultation, a 5–year work plan has been developed, which focuses on research in four catchment areas and gaining ownership and endorsement of the initiative by local communities and stakeholders. The initiative was launched nationally in December 2000 by the Hon Wilson Tuckey, Minister for Forestry and Conservation and the first on–ground works (tree planting) have commenced.

Additional funding has been gained for on–ground works from the Natural Heritage Trust, for a program of airborne salt mapping from the MDBC, and for other research from the MDBC and Land and Water Australia.

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A Suite of Genetic Engineering Technologies >>

(a) Genomics and Gene Discovery

Aims – to participate in International Genome Projects in plants and animals in order to gain access to data generated by overseas laboratories and to isolate key genes for quality and productivity in wheat, barley, rice, sugarcane, cattle, and sheep.

Results – international positioning of each of the participating groups in the fast evolving area of genomics was achieved through overseas contacts and workshops.

Achievements in specific areas include:

- wheat and barley: new transporters responsible for importing sucrose and other metabolites into the developing endosperm of the grain were identified and studied, as well as a new class of seed storage protein that has the potential for altering flour processing properties. New molecular markers for use in breeding were identified;
- rice: the technology, including the design of new DNA vectors, was established to generate large numbers of mutations using transposable elements. The developments were demonstrated to work by producing rice plants with mutated phenotypes;
- sugar cane: new families of transporters of sugars and metabolites were identified and patent protection taken out on one novel class of transporter. A strong internationally competitive position in the area of gene discovery in developing sugar cane stems was established;
- cattle: technology to analyse the difficult tissue of the skin was established and has positioned the group well to participate in new projects targeting molecular markers for breeding economically important traits; and
- sheep: several new families of genes were identified as being "in the right place and at the right time" for influencing wool fibre quality. The study has provided a suite of novel genes for use as molecular markers in breeding programs.

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(b) Bioinformatics Initiative

Aim – to provide a secure, single point access to databases of genomic and biodiversity information.

Results – informatics tools developed for biodiversity data (BioLink®) are now in use in the national wildlife and insect collections managed by CSIRO, and the Australian Museum and several State based institutions. BioLink® has received sponsorship from the National Science Foundation (USA), and has been adopted by the Academy of Natural Sciences, Philadelphia and biological collections in Indonesia (World Bank sponsorship). It is under evaluation by other institutions in Europe and Australasia. Collaboration with the Australian National Genomic Information Service has led to the expansion of the informatics capability of research groups within CSIRO, and has fostered linkages to State based bioinformatics initiatives building an expanded national infrastructure and network in biotechnology. Negotiations are under way with Plant Health Australia to use the database integration tools developed within the project to build a national pest and disease data network, an essential contribution to Australia's biosecurity and trade in agriculture.

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(c) Bioactive Molecule Initiative

Aim – to combine new chemistry with new biology with CSIRO's diverse biota collections for the discovery, design and development of biologically active compounds for the pharmaceutical, agrichemical, nutraceutical and food industries.

Results – integration with the Bioinformatics Initiative enabled the mining of the "big science" international genomics databases and this, combined with in–house analysis of biological systems led to the discovery of:

- a class of molecular targets for pest control whose presence in invertebrates had previously been discounted;
- novel molecular target sites in bacteria; and
- compounds with useful biological activities obtained from insects, marine microalgae and synthetic sources.

As a result, CSIRO has developed early leads in nutraceutical, drug and agrochemical discovery and validated collections of biota for applying to the discovery of bioactives. Commercial opportunities are now being explored in the development of anthelminthics, insecticides and antibiotics, in the reduction of cardiovascular disease risk, and in broad aspects of biodiscovery.

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Chapter 8
Awards and Honours

In 2000-01, CSIRO scientists won international and national acclaim for the excellence of their work. These awards are further demonstration of our effectiveness in research and its application in industry and the community.

The Prime Minister's Prize for Science >>

The inaugural Prime Minister's Prize for Science was won in October 2000 by **Dr Jim Peacock** and **Dr Liz Dennis** of CSIRO Plant Industry, for the discovery of the flowering switch gene. By manipulating the flowering switch gene it will be possible to produce strains of canola, wheat and other crops that flower at the right time for the climate in which they are grown, so reducing the risk of yield losses.

Dr Liz Dennis and Dr Jim Peacock

Photo: Brad Collis

The Marcus Wallenberg Prize >>

Dr Rob Evans, (Forestry and Forest Products), was awarded the world's premier international forestry prize in 2001 his pioneering work in characterising the quality and structure of wood. This led to the development of an instrument called SilviScan, which allows the rapid analysis of wood samples to determine the optimum and most valuable end use of the timber.

This was the second consecutive year in which a CSIRO scientist was recognised by the Award, with **Dr Bob Leicester**, (Building, Construction and Engineering), receiving the Award in 2000 for his research on the safety, fire performance and durability of wood as a building material.

Dr Rob Evans

Photo: CSIRO Forestry & Forest Products

Australian Honours >>

Order of Australia

Officer (AO)

Dr Ian Common (retired Entomology) for service to entomology, particularly the study of Lepidoptera insect pests, their effects on agriculture and the development of adequate controls, and to community education through the publication of books dealing with insects and their role in the environment.

Member (AM)

Dr John Black (retired Animal Production) for service to animal science, particularly in the field of livestock nutrition research, and to the community through bushfire control and sporting organisations (*inventor of Auspig*).

John Brockwell (Honorary Fellow, Plant Industry) for service to research in the field of rhizobium ecology and its application to pasture, grain and oilseed legumes, and to promotion of the game of bridge.

Dr John Radcliffe (retired Corporate Executive) for services to agricultural science policy and land and resource management through the dissemination of scientific knowledge in support of sustainable development, biosafety, and the conservation of agricultural biodiversity.

Medal (OAM)

Dr George Bornemissza (retired Entomology) for services to science and entomology, particularly through the ecological study of dung beetles and the introduction of new species to Australia.

Dr Don Sands (Entomology) for service to the horticultural industry in Australia and the Pacific Region through the development of biological pest control solutions, and to entomology, particularly through conservation projects.

Dr Arthur Malcolm Gill, (Plant Industry) for services to bushfire research.

Public Service Medal >>

Dr Anthony ('Nick') Nicholls, (Sustainable Ecosystems), for outstanding service in the field of ecological research.

Dr John Whiteoak, Australia Telescope National Facility (ATNF), for outstanding public service in the field of radio astronomy, especially for his contribution towards the Australia Telescope National Facility and his efforts to preserve the high frequency radio spectrum for scientific research.

Australian Awards >>

Dr Jackie Cai, (Textile and Fibre Technology), received the *Annual Achievement Award for Innovative Scientific Research* at the annual review of the Australian Cotton CRC. The achievement award highlighted the new bleaching technology established for cotton/wool blends during the first year of the project.

Dr Russell Muchow, (Sustainable Ecosystems), won the 2001 *Australian Medal of Agriculture*, Australian Institute of Agricultural Science and Technology.

David Tongway and **Norman Hindley**, (Sustainable Ecosystems), won the *Australian Minerals and Energy Environment Foundation (AMEEF) Environmental Excellence Award (Individual/Small Team Award)* for a field monitoring method developed to assess the effectiveness of minesite rehabilitation.

Dr Fiona Solomon, (Minerals), received an *Australian Minerals and Energy Environment Foundation (AMEEF) Environmental Excellence Award*, Travelling Scholarship.

Dr Brian Cooke, (Sustainable Ecosystems), won the *Australian Museum POL Eureka Prize for Environmental Research* for his three decades of research into controlling wild rabbits.

David Lamb and **team**, (Manufacturing Science and Technology), won the *Automotive Engineering Excellence Award* for outstanding contribution to advancing technology.

Dr Jeff Short, Jacqui Richards and **Bruce Turner**, (Sustainable Ecosystems), of the Useless Loop Community Biosphere Project Group, won the *Banksia Environment Foundation Award* for Community Group Achievement.

CSIRO Publishing won the *Banksia Environment Foundation Award* for Communications, for the magazine, *Ecos*.

Dr David Roget and **team**, (Land and Water), won the *BHP Billiton Landcare Research Award* for 2001 for work on the Mallee Sustainable Farming project. The project also received an award for the inaugural *River Murray Catchment Board Environmental Awards* under the category of 'Changing Farming Practices'.

Dr Bryan Eaton, Dr Allan Gould and **Dr Peter Daniels**, (Livestock Industries), won the *Charles C Shepard Science Award* awarded for co–authorship of 'Nipah virus; a recently emergent deadly Paramyxovirus.'

Dr Bill Mathew, (Minerals), won a *Clunies Ross National Science & Technology Award* in 2000 for research that led to online analysis techniques worth millions of dollars to the Australian minerals industry.

Laurie Jarvis and **team**, (Manufacturing Science and Technology), won the *Consensus Manufacturing Award 2001* for innovation in gas tungsten arc welding with Weldtronics Pty Ltd and Meanderlyn Pty Ltd.

The *Excellence in the Development of Technology from the Government Sector 2000 Award* was won jointly with the CSIRO spin–off company **Quantm Ltd**. The Quantm super–computer system replaces existing manual techniques with a revolutionary planning tool designed specifically to support skilled planners through the complex process of route selection.

Dr Bruce Hobbs, CSIRO Deputy Chief Executive – Minerals and Energy was awarded the *John Jaeger Medal 2001* by the Australian Academy of Science for investigations of a high order into the solid earth or oceans of Australia.

Dr Christine O'Keefe, (Mathematical and Information Sciences), won the *Medal of the Australian Mathematical Society*. The Medal is awarded in recognition of outstanding work in the mathematical sciences, conducted in Australia, by scientists under 40 years of age. Christine is both the first woman to win the award and the youngest winner ever.

The **Diagnostic Sciences Program Team**, led by **Dr Alex Hyatt**, from CSIRO's Australian Animal Health Laboratory won the *National Quarantine Award (Category of Science and Research Contribution to Quarantine)*.

Dr Denis Saunders, (Sustainable Ecosystems), won a *Prime Minister's Environment Award 2000* for outstanding individual achievement for his significant contribution to the research and practice of biodiversity conservation.

The Sorghum Stay–Green Team, a collaboration between the Department of Primary Industries and CSIRO, won the *Queensland Primary Industries Achievement award (Innovation and Development)* 2001 for drought resistance (stay–green in sorghum) project. **Dr Lynne McIntyre**, (Plant Industry), led the CSIRO component.

Dr Paul Yuk Hung Fung, (Forestry and Forest Products), won the *Rabobank Agribusiness Awards for Excellence* for the ITP Mallee.

Dr Colin Jacka and **team**, (Telecommunications and Industrial Physics), won a *Research Excellence Award* from the Australian Coal Association for the development of an emergency mine communication system.

Riverside Corporate Park, CSIRO Corporate Property, led by George Harley, won the *Rider Hunt Award (National)*. Chosen from a field of six finalists, the award is given to a major commercial property development displaying an efficient use of capital, quality design and services, positive industry and community perception and owner and user satisfaction.

International Awards >>

Dr John W Smith, (Petroleum), won the USA *Alfred Treibs Medal*. His original ideas on the origins of Australia's oil and gas deposits helped discover our current reserves of these precious fossil fuels.

Dr Barry Inglis, (National Measurement Laboratory), won an *Asia Pacific Metrology Programme* award for his long–term contributions to regional and international metrology.

Dr Steve Midgley, (Australian Tree Seed Centre), won the *Asia–Pacific Regional Award for Excellence* for his work on wattles and eucalypts and casuarinas.

Achim Leistner, (Telecommunications and Industrial Physics), won the *David Richardson Medal 2000*. The David Richardson Medal recognises outstanding achievements in technical optics.

Professor Dalway Swaine, (Energy Technology), received an *Excellence Award from the Energy and Environmental Research Centre* (EERC) in North Dakota, USA for his assistance and friendship given to the Centre for Air Toxic Metals.

Dr Alan Andersen, (Sustainable Ecosystems), won the *Far Eastern Economic Review Innovation Award* for his work on using ants as biological indicators.

Dr Shirley Jeffrey, (Marine Research), won the *Gilbert Morgan Smith Medal*, USA which recognises excellence in marine and freshwater research.

Dr Frank Bekes and **Dr Peter Gras**, (Plant Industry), won the *Harald Perten Prize of the International Association for Cereal Science and Technology* (ICC) for advancing our understanding of the nature of wheat dough at the molecular level.

Dr John Jacobsen, (Plant Industry), won the Silver Medal of the *International Plant Growth Substances Association* in the field of plant hormones.

Dr W S (Voytek) Gutowski, (Building, Construction and Engineering), won the *International Plueddeman Award* for inventing a process which, for the first time enables the successful adhesion of paints, adhesives, inks, metallic coatings and other materials to otherwise non–bondable plastics (polyethylene, polypropylene and others).

Dr Rob Vertessy, (Land and Water), won the *International Union of Forestry Research Organisation Scientific Achievement Award*.

Drewe Ferguson and **Frank Shaw**, (Food Science Australia), and the Meat Standards Australia (MSA) Pathways Team were a joint winner of the International Meat Secretariat *Millennium Prize for Meat Science and Technology* for outstanding contribution to the international meat industry.

Dr Vute Sirivivatnanon, (Building, Construction and Engineering), won the Canada and USA *Mohan Malhotra Award* for Supplementary Cementing Materials. The award recognises more than 12 years research to developing useful applications of fly ash, slags and silica fume.

CSIRO, led by **Dr Trevor Bird**, and the **CRC** for Satellite Systems were given a *special award* for co–operating with the Communications Research Laboratory (CRL), Ministry of Posts and Telecommunications, Japan, on land–mobile satellite communication experiments carried out in Australia using the COMETS satellite in 1999.

CSIRO Award Schemes >>

The Chairman's Medal

The 2000 Chairman's Medal and CSIRO Medals were presented on 5 December 2000 by Sir Walter Bodmer, FRS, Principal, Hartford College, Oxford University, UK.

The Low Emission Vehicle Project won the 2000 Chairman's Medal.

The winners of the Chairman's Medal were Team Leaders: **Mr David Lamb, Dr Michael Brothers, Dr David Gates, Dr Howard Lovatt, Dr Peter Manins, Dr David Rand, Dr Warren Thorpe, Dr Tony Vassallo** and **Dr Mark Westcott**.

Team members: **Dr Tom Beer, Mr Colin Bilson, Mr Vic Buriak, Mr Lindsay Burke, Mr Daniel Byrnes, Mr Chris Cantrall, Mr Brad Cowley, Mr Peter Cusack, Mr Tom Davis, Mr Vivian D'Offay, Dr John Dunlop, Mr Quentin Fletcher, Mr Paul Gwan, Dr Peter Hurley, Dr Houyuan Jiang, Mr Bruce Kalan, Dr Lan Lam, Mr Bruce Lanham, Dr Russell Newnham, Ms Hilkat Ozgun, Dr Tony Pandolfo, Mr Glen Prout, Professor Vic Ramsden, Mr Greg Redden, Mr Randy Rhoads, Mr Claude Sacchetta, Mr Chris Sharman, Dr Nariida Smith, Mr Trevor Smith, Mr Werner Strecker, Dr Gerardo Trinidad, Dr Palitha Welgama** and **Dr Wei Wu**.

From left to right are:
Dr Mark Westcott, Dr Colin Adam, Dr Tony Vassallo, Sir Walter Bodmer, Mr Charles Allen, Dr Peter Manins, Mr David Lamb, Dr Warren Thorpe, Dr David Rand and Dr Howard Lovatt.
(other winners absent from event)

Photo: Photographic Services, QLD Department of Natural Resources

CSIRO Medals

The CSIRO Medals for 2000 for CSIRO staff were awarded for:

- the world's first high performance Local Area Network by **Dr Terence Percival, Mr Graham Daniels** and **Professor David Skellern**.
- the development and commercialisation of the Australian Magnesium Process by **Dr Malcolm Frost, Dr Keith Cathro, Professor Gordon Dunlop, Mr Richard Furness, Mr Jason Hepburn, Mr Michael Hourn, Mr David Jenkins, Mr Raymond Koenig, Dr William H Kruesi, Mr Julian Land, Dr Raj Rajakumar, Dr Nigel Ricketts, Dr Murray Rudman, Dr Greg Sheehan, Mr Peter Tait, Professor Martin Welsh** and **Dr Fook Wong**.
- amphibian disease research by **Dr Alex Hyatt, Dr Lee Berger, Dr Andrew Cunningham, Dr Peter Daszak, Dr Louise Goggin, Dr David Green, Mr Harry Hines, Dr Karen Lips, Mr Gerry Marantelli, Mr Keith McDonald, Dr Helen Parkes, Dr Mark Ragan, Dr Ron Slocombe** and **Dr Rick Speare**.

The CSIRO Business Excellence Medal

The CSIRO Business Excellence Medal was awarded to the **Polyurethane Biomaterials Team**, **Dr Simon Carroll, Dr Pathiraja Gunatillake, Mr Bryan Loft, Dr Gordon Meijs, Dr Greg Simpson, Dr Mike Skalsky, Dr Tom Spurling** and **Dr Jack Steele** for the development and manufacture of medical devices.

The external CSIRO medal

BHP's Project Falcon led by **Dr Edwin van Leeuwen, Mr Clive Affleck, Dr Mike Asten, Dr Maurice Craig, Mr Peter Diorio, Dr Mark Dransfield, Mr Nick Fitton, Mr Giles Hofmeyer, Mr Gary Hooper, Dr Jim Lee, Dr Xiong Li, Dr Ken McCracken, Dr Tim Monks (deceased), Dr Graeme O'Keefe, Mrs Marion Rose, Mr Peter Stone, Mr Bob Turner** and **Mr Ken Witherley**.

CSIRO Business Excellence Awards

Mr Trevor Thacker won the *Customer Relationship Management Award* for the Boeing project.

Dr Simon Carroll, Dr Pathiraja Gunatillake, Mr Bryan Loft, Dr Gordon Meijs, Dr Greg Simpson, Dr Mike Skalsky (Elastomedic), **Dr Tom Spurling** and **Dr Jack Steele** won the *Technology Transfer Award* for polyurethane biomaterials.

Russel Rankin, Stephan Wellink and **Judy Marcure** won the *Marketing and Business Development Award* for CSIRO's Food into Asia program.

John Phillip Award for Promotion of Excellence in Young Scientists

Dr Jawahar Patil, CSIRO Marine Research, won the *John Phillip Award for Promotion of Excellence in Young Scientists*.

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 2000 Award was presented on 9 November 2000 by Mr Campbell Anderson, President, Business Council of Australia. The winner was **Dr Tony Miller** of CSIRO Mathematical and Information Sciences for his skills on the complex problems surrounding the optimal design of spectacle lenses.

Dr Pathiraja Gunatillake, CSIRO Molecular Science, received a Certificate of Commendation in recognition of innovations in biostable polyurethanes.

From left to right are: Mr Campbell Anderson, winner Dr Tony Miller, and Sir Peter Derham.

Photo: Mark Fergus

Citation Awards

A Patent of **Dr Trevor Bird, Dr Graeme James** and **Stephen Skinner**, (Telecommunications and Industrial Physics), is the most often cited Australian Patent in the Information Communications Technology area as shown by a recent US analysis.

Dr Phil Larkin, (Plant Industry), won the *Institute of Scientific Information Award for Most Cited CSIRO paper* for *Somaclonal Variation – a novel source of variability from cell culture for plant improvement*.

Dr Dick Manchester, (Australia Telescope National Facility), **Dr Paul Fraser** and **Dr Paul Steele** (Atmospheric Research), **Dr Jeffrey Ladd**, (Soils), and **Dr Neil Turner**, (Plant Industry) were honoured within a group of 35 top Australian scientists who had been most frequently cited in the science literature as measured by the *Science Citation Index*.

Fellowships and International Societies

Dr Shirley Jeffrey, (Marine Research), was elected a Foreign Associate of the *Academy of Sciences*, US.

Dr Andrew Johnson, (Sustainable Ecosystems), won an *Ambassadorial Fellowship of Rotary International* to study at J F Kennedy School of Government Harvard University.

Dr John Angus, (Plant Industry), was elected a Fellow of the *American Society of Agronomy* for crop agronomy and modelling.

Dr Keith Bristow, (Land and Water), was elected a Fellow of the *American Society of Agronomy and Soil Science Society of America* 2001.

Dr Laurie Piper, (Livestock Industries), was elected a Fellow of the *Association for the Advancement of Animal Breeding and Genetics*.

Dr Greg Constable, (Plant Industry), **Dr Elizabeth Heij**, (Land and Water) and **Dr Glen Kile**, (Forestry and Forest Products), were elected members of the *Australian Academy of Technological Science and Engineering*.

Dr Patricia Desmarchelier, (Food Science Australia), was elected as a Fellow of the *Australian Institute of Food Science and Technology*.

Dr David Michael Spratt, (Sustainable Ecosystems), was elected a Fellow of the *Australian Society for Parasitology*. The fellowship is given to distinguished parasitologists who by their influence or endeavour have promoted the advance of parasitology.

Dr Tony Della–Porta, (Livestock Industries), was elected Fellow of the *Australian Veterinary Association* (awarded for contributions to recognition of exotic animal diseases, biocontainment and biological safety).

Dr James Ridsdell–Smith, (Entomology), was elected a Fellow of the *Institute of Agricultural Science*.

Hugo Ilic, (Forestry and Forest Products), was elected a Fellow of the *International Academy of Wood Science*.

Professor Ron Ekers, (Australia Telescope National Facility), was elected President–elect of the *International Astronomical Union*.

Dr Martin Cole, (Food Science Australia), was elected Chairman of the *International Commission on Microbiological Specifications for Foods*.

Dr Barry Inglis, (National Measurement Laboratory), was elected to the *International Committee for Weights and Measures*.

George King, (Building, Construction and Engineering), was elected a Fellow of the *National Association of Corrosion Engineers* for sustained professional activity.

Dr Rodrigo Bustamante, (Marine Research), was awarded a *Pew Fellowship*, UK.

Dr Ravi Naidu, (Land and Water), was named a *Fellow of the Soil Society of America*.

Dr David Michael Spratt, (Sustainable Ecosystems), was elected a Life Member of the *Wildlife Disease Association* for his editorial contributions to the Journal of Wildlife Diseases, his efforts in establishing the Australasian Section of the Wildlife Disease Association and for his enormous contribution to the understanding of the parasites and diseases of Australian fauna.

3: The Future

Chapter 9
Strategic Action Plan

In early May 2001 CSIRO's senior management team met for a week to develop a Strategic Action Plan for the Organisation. The meeting followed a period of extensive consultation with many key stakeholders and clients (including our Sector Advisory Committee Chairs) and with staff, and incorporates key elements of the work done by 17 Strategic Priorities Task Groups that reported in late April.

This Chapter summarises the main features of this Plan in the language used in the Plan. It paints a map of the future for the Organisation.

Six key messages >>

This is a volatile world. There are numerous, escalating pressures on CSIRO, demanding the delivery of relevant and meaningful outcomes. We must add maximum value to the national enterprise and make an indispensable contribution. We must **look outward**. For CSIRO to realise its full potential, it is critical that we make changes.

We must pay close attention to our customers and the wider community. This demands an uncompromising customer focus – delivering **service** from excellent science.

We are currently spreading ourselves too thinly. We need to focus our energies and to build teams and **quality partnerships**, nationally and globally, increasing our capability to deliver creative science and innovative solutions in a timely way.

We must harness the full power of a **unified CSIRO** and build multi–disciplinary teams that will address major national challenges and global opportunities. This will also enable us to move rapidly to identify and exploit new opportunities and technologies that will emerge beyond and across conventional boundaries.

If we succeed in implementing these changes, our nation will benefit and our business and impact will **grow**.

In summary, the key messages we have to live are:

- *Look out!!!*
- *Focus*
- *Service from Science*
- *"One CSIRO"*
- *Partner or Perish*
- *Go for growth*

Strategic priorities >>

Eight strategic priorities have been defined as crucial for CSIRO's development in the immediate future.

* Our people

The viability of CSIRO and our competitive advantage is a direct result of the capabilities and achievements of our staff. We need mechanisms to retain high performers and to ensure that we improve our management and supervisory skills.

Key objective – to maximise our competitive advantage and the delivery of quality and value–adding outputs by:

- attracting, retaining, rewarding and motivating the right mix of creative, highly skilled, outcome–focused, team–oriented people; and
- improving professional development for all of our staff.

Actions – to achieve this objective we will:

- ensure CSIRO has a more attractive and competitive performance–based salary and rewards system;
- provide mentoring and career development at all levels;
- become a gateway to new careers in spin–off companies; and
- substantially enhance team–based skills and processes.

* Science base

Preserving and building the science base in CSIRO is fundamental. Without top people, world–class facilities, access to libraries and equipment, critical mass teams and smart friends, there will be no new ideas and no innovation. CSIRO needs to pay attention to all these factors.

Key objectives –

- to grow, and focus, our science base;
- to increase our investment in emerging science and technology areas; and
- to enhance CSIRO's reputation for high quality science and technology.

Actions

- grow key and emerging science areas (rising to an additional $40 million per annum);
- focus and synergy – do fewer things better, across boundaries;
- double the number of our post–doctoral students, establish a prestigious CSIRO post–doctoral program, and enhance and expand our post–graduate training;
- establish strong science advocacy at Executive level (eg through creation of a CSIRO Science Forum with representatives from all levels);
- strengthen core capabilities in information and communications technology and biotechnology, across CSIRO; and
- take a whole–of–CSIRO perspective on scientific standards, and focus.

* Business development

The future success of CSIRO is dependent on engaging productively with both business and the public sector, because helping improve the performance of both is one of the principal reasons for our existence.

Key objective – to increase revenue, significantly, by building our commercial engagements around a streamlined and vigorous investment model and a new approach to business development.

Actions

- improve the process for choosing the right things to do, then focus, ie design and implement a new investment process based on CSIRO's business model, building upon the existing Sector and Executive processes;
- substantially enhance our licensing and new enterprise creation;
- expand our regional and global business activities;
- enhance our future commercial prospects by creating and focusing on a differentiated customer/stakeholder value proposition;
- strengthen Key Account Management and Facilitation; and
- strengthen business development planning.

* 'One CSIRO' – death of silos

CSIRO has major, core strengths relevant to the learning culture of a 'one CSIRO' but for many years has had a number of internal structures and practices that have hindered both horizontal and vertical communication and collective effort.

Key objectives –

- move towards a 'one CSIRO' culture in order to be able to respond rapidly in the best possible way using CSIRO and global networks, without being constrained by boundaries; and
- identify radically new solutions through teams and research synergies across CSIRO.

Actions

- improve collaborative behaviour;
- better sharing of knowledge and information, horizontally and vertically;
- strengthen Key Cross–Organisation Relationship Management and Facilitation;
- develop and present a 'one CSIRO' external image; and
- review, and appropriately amend, CSIRO–wide support processes for 'one–ness'.

* External communication and relationship management

CSIRO requires a more strategic and coordinated approach to relationship development based on better market analysis and better information on the benefits of existing national and international relationships.

Key objective – strengthen CSIRO's position and influence in Australia's science and technology/innovation systems, by constructively engaging with government, industry, academia and the public at large.

Actions

- build effective and coordinated external communication strategies;
- develop an improved relationship with government and political decision–makers and influencers; and
- improve our relationships with the Universities, Cooperative Research Centres and the Academies, and other research providers.

* e–CSIRO

CSIRO has much to gain by taking a leadership role in the application of information technology in carrying out its mission as a world–class scientific research organisation, for example, in doing business in new and different ways, and in achieving greater efficiency in all our work.

Key objective – The innovative use of Information and Communication Technology to give us a competitive advantage in everything we do and a peerless ability to do business in new and unpredictable ways.

Actions

- develop and communicate a clear vision of e–CSIRO which will excite and energise staff and customers about opportunities and possibilities;
- develop an e–CSIRO plan and implementation strategy;
- expand business opportunities through electronic contact and delivery; and
- improve operational efficiency through e–services, harnessing the power of 'one CSIRO'.

* Operating excellence

There is a strong need to reinforce the notion that CSIRO's purpose is to deliver service from science and stimulate an excellent service culture.

Key objectives–

- to deliver excellent service to our customers (internal and external); and
- to pursue relentlessly operating efficiencies and effectiveness.

Actions

- stimulate an excellent service culture, based on customer feedback and appropriate training;
- eliminate subsidies from research services and consulting;
- push down authority and accountability – flatter management structure; and
- establish customer and staff satisfaction metrics and measurement processes.

* Organising arrangements

To provide the foundation for a cohesive, outward-looking and growing CSIRO – founded on great people, teamwork, service and, above all, our excellent science – we have re-examined our organising arrangements. Central to the new arrangements will be flatter top management structures reflecting the greater empowerment of people at all levels in CSIRO. To promote greater inter-operability between Divisions we will form four self-managed groups of Divisions, with one of the Chiefs from each group serving on a new Executive Team, which will also include representation from the newly constituted CSIRO Science Forum.

Key objectives–

To introduce organising arrangements that:

- allow CSIRO to realise its full capability to deliver value from excellent science;
- harness the full power of our multi-disciplinary teams;
- increase CSIRO's outward focus and responsiveness; and
- clarify and simplify decision-making processes.

Actions

- introduce/reinforce team-based management that connects better into the Organisation;
- develop simpler and better strategic investment processes; and
- decide, and agree with the Board, on a set of Key Performance Indicators that provides the Chief Executive and Executive Team with highly aggregated whole-of-CSIRO measures for effectively managing the Organisation.

Our purpose >>

By igniting the creative spirit of our people, we deliver great science and innovative solutions for industry, society and the environment.

Our Five Year Mission >>

'Where are we going, and what do we want to achieve?'

We will grow our business by 50 per cent to $1.3 billion over the next five years.

Based on our intellectual assets and capabilities, we will increase our revenue from licensing and enterprise creation by a factor of ten over year 2000 levels.

We will ensure that CSIRO is a place where:

- great people choose to work;
- teams are responsive, energetic and communicative;
- we value our people, empower them and reward their excellence; and
- partnership is prized.

We will transform our effectiveness as an organisation through the creative use of information and communication technologies to: enable us to do business in new and different ways; significantly increase the efficiency of all our business processes; and facilitate the unhindered sharing of knowledge across the Organisation.

We will help make Australia a stronger global competitor in the 21st century through a new set of large projects that will deliver outcomes around:

- information and communication technologies to build and enhance national performance in the sector;
- biotechnology to drive pharmaceutical and agribusiness developments;
- sustainable natural resource industries and the building of world–class knowledge services based upon them;
- practical solutions to major environmental challenges and safeguarding our biodiversity;
- new and transforming manufacturing industries;
- new companies to take Australian knowledge products to the world;
- science and technology to help Australians live longer, healthier, more productive lives enriched by scientific discoveries; and
- technology to overcome the disadvantages that remote Australia suffers in communications, health and education.

We will increase CSIRO's flexibility to invest in key fields of science and emerging research areas, ramping up to an additional $40 million a year across the Organisation.

We will, in partnership with others, continue to strive to raise awareness of the excitement and importance of science to our nation, especially amongst our youth.

Management arrangements >>

To drive these strategic processes, CSIRO is adopting a new top management structure from July 2001.

CSIRO Executive Management Council and Executive Team

Executive Management Council

Agri–Food & Fibre Group	Mr Shaun Coffey	Livestock Industries
	Dr Michael Eyles	Food Science Australia
	Prof Richard Head	Health Sciences and Nutrition
	Dr Glen Kile	Forestry and Forest Products
	Dr Jim Peacock (chair)	Plant Industry
Environment & Natural Resources Group	Dr Nan Bray	Marine Research
	Dr Jim Cullen	Entomology
	Dr Graham Harris	Land and Water
	Dr Steve Morton	Sustainable Ecosystems
	Dr Graeme Pearman (chair)	Atmospheric Research
IT, Manufacturing & Services Group	Dr Brett Bateup	Textile and Fibre Technology
	Dr Murray Cameron	Mathematical and Information Sciences
	Dr Annabelle Duncan	Molecular Science
	Prof Ron Ekers	Australia Telescope National Facility
	Dr Warren King	Telecommunications and Industrial Physics
	Mr Larry Little (chair)	Building, Construction and Engineering
	Dr Ian Sare	Manufacturing Science and Technology
Sustainable Minerals & Energy Group	Dr Rod Hill	Minerals
	Dr Neil Phillips	Exploration and Mining
	Dr Adrian Williams (chair)	Petroleum Resources
	Dr John Wright	Energy Technology

Executive Team

	Mr Larry Little	Four Chairs of Business Groups
	Dr Jim Peacock	
	Dr Graeme Pearman	
	Dr Adrian Williams	
	Dr Ted Cain	Corporate Secretary
		Chair: Risk Management
	Dr Geoff Garrett	Chief Executive
	Dr Bruce Hobbs	DCE. Special Adviser: Strategic Investment Planning
	Dr Ron Sandland	DCE. Director: e–CSIRO.
		Chair: ICT Strategy Team
	Dr Paul Wellings	DCE. Director: Business Development.
		Chair: Biotech Strategy Team
	Dr Vijoleta Braach–Maksvytis	Chair: CSIRO Science Forum
	Mr John Read	Executive Director: Commercial & Finance
	To be appointed	Director: Communications
	Ms Jane Lowther (Acting)	Director: People Development

4: Supporting the Science

Chapter 10
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 six times each year 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 separate section in this Chapter). 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 2000-01 Board members, their qualifications and terms of appointment are shown in Chapter 3. 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 2001, 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 fulfiling 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 >>

In accordance with the Board – endorsed Fraud Control Policy, the most recent fraud risk assessment was undertaken during 1998 and a follow up was completed during 2000. A comprehensive fraud risk assessment has also been scheduled for 2001.

A detailed Fraud Control Plan operates in accordance with Commonwealth Law Enforcement Board Guidelines. 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.

Chapter 11

Support Activities

Human Resources Management, Occupational Health and Safety and People Development

The year commenced with the implementation of changes to CSIRO's salary and classification system, following staff endorsement of the proposals in July 2000. The proposals increased the emphasis on teamwork, collaborative behaviour and leadership. The performance appraisal system was also overhauled and the new system implemented in April this year.

A new Enterprise Agreement was negotiated and will take effect from July 2001. It contains a range of initiatives to simplify processing and policy in relation to conditions of employment.

A CSIRO Mentoring program was introduced in December 2000, targeting middle managers with potential to become future leaders. The program involves selecting mentors for groups of up to 8 staff for a period of one year. The mentors, who are Divisional Chiefs, meet with their group every 2 months, dealing with issues such as strategic future and direction of CSIRO, commercialisation and globalisation issues, relationships with internal and external customers and building networks. There were 40 staff in the first intake, based in Melbourne and Canberra.

An Employer of Choice project was established to identify what is important to staff about working for CSIRO and how CSIRO can enhance its policies and practices to become an employer of choice.

CSIRO is developing a new Workplace Diversity Plan, which is expected to be implemented by November 2001. A number of strategies have already been identified to promote increased use of the family friendly work arrangements already in place as well as to identify new initiatives. The new Plan will also introduce performance measures consistent with the Commonwealth Disability Strategy, and establish baseline data. Some projects that have already been established (and will include examination of diversity–related factors), include mentoring and career development, staff surveys and reviews of grievance procedures, employment policy and practices, recruitment, induction policy and practice.

The Human Resource (HR) function is under review with a view to implementing a more efficient structure for delivery of HR services across the organisation and streamlining and/or eliminating routine processing activities.

Occupational health and safety

CSIRO's Occupational Health, Safety and Environment (OHS&E) function and structure is under review to determine the best delivery model for the Organisation. An OHS&E culture audit was completed during the year to identify cultural factors in CSIRO that may inhibit the further improvement of CSIRO's OHS&E performance.

CSIRO's Occupational Health and Safety Policy outlines the principles for protecting all staff and others that might be affected by the work of the organisation. The Corporate Health and Safety Committee advises on the development of OHS Policies and programs and broad OHS priorities.

The CSIRO OHS Management System has four main stages: planning, implementation, measurement and evaluation and review and improvement, comprising elements to support continuous improvement. Business Units report quarterly on a suite of OHS performance indicators. Guidelines for Contractor Controls have been issued, and OHS Improvement Plans, and OHS Internal Audit Procedures are being developed.

CSIRO continued to improve its OHS performance compared with the previous year. The Lost Time Incident Frequency Rate, LTIFR, (5) and Medical Treatment Frequency Rate, MTFR, (23) compares well with previous years. This is evident by a 12 per cent reduction in the number of compensation claims and a 47 per cent reduction in time lost. This improved performance is also reflected in a reduced workers' compensation premium rate.

CSIRO's OHS Performance for the past two years

Indicator	2000-01	1999–00
LTIFR	5	5
MTFR	23	25
No of incidents reported	935	835
No of compensation claims	270	308
Time lost – weeks	136	255

In response to recommendations by Comcare CSIRO has developed plans to improve contractor safety and certification of work, and reviewed local OHS induction procedures.

People development

CSIRO recognises that significant investment in the development and regular updating of the professional, technical, leadership and management skills of its staff is essential to maintain and extend its core competence. Principal responsibility for providing training and development of staff is held by Divisions.

Corporate programs designed to support Chiefs and General Managers, prepare high potential staff for future leadership roles and to assist other staff at major, career transition points supplement the initiatives of Divisions.

A comprehensive series of career development discussions was held with Chiefs and General Managers. Individual development needs and opportunities for each were identified and the implementation phase has commenced. Four Chiefs completed Executive Education programs at leading overseas business schools during the year.

The fifth Leadership Development Program, CSIRO's major succession planning activity, was completed. Twenty–two participants, including four external members, graduated in May 2001.

The Leadership in Innovation: Achievement Through Teams joint venture with the Business/Higher Education Round Table continued. Four programs were held with a total of fifty–one participants from CSIRO, industry, academia and public sector research agencies.

Three Project Leaders Programs with a total of sixty participants were completed and a fourth course (the eleventh in the series) commenced. The commercial and business development component was redesigned and strengthened. The program continues to have a strong action learning component. Two additional programs with a total of 35 participants were conducted for specific Divisions.

Two new programs commenced during the year. The Research Business Program is aimed at developing the commercial and business capability of research and commercial staff. 'Thriving on Complexity' builds collaboration, synergy and enhanced self–awareness for staff embarking on complex, multi–divisional and multi–disciplinary research ventures.

CSIRO is a member of The Leadership Consortium Inc, a grouping of 20 major private and public sector organisations which jointly offer leadership development activities for high–potential managers. During 2000-01, teams of CSIRO staff participated in two Consortium programs with teams from other member organisations.

Development of the Team Leadership Program continued. The Program provides core skills for all team leaders and supervisors through short courses and workshops in areas including people management, commercialisation, legal obligations, financial management, managing conflict, corporate governance and conflict of interest.

A major, five year, consulting activity as part of CSIRO's Management Systems Strengthening contract with the Indonesian Institute of Sciences (LIPI) was successfully completed. A total of 50 LIPI staff participated in two Leadership Development Programs. Additional consulting work was undertaken for the New Zealand Crown Research Institute for Geological and Nuclear Sciences.

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Environmental Management >>

CSIRO complies with Commonwealth and State and Territory environmental legislation, including the *Commonwealth Environmental Protection and Biodiversity Conservation Act (EPBC) 1999*.

CSIRO's research is committed to achieving positive environmental outcomes focusing on large–scale integrated solutions to biodiversity issues at a regional and national scale. CSIRO scientists work closely with community, industry and government groups and organisations. Specific research includes:

- ***Conserving and monitoring biodiversity.*** CSIRO conducts research into effective solutions for biodiversity conservation problems including the clearing and modification of native vegetation, and aquatic systems through land or water use, alien species, pollution, and fire.
- ***Ecosystem sustainability.*** CSIRO scientists, working with farmers, farm organisations and government agencies, are investigating the value of ecosystem services and how to improve the profitability and sustainability of farms.
- ***Integrating biodiversity with resource management.*** CSIRO is taking a systems approach to integrating biodiversity with resource management decisions.
- ***Managing environmental pests, weeds and diseases.*** CSIRO aims to understand and develop ecologically sound management systems for a diversity of organisms that threaten Australia's biodiversity.
- ***The functional role of biodiversity.*** CSIRO is concerned with defining the relationship between biodiversity, the functioning and maintenance of terrestrial ecosystems.
- ***Using biodiversity.*** CSIRO is focusing on expanding the utilisation of biological assets for current or future economic benefit through existing industries and future ventures.
- ***Knowledge and informatics.*** CSIRO scientists are studying, classifying and documenting the nation's flora and fauna, managing national biological collections and developing new technologies for handling and delivering biodiversity information.

CSIRO appointed a Biotechnology Coordinator heading a Biotechnology Strategy Unit in January 2001 to provide a facilitating and coordinating role on biotechnology issues. This includes coverage of environmental impacts of biotechnology projects.

CSIRO has initiated a program of independent environmental audits of all research and support activities to identify environmental aspects, legal obligations and improvement opportunities.

Commencing in 2001–02 CSIRO Business Units will be required to report to the Executive on a suite of environmental performance indicators including: rate of energy use, environmental risk assessments, and staff training on environmental management.

CSIRO is working closely with State and Commonwealth Departments to review the CSIRO Heritage Register to ensure the protection and management of these properties.

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Energy Services

The Corporate Energy Services Unit (CESU) provides advice on the design of energy efficient building services and air conditioning systems. It also monitors and advises Divisions and users on energy consumption and recommends methods to reduce CSIRO's overall energy usage in line with Government annual reduction targets and when relevant, to provide staff awareness and training programs.

Electricity usage at most sites can now be effectively monitored by the installation of a metering system. An initiative to analyse Energy and Water usage to determine improvement strategies at major sites has been commenced.

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Finance

The investment in planning and training for the implementation of the New Tax System was beneficial. During 2000-01 all monthly Business Activity Statements were prepared directly from the Financial Management Information System and lodged electronically to the Australian Taxation Office within the prescribed deadlines.

The Executive endorsed the implementation of a 'Graphical User Interface' version of the CSIRO's finance system *UNIBIS*.

Budgets for operating result, cash and capital expenditure were set for each Business Unit consistent with the Organisation's strategic plan and research priorities for each year of the new triennium.

In line with government policy CSIRO achieved in excess of 90 per cent of all payments by electronic funds transfer.

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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 Risk Assessment and Audit 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. The organisation's risk profile is revised every six months on an ongoing basis.

A further important outcome is the provision of regular risk assessment and audit reports to Senior Management and the Board Audit Committee. These reports cover risk identification and analysis, and associated risk management strategies and action plans. They also provide independent assurance that internal controls are in place and operating effectively.

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Information Technology Services >>

During 2000 CSIRO worked with OASITO (The Office of Asset Sales and Information Technology Outsourcing) to reach an agreement on a suitable model for Information Technology (IT) outsourcing that complied with government policy and met the unique requirements of the Organisation. The implementation strategy for the initiative was significantly altered following the independent Humphry review and CSIRO was pleased that the Government recognised the special needs of the research agencies to be highly flexible and selective in their approach to outsourcing. CSIRO continues to work within the Government's policy guidelines to support the industry development components of the initiative and to find effective ways in which IT can be outsourced where there is a demonstrable benefit to CSIRO.

CSIRO entered into a Joint Collaboration with the Office for Government Online (now the National Office for the Information Economy) covering e–procurement initiatives. One outcome of this collaboration was the completion of an e–Procurement Scoping Study in early 2000. The study demonstrated a strong business case for e–procurement, and provided a roadmap for action. The version of the final report has been adopted by NOIE as a 'best practice' document for Commonwealth agencies.

Information Technology Services (ITS) undertook a number of projects to utilise e–business tools within the Organisation. Notable amongst these was the completion of an electronic vote in July 2000 covering aspects of the Enterprise Bargaining Agreement. This was the second electronic vote conducted within the Commonwealth and utilised a customised version of the Department of Defence's eVote system. This system has now been adopted by the Australian Electoral System following agreement between the Australian Electoral Commission, Defence and CSIRO.

ITS also continues to explore creative solutions to the ongoing problem of providing adequate network bandwidth, at an affordable cost, to support the research of CSIRO throughout the Organisation's geographically dispersed locations across Australia. With the recent granting of a carrier licence to the Australian Academic Research Network (AARNet Pty Ltd), ITS is now able to pursue opportunities in areas such as building metropolitan based fibre optic networks and gaining access to carrier wholesale rates for more cost–effective communications services for the Organisation.

ITS continues to develop and roll out new leading edge technologies that both improve the functionality while reducing costs of voice, video and data communications to the organisation. IP (Internet Protocol) Telephony is a good example of this, which builds on our successful implementation of Voice over Internet Protocol (VoIP) to connect the telephone handset on the desk 'directly to the internet', thus avoiding the need for what is fast becoming expensive legacy infrastructure such as PABXs. These new 'PABXless' IP telephones are currently being installed at CSIRO's new site at Bentley Technology Park, Western Australia, and provide a cost–effective voice communications system, whilst enabling the true integration of voice, video and data into one homogeneous intelligent environment.

Communication and Education >>

In March 2001, CSIRO relaunched its intranet. The redevelopment provides a more user–friendly experience and significantly improves accessibility to the wealth of information available to CSIRO staff. Through this development, the intranet has become an essential tool for sharing knowledge and facilitating communication within CSIRO rather than a large repository for corporate documents.

CSIRO has made significant progress in the development of the largest locally stored science library in Australia. Following the success of the initial implementation of the Elsevier journal collection, the last year has seen the addition of electronic content from Blackwell Science, CSIRO Publishing, and Kluwer. The e–journals collection now holds approximately 3 000 journal titles and approximately 2 million journal articles. Usage data demonstrate the positive uptake of electronic journals by CSIRO scientists.

In July 2000 the Commercial Information System (CIS) was released. This module of the Project Support System (PSS) is a standard management tool for each Division's Customer, Contacts, Prospects, Proposal and Agreement information and provides reporting capabilities for the Organisation's commercial information, and facilitates the sharing of basic Customer, Contact and Contract information between Divisions.

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National Awareness

Service to politicians. Science Briefings have been extended to most State Parliaments where they are being well received. Nine National Science Briefings have been held at Parliament House in Canberra and 12 State Briefings: 3 in Victoria, 2 in New South Wales, 1 in Western Australia, 4 in South Australia and 2 in Tasmania. 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 triennium.

Media. Outcomes of public awareness activities have been measured by media analysis. 328 media releases went out during the financial year. Analysis of print media during 2000 showed that CSIRO continues to receive highly favourable print coverage in volume and quality. National Awareness has established an email database containing over 350 journalists, media organisations, research institutions and technical publications from around the world. Selected media stories are sent to these contacts raising the profile and awareness of CSIRO and Australian science worldwide. The database has been divided into categories to cater for the different interests of each contact.

Scinema. National Awareness organised Australia's first international festival of science film and multimedia, which was held in Canberra in May 2001 and coincided with National Science Week. It was a competitive international festival and drew over 140 film and multimedia entries from 14 countries. With a total of 88 films screening at Centre Cinema and CSIRO Discovery Centre, in its first year *Scinema* became one of the world's largest film festivals. National Awareness has had requests for *Scinema* to tour to three states in late 2001.

metis II. metis II was the second exhibition project to facilitate cross–disciplinary communication between the visual arts and sciences. The theme for May 2001 was waste and ecological degradation. It was a series of 13 exhibition projects involving over 50 artists and was exhibited across major art and science institutions in the Australian Capital Territory. *metis* is a biennial exhibition and has had requests to expand in 2003.

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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.

Major sponsorship was gained for a number of projects to enable specific projects to continue and to launch a new initiative. Members Australia Credit Union is funding a new project, Science by Email, which was launched in May. It will offer an e–newsletter to members of CSIRO's Double Helix Science Club and Scientriffic subscribers. The project will provide the latest science information, experiments to try at home and web chats with scientists on topics of interest. Members Australia has close links with CSIRO.

Alcoa World Alumina Australia has offered to provide generous support for the CREST project. CREST allows school students to undertake their own scientific research projects. It supports teachers in providing this experience to their students and is contributing to an important change in science teaching in Australia.

The Student Research Scheme has been supported in 2001 by three major partners – The Ian Potter Foundation, University of NSW and University of WA. Additional support is being provided by the Australian National University, James Cook University and the University of Tasmania.

Scientriffic magazine continued to increase its circulation after two years in production with subscriptions increasing to over 7 500. Sponsors continue to support the magazine. There are over 10 000 individual members of Double Helix with its magazine, *The Helix*, having a circulation of 16 000.

CSIRO Science Education Centres (CSIROSECs) provided educational, interactive sessions for 170 000 students both in the nine Centres and across Australia through their *Lab on Legs*. CSIROSECs are located in every capital city plus Townsville.

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CSIRO Enquiries

CSIRO Enquiries' role is to provide a responsive information service on behalf of all CSIRO divisions and units, dealing with enquiries received from people in Australian and international communities.

The unit handled over 37 000 calls in 2000-01. Enquiries were received from the general public (68.5 per cent), students (13.1 per cent), industry (12.3 per cent), government (4.5 per cent) and the media (1.6 per cent).

CSIRO Enquiries utilises up–to–date telecommunications and IT technologies to offer a personal service, ensuring that every enquirer interacts with an experienced, science–trained professional. Enquirers have easy access to the service via a national telephone number **1300 363 400** at local call costs, an email service to *enquiries@csiro.au* as well as fax and mail.

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Property and Security >>

Property

CSIRO's property assets are being efficiently and effectively managed, using principles and strategies contained in the CSIRO Property Management Plan 2000. 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.

A Government Property Review determined that six CSIRO properties were to be sold and leased back. The Government has agreed that CSIRO will receive appropriation funding for additional sale and ongoing rental costs as part of this exercise. Riverside Corporate Park, the centre of CSIRO research in New South Wales, was sold in June 2001 with a 20–year plus lease back provision. Tenders for three Australian Capital Territory properties closed in early July 2001.

The Capital Works program continues to facilitate the refurbishment and replacement of Research Facilities across the portfolio, with one of the two–major State funded projects in Queensland completed and the other in Western Australia nearing completion. Work on developing the major research facilities at St Lucia, Queensland and North Ryde, New South Wales is in mid–term.

Security

The Organisation's Security Policy was issued in February 1996 and is currently being reviewed in light of the Government's promulgation of the Commonwealth Protective Security Manual 2001. A revised Corporate Security Plan will be developed as a result of the new policies and regulations contained in the manual.

The security review program has been ongoing and will continue through 2001 and 2002. Even though the new standards will place additional demands upon CSIRO the Organisation is well placed to meet the Government's requirements and demonstrate compliance with the new standards.

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Strategic Planning and Evaluation >>

CSIRO's comprehensive process for identifying triennial research priorities culminated in the publication in July 2001 of the *CSIRO Strategic Plan 2000-01* to 2002–03. The Strategic Plan sets out CSIRO's planned investment in specified outcomes and outputs across 22 Sectors of industry and the environment. It is supported by an annual *CSIRO Operational Plan* that details the planned activities and achievements of individual CSIRO Divisions and corporate units in support of the Strategic Plan.

Considerable progress has been made toward the development of a comprehensive set of quantitative and qualitative measures to assist in the management of CSIRO's performance and to enhance external accountability and reporting. One key area of focus has been the development of a process of 'customer value analysis and management'. This included the pilot testing of a new customer value survey and a two–day training course for senior CSIRO officers involved in managing key and major accounts. A second pilot survey – to test a new approach to the gathering of data on staff satisfaction – was also conducted during the year.

Coordination support was provided for 17 Strategic Task Groups convened by the new Chief Executive to provide input to the *CSIRO Strategic Action Plan 2001–02 – A New CSIRO for a New Century* – developed by the Executive Team in May 2001. The Strategic Action Plan outlines a bold approach to grow CSIRO by 50 per cent over the next five years with an increasingly strong 'service from science' orientation, greater focussing of resources, an emphasis on substantially increased partnering, and the development of strategies to reinvigorate CSIRO's commercialisation and business development processes.

CSIRO's preparation for the next triennial planning round also commenced during the year with external and internal consultations to help articulate the high level priority issues and research goals for Australia. This process has now come together with the emerging national approach to priority setting led by the Chief Scientist arising from the Government's report *Backing Australia's Ability*. Together with the ongoing Sector Advisory Committee processes, these overarching national considerations will help shape CSIRO's planned research portfolio and associated triennial funding negotiations with government for the 2003–04 to 2005–06 triennium.

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Legal and Intellectual Property >>

Legal and intellectual property services are an increasingly important component in CSIRO's technology transfer, commercial and other activities carried out in pursuit of the Organisation's statutory functions.

Legal services

CSIRO's Legal Group currently comprises thirteen corporate and divisional lawyers. At corporate level, principal legal activities include: provision of corporate governance advice and services to the Executive Team to assist in the effective management of CSIRO and the Organisation's compliance with its legal obligations, including relevant Federal, State and Territory legislation; provision of legal advice and services in support of commercial arrangements in which CSIRO is engaged (such as new business enterprise creation, joint ventures, research contracts, licensing arrangements and collaborations); and provision of litigation, arbitration, mediation, negotiation and reporting advice and services to assist CSIRO in the management of disputes and compliance with CSIRO's statutory reporting and insurance obligations.

CSIRO Legal also helps to provide legal training and information resources, such as the development of CSIRO commercial and legal intranet sites (providing access to relevant legislation, tools for commercialisation and standard form agreements) and preparation of training modules relating to general legal issues and conflicts of interest and duty.

Intellectual property services

Since 1993 CSIRO has used an external contractor, Intellectual Property Management Pty Ltd (IPM), to provide a range of services to support CSIRO in its handling of IP matters. IPM currently maintains a database of all CSIRO's registrable intellectual property and provides professional patent attorney advice. In June 2001, a consultative process for the possible re–tender for the supply of IP services to CSIRO was commenced. Intellectual property firms were invited to consult with CSIRO about the kinds of IP support services now available from the private sector and how CSIRO might best access such services in order to expand and optimise the value of, and returns from, its IP portfolio.

Major litigation

Litigation between CSIRO and Charter Pacific Corporation Ltd (CPC) was settled in September 2000 and the parties agreed to sever all commercial relations between them. The settlement terminated all court proceedings and also terminated CPC's rights to share in any future Exelgram commercialisation revenue.

CSIRO and the Commonwealth are defendants in litigation relating to the escape of Rabbit Calicivirus Disease from Wardang Island, South Australia in 1995. The litigation remains listed in the major torts list of the Supreme Court of Victoria. CSIRO and the Commonwealth have settled with a number of claimants; negotiations continue in relation to outstanding claims.

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5: Developments since 30 June 2001

Developments since 30 June 2001 >>

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.

We report the following significant developments.

Mr John Read was appointed Executive Director, Commercial and Finance.

CSIRO and New Zealand's Crop and Food Research have formed a research alliance called Ausgrainz. The trans–Tasman agreement between the public research organisations will expand the two countries' plant breeding efforts by widening access to international germplasm and building the scientific research base.

A Memorandum of Understanding was signed in August between CSIRO and Central Queensland University (CQU) which will co–locate CQU Plant Sciences Group, led by Professor David Midmore, to the CSIRO's J M Rendel Laboratory. This will utilise space not required by the CSIRO whilst still permitting the planned and previously announced expansion in the numbers of Division of Livestock Industry scientists at the Rendel Laboratory. CSIRO has undertaken to provide access for CQU to the facility for 10 years.

Section 6
Financial Statements

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 2001. The financial statements comprise:

- Statement by Board Members;
- Statement of Financial Performance;
- Statement of Financial Position;
- 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 entity which is consistent with my understanding of its financial position, the results of its operations and its cash flows.

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

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BARTON ACT
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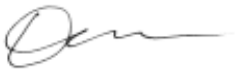
Audit Opinion

In my opinion,

(i) the financial statements have been prepared in accordance with Schedule 1 of the Commonwealth Authorities and Companies (Financial Statements 2000-2001) 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 1 of the Commonwealth Authorities and Companies (Financial Statements 2000-2001) Orders, of the financial position of the Commonwealth Scientific and Industrial Research Organisation as at 30 June 2001 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
6 September 2001

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

STATEMENT BY BOARD MEMBERS

In our opinion, the attached financial statements give a true and fair view of the matters required by Schedule 1 of the Commonwealth Authorities and Companies (Financial Statements 2000/2001) Orders made under the *Commonwealth Authorities and Companies Act 1997* for the year ended 30 June 2001.

Signed on the 3rd day of September 2001 in accordance with a resolution of the Board Members.

D Charles K Allen, AO

Chairman of the Board

Geoff G Garrett

Chief Executive and Board Member

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

STATEMENT OF FINANCIAL PERFORMANCE

For the year ended 30 June 2001

	Notes	2001 $'000	2000 $'000
Revenues from ordinary activities			
Revenues from Government	5.1	611 042	617 093
Sales of goods and services	5.2	250 453	250 417
Interest	5.3	6 444	6 251
Dividends	5.4	—	138
Net gains from sales of assets	5.5	10 238	9 363
Net foreign exchange gains	5.6	59	53
Other	5.7	7 067	11 635
Total revenues from ordinary activities		**885 303**	**894 950**
Expenses from ordinary activities			
Employees	6.1	445 269	437 902
Suppliers	6.2	259 821	255 246
Depreciation and amortisation	6.3	77 703	77 310
Write–down of assets	6.4	(430)	1 387
Other	6.5	1 240	2 950
Total expenses from ordinary activities		**783 603**	**774 795**
		101 700	**120 155**
Borrowing costs expense	6.6	(1 062)	(535)
Share of net operating surplus of joint ventures accounted for using the equity method	21(e)	361	268
Net operating surplus from ordinary activities	**19**	**100 999**	**119 888**
Net surplus attributable to the Commonwealth Government	**19**	**100 999**	**119 888**
Net credit to asset revaluation reserve	19	46 122	–
Total valuation adjustments recognised directly in equity	**19**	**46 122**	**–**
Total changes in equity other than those resulting from transactions with owners as owners		**147 121**	**119 888**

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

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

STATEMENT OF FINANCIAL POSITION

As at 30 June 2001

	Notes	2001 $'000	2000 $'000
ASSETS			
Financial Assets			
Cash	7	109 713	54 624
Receivables	8	47 447	45 401
Investments	9	28 789	90 774
Total financial assets		**185 949**	**190 799**
Non–Financial Assets			
Land and buildings	10	822 431	835 433
Plant and equipment	11	233 539	241 372
Inventories	12	896	745
Intangibles	13	4 994	6 325
Other	14	21 344	19 276
Total non–financial assets		**1 083 204**	**1 103 151**
Total assets		**1 269 153**	**1 293 950**
LIABILITIES			
Interest Bearing Liabilities			
Leases	15	43 234	20 397
Deposits – trust monies		8 477	9 464
Total interest bearing liabilities		**51 711**	**29 861**
Provisions			
Capital use charge	1.16	527	–
Employees	16	170 048	154 606
Total provisions		**170 575**	**154 606**
Payables			
Suppliers	17	23 911	28 299
Other	18	87 494	128 316
Total payables		**111 405**	**156 615**
Total liabilities		**333 691**	**341 082**
EQUITY			
Reserves	19	443 946	397 824
Accumulated surpluses	19	491 516	555 044
Total equity		**935 462**	**952 868**
Total liabilities and equity		**1 269 153**	**1 293 950**
Current assets		**292 609**	**153 133**
Non–current assets		**976 544**	**1 140 817**
Current liabilities		**198 400**	**173 505**
Non–current liabilities		**135 291**	**167 577**

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

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

STATEMENT OF CASH FLOWS

For the year ended 30 June 2001

	Notes	2001 $'000	2000 $'000
OPERATING ACTIVITIES			
Cash received			
Appropriations	5.1	611 042	617 093
Sales of goods and services		282 151	240 397
Dividends		—	138
Interest		6 444	6 251
GST recovered from Australian Taxation Office		8 593	—
		908 230	863 879
Cash used			
Employees		429 851	418 539
Suppliers		288 187	261 280
Borrowing		1 062	535
Other		987	6 831
		720 087	687 185
Net cash provided/(used) by operating activities	20	**188 143**	**176 694**
INVESTING ACTIVITIES			
Cash received			
Proceeds from sale of property, plant and equipment		110 539	17 124
Proceeds from sale of equity investment		3	10 596
		110 542	27 720
Cash used			
Purchase of property, plant and equipment		101 733	66 467
Purchase of equity investment		551	3 416
		102 284	69 883
Net cash provided/(used) by investing activities		**8 258**	**(42 163)**
FINANCING ACTIVITIES			
Cash received			
Proceeds from debt		22 837	593
Cash used			
Repayment of debt		62 731	—
Capital use paid to Government	19	104 409	112 804
Revenue measure – paid to Government	19	—	30 000
Proceeds from property sales – paid to Government	19	59 591	—
		226 731	142 804
Net cash provided/(used) by financing activities		**(203 894)**	**(142 211)**
Net increase/(decrease) in cash held		**(7 493)**	**(7 680)**
Cash at 1 July		144 214	151 894
Cash at 30 June	20	**136 721**	**144 214**

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

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

SCHEDULE OF COMMITMENTS

As at 30 June 2001

	2001	2000
	$'000	$'000
By Type		
Commitments payable		
Capital commitments		
Land and buildings	46 820	54 974
Plant and equipment	3 342	2 187
Total capital commitments	50 162	57 161
Other commitments		
Operating leases	329 524	18 439
Research and development commitments	284 069	275 256
Other commitments	8 583	12 054
Total other commitments	622 176	305 749
Total commitments payable	**672 338**	**362 910**
Commitments receivable		
Research and development commitments	246 670	230 681
Other receivables	6 490	4 231
Total commitments receivable	**253 160**	**234 912**
Net commitments payable	**419 178**	**127 998**
By Maturity		
All net commitments		
One year or less	79 657	58 736
From one to five years	91 843	63 408
Over five years	247 678	5 854
Net commitments payable	**419 178**	**127 998**
Operating lease commitments		
One year or less	19 198	8 669
From one to five years	58 228	8 397
Over five years	252 098	1 373
Total net operating lease commitments	**329 524**	**18 439**

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

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

SCHEDULE OF CONTINGENCIES

As at 30 June 2001

	2001 $'000	2000 $'000
Contingent losses		
Bank guarantees	109	–
Estimated legal claims arising from employment, motor vehicle accidents and contractual disputes. In addition, CSIRO had a number of other claims where the estimated amounts of eventual payments, if any, could not be quantified. CSIRO has denied liability and is defending the claims.	215	1 800
	324	1 800
Contingent gains		
Legal claims expected to succeed from recovery of debts.	(190)	(214)
Net contingencies	**134**	**1 586**

SCHEDULE OF UNQUANTIFIABLE CONTINGENCIES

As at 30 June 2001

Preliminary investigation by the CSIRO Environmental Management Committee identifies a range of potential environmental risks associated with storage of low–level radioactive waste at Woomera, South Australia, and low–level contamination of a number of sites with asbestos or other hazardous substances. The costs associated with the clean up of these sites have not been quantified.

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

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

For the year ended 30 June 2001

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

For the year ended 30 June 2001

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:

- Schedule 1 of the Commonwealth Authorities and Companies (Financial Statements 2000/2001) Orders made by the Finance Minister;
- Australian Accounting Standards and Accounting Interpretations issued by Australian Accounting Standards Boards;
- other authoritative pronouncements of the Boards; and
- the Consensus Views of the Urgent Issues Group.

In addition, the statements are prepared having regard to:

- Statements of Accounting Concepts;
- the Explanatory Notes to Schedule 1 of the Orders issued by the Department of Finance and Administration; and
- Guideline Notes issued by that Department.

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.

Assets and liabilities are recognised in the Statements of Financial Position when and only when it is probable that future economic benefits will flow and the amounts of the assets or liabilities can be reliably measured. Assets and liabilities arising under agreements equally proportionately unperformed are however not recognised unless required by an Accounting Standard. Liabilities and assets, which are unrecognised, are reported in the Schedule of Commitments and the Schedule of Contingencies.

Revenues and expenses are recognised in the Statements of Financial Performance when and only when the flow or consumption or loss of economic benefits has occurred and can be reliably measured.

1.2 Consolidation

CSIRO acquired five R&D Syndication companies listed in Note 9 when investors in the Syndications exercised their put options under the agreements. These companies are in the process of being wound up by members' voluntary liquidation in 2001/2002. In addition, during the year CSIRO has either acquired or incorporated four subsidiary companies listed in Note 9 as vehicles for the commercialisation of its intellectual properties.

These R&D Syndicates and new R&D subsidiaries do not have a material effect on CSIRO's financial statements and as a result they have not been consolidated.

1.3 Revenue Recognition

Parliamentary appropriation revenue is recognised at the time CSIRO becomes entitled to receive the revenue. Revenues from Government are 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 14) or contract research revenue received in advance (Note 18) in the Statement of Financial Position. 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.

1.4 Resources Received Free of Charge

Services received free of charge are recognised in the Statement of Financial Performance 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.

1.5 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 2001 no research and development costs or intellectual property have been capitalised.

1.6 Property, Plant and Equipment

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the Statement of Financial Position, except for purchases costing less than $3 000, which are expensed in the year of acquisition.

Revaluations

Property, plant and equipment are revalued in accordance with the "deprival" method of valuation every three years, so that no asset has a value greater than three years old.

Land, which will continue to be used for research activity, was valued by CSIRO's registered valuer as at 30 June 1999 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.

Buildings and leasehold improvements, which will continue to be used for research activities, were valued as at 30 June 1999 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.

Land and buildings designated for possible sale were valued at market value as at 1 July 2000 by registered independent valuers. The net revaluation increase of $46 122 600 was credited to the Asset Revaluation Reserve (Note 19).

Plant and equipment with historical costs of $75 000 and over was revalued by the Australian Valuation Office as at 1 July 1998 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.

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 24.

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.

Depreciation/amortisation rates (ie useful lives) and methods are reviewed at each balance date and necessary adjustments are recognised in the current, or 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 have been reviewed to determine whether they are in excess of their recoverable amounts. 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 was made as a result of the review.

1.7 Intangibles

Internally developed and externally acquired computer software with an estimated cost of more than $250 000 threshold had been valued by the Australian Valuation Office as at 30 June 2000 using the "deprival" method (Note 13). The effect of this change in accounting policy increased last years 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.

1.8 Investments

Australian Accounting Standard, AAS38 on "Valuation of Non–Current Assets" allows a choice to either adopt the cost basis or the fair value basis in the valuation of its investments. CSIRO has elected the early adoption of AAS38 as at 30 June 2001 and valued its investments at cost, which is not in excess of their recoverable amounts.

CSIRO fully provides for diminution in value of its investment in unlisted R&D associate and subsidiary companies due to the inherent business risk of these companies involved in R&D and high technology industries (Note 9).

CSIRO has adopted the cost basis to account for its interest in the R&D associate companies. They are not material and are held with the intent for sale in the near future, as a result the equity method of accounting is not adopted.

1.9 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 Statement of Financial Performance on a basis which is representative of the pattern of benefits derived from the leased assets.

1.10 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 2001 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 2001. In determining the present value of the liability, attrition rates and pay increases through promotion and inflation have been taken into account.

Provision for severance pay in respect of term staff was recognised at its nominal value.

Separation, redundancy and relocation

Provision is made for separation and redundancy payments in circumstances 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 employees' superannuation by contributing to the Commonwealth Superannuation Scheme (CSS) and the Public Sector Superannuation Scheme (PSS), 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 Superannuation Productivity Benefit is contributed for CSS and PSS members. For term employees who have chosen not to join CSS or PSS, a 8% employer productivity superannuation benefit is contributed to Australian Government Employees Superannuation Trust (AGEST) or other eligible superannuation funds.

1.11 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.

1.12 Insurance

As part of its risk management strategy, CSIRO has insured for risks through the Commonwealth Government's insurable risk 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. There is a deductible on each of the above insurances, the largest being $650 000.

1.13 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.

1.14 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.

1.15 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.

1.16 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 reduced to take account of asset gifts and revaluation increments during the financial year.

1.17 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 receivables outstanding for more than 90 days at year–end and any other specific debt where the collection of the full amount is considered doubtful.

1.18 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 Statement of Financial Performance.

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.

1.19 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.

1.20 Rounding

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

- remuneration of Board Members;
- remuneration of Officers;
- remuneration of auditors; and
- investment at cost in companies which are less than $1 000 (Note 9(b)).

1.21 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 21.

1.22 Financial Instruments

Accounting policies for financial instruments are stated in Note 32.

1.23 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.

1.24 Reporting by Outcomes

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

1.25 Comparative Figures

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

Note 2 Economic Dependency

CSIRO was established by the *Science and Industry Research Act 1949* and is controlled by the Commonwealth of Australia.

It receives approximately two thirds of its funding from Commonwealth Parliamentary appropriations and it has no expressed borrowing powers under its enabling legislation.

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".

	2001		2000	
	Actual	Budget	Actual	Budget
	$'000	$'000	$'000	$'000
(a) Reporting by outcome for 2000/2001				
Revenues				
Revenue from Government Appropriations	610 032	610 032	597 540	597 540
Additional estimates of revenue from Government – Appropriation Acts 3 & 4	1 010	1 010	19 553	19 553
	611 042	611 042	617 093	617 093
Revenue from other sources	274 622	276 169	278 125	252 952
Increase to original revenue from other sources	–	–	–	11 709
	274 622	276 169	278 125	264 661
Total revenues	**885 664**	**887 211**	**895 218**	**881 754**
Net cost to budget outcome	**889 601**	**887 211**	**888 134**	**881 754**
Total assets deployed as at 30 June	1 269 153	1 318 447	1 293 950	1 288 150
Net assets deployed as at 30 June	935 462	944 709	952 868	945 784
(b) Report by outcome by funding source for 2000/2001				
Expenses against revenue from Government Appropriations	611 042	611 042	617 093	617 093
Expenses against revenue from other sources	278 559	276 169	271 041	264 661
Total expenses against output	**889 601**	**887 211**	**888 134**	**881 754**

	Notes	2001 $'000	2000 $'000

Note 5 Operating Revenues

5.1 Revenues from Government

Appropriations for outputs	4	611 042	617 093

5.2 Sales of goods and services

Research and development activities		215 208	219 106
Agriculture, Fisheries and Forestry – Australia – contribution to the operation of the Australian Animal Health Laboratory National Facility		6 129	6 129
Consultancies, collaboration and testing fees		11 221	8 121
Publications, research products and processes		8 619	8 802
Royalties and license fees		9 276	8 259
		250 453	250 417

5.3 Interest

Bank and term deposits		6 444	6 251

5.4 Dividends

Other company		–	138

5.5 Net gains/(losses) from sales of assets

Property, plant and equipment		11 236	751
Shares		(998)	8 612
		10 238	9 363

5.6 Net foreign exchange gains

Non–speculative		59	53

5.7 Other revenues

Contributions – staff and others		1 241	1 267
Donations		2 952	713
Rental		2 874	3 330
Computer software brought to account as a result of a change in accounting policy	13	–	6 325
		7 067	11 635

	2001 $'000	2000 $'000

Note 6 Operating Expenses

6.1 Employees expenses

Remuneration for services provided	432 833	418 320
Separation and redundancy	12 436	19 582
	445 269	437 902

6.2 Suppliers

Supply of goods and services	250 583	247 074
Operating lease rentals	9 238	8 172
	259 821	255 246

6.3 Depreciation and amortisation

Depreciation and amortisation of property, plant and equipment	74 756	76 521
Amortisation of finance leased assets	1 616	789
Amortisation of intangibles	1 331	–
	77 703	77 310

6.4 Write–down of assets

Bad debts	102	240
Receivables – increase in provision for doubtful debts	468	(98)
Investment – provision for diminution in value written back	(1 000)	1 245
	(430)	1 387

6.5 Other expenses

Contamination clean up and other	1 240	2 950

6.6 Borrowing costs expense

Finance charges on lease liabilities	1 062	535

Note 7 Cash

Cash at bank and on hand	43 327	15 160
Cash at bank – trust monies	8 477	9 464
Deposits – at call	57 909	30 000
Total cash	**109 713**	**54 624**

	Notes	2001 $'000	2000 $'000

Note 8 Receivables

Goods and services		44 124	31 410
Provision for doubtful debts		(999)	(535)
		43 125	30 875
Property sales		–	6 986
Other		4 322	7 540
Total receivables		**47 447**	**45 401**
Gross receivables which are overdue are aged as follows:			
Not overdue		34 904	37 293
Overdue by:			
Less than 30 days		7 364	5 465
30 to 60 days		3 723	1 334
60 to 90 days		885	885
More than 90 days		1 570	959
		13 542	8 643
Total gross receivables		**48 446**	**45 936**

Note 9 Investments

R&D Syndicate deposits – under contract	23	27 008	89 590
Shares – at cost	**% CSIRO interest**		
Unlisted associate companies (a)			
Dunlena Pty Ltd	47.0	5	5
Gene Shears Pty Ltd	50.0	580	580
Gropep Pty Ltd	–	–	545
X–Ray Technologies Pty Ltd	33.1	1 290	1 290
Ceramic Fuel Cells Ltd	20.3	1 879	1 813
Quantm Pty Ltd	–	–	1 001
Quickstep Holdings Pty Ltd	22.5	480	–
		4 234	5 234
Provision for diminution in value	1.8	(4 234)	(5 234)
		–	–
Unlisted subsidary companies (b)	1.2	–	–
Listed companies (c)			
Australian Magnesium Corporation Ltd		1 126	1 126
Gropep Limited		545	–
Woolstock Australia Limited		55	–
		1 726	1 126
Other unlisted companies			
Unlisted entities		10	58
Investment in joint venture entity accounted for using the equity method	21(e)	45	–
Total investments		**28 789**	**90 774**

Note 9 Investments (cont)

(a) Associate Companies

Names	Principal 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.
Quickstep Holdings Pty Ltd	Development and sale of the Quickstep™ process manufacturing technology for uses with polymer composite.
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. This company was sold during the year.
Gropep Pty Ltd	Development, manufacture, licensing and sale of biotechnology products. This company was listed on the Australian Stock Exchange and changed its name to Gropep Limited during the year.

(b) Subsidiary Companies – Fully Owned

(i) R&D Syndication Companies

The following companies were acquired when investors in the Syndication exercised their put options under the agreements:

Exsynd 1 Pty Ltd
Exsynd 2 Pty Ltd
Exsynd 3 Pty Ltd
Exsynd 4 Pty Ltd
Exsynd 5 Pty Ltd

(ii) R&D Start–up Companies

The following companies which cost less than $1 000 have either been acquired or incorporated to commercialise CSIRO's intellectual properties:

	2001	2000
	$	$
Aries Information Services Pty Ltd	2	1
CSIRO Bioinformatics Pty Ltd	12	–
Goldwood Holdings Pty Ltd	2	–
Inmag Pty Ltd	12	–
	28	1
Provision for diminution in value	(28)	(1)
	–	–

	2001 $'000	2000 $'000

Note 9 Investments (cont)

(c) Listed Companies

The quoted market value of the following listed companies as at 30 June 2001 were:

Australian Magnesium Corporation Ltd	671	716
Gropep Limited	24 904	unlisted
Woolstock Australia Limited	54	–
	25 629	716

Note 10 Land and buildings

Land		
At cost	1 238	774
At June 1999 valuation	109 070	149 330
At July 2000 valuation*	45 383	–
	155 691	150 104
Buildings		
At cost	23 861	11 779
At June 1999 gross valuation	1 044 711	1 219 665
At July 2000 gross valuation*	43 195	–
	1 111 767	1 231 444
Accumulated depreciation	(548 649)	(624 353)
	563 118	607 091
Capital works in progress – at cost	27 173	23 658
	590 291	630 749
Leasehold improvements		
At cost	3 227	642
At June 1999 gross valuation	65 815	77 101
	69 042	77 743
Accumulated amortisation	(31 149)	(40 204)
	37 893	37 539
Buildings under finance lease		
At cost	22 524	–
At June 1999 gross valuation	20 827	20 827
	43 351	20 827
Accumulated amortisation	(4 795)	(3 786)
	38 556	17 041
Total land and buildings	**822 431**	**835 433**

**These properties are designated for sale.*

Note 11 Plant and equipment

	2001 $'000	2000 $'000
Plant and equipment		
At cost	112 081	81 426
At July 1998 gross valuation	439 991	452 842
	552 072	534 268
Accumulated depreciation	(343 761)	(317 980)
	208 311	216 288
Research vessels		
At cost	670	654
At July 1998 gross valuation	46 093	46 138
	46 763	46 792
Accumulated depreciation	(25 822)	(23 928)
	20 941	22 864
Plant and equipment under finance lease		
At cost	5 108	2 434
At July 1998 gross valuation	100	100
	5 208	2 534
Accumulated amortisation	(921)	(314)
	4 287	2 220
Total plant and equipment	**233 539**	**241 372**

Note 11 Plant and equipment (cont)

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

Movement summary 2000/2001 for all assets irrespective of valuation basis

Description	Land	Buildings	Total Land & Buildings	Plant and Equipment	Intangibles (Note 13)	Total
	$'000	$'000	$'000	$'000	$'000	$'000
Gross value as at 1.7.00	150 104	1 353 672	1 503 776	583 595	15 480	2 102 851
Additions	3 048	63 268	66 316	35 417	–	101 733
Revaluations increase/(decrease)	55 369	(97 009)	(41 640)	–	–	(41 640)
Disposals	(52 830)	(68 598)	(121 428)	(14 969)	–	(136 397)
Gross value as at 30.6.2001	155 691	1 251 333	1 407 024	604 043	15 480	2 026 547
Accumulated depreciation/ amortisation as at 1.7.00	–	668 343	668 343	342 223	9 155	1 019 721
Depreciation/amortisation	–	35 275	35 275	41 097	1 331	77 703
Revaluations increase/(decrease)	–	(87 762)	(87 762)	–	–	(87 762)
Adjustment for disposals	–	(31 263)	(31 263)	(12 816)	–	(44 079)
Accumulated depreciation/ amortisation as at 30.06.01	–	584 593	584 593	370 504	10 486	965 583
Net book value as at 30.06.01	**155 691**	**666 740**	**822 431**	**233 539**	**4 994**	**1 060 964**
Net book value as at 30.06.00	**150 104**	**685 329**	**835 433**	**241 372**	**6 325**	**1 083 130**

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

Description	Land	Buildings	Plant and Equipment	Intangibles	Total 2001	Total 2000
	$'000	$'000	$'000	$'000	$'000	$'000
Freehold	92 725	451 713	–	–	544 438	692 460
Commonwealth Crown Leases	4 318	145 940	–	–	150 258	204 516
Leasehold	–	69 042	–	–	69 042	77 743
National Facilities	8 765	470 919	200 869	–	680 553	675 414
Deed of Grant	–	–	–	–	–	2 535
Finance Lease	4 500	43 351	5 208	–	53 059	27 861
Designated for Sale	45 383	43 195	–	–	88 578	–
Capital Works in Progress	–	27 173	–	–	27 173	23 658
	155 691	1 251 333	206 077	–	1 613 101	1 704 187
Plant and Equipment	–	–	397 966	–	397 966	383 184
Intangibles	–	–	–	15 480	15 480	15 480
Gross value	155 691	1 251 333	604 043	15 480	2 026 547	2 102 851
Accumulated depreciation/amortisation	–	(584 593)	(370 504)	(10 486)	(965 583)	(1 019 721)
Net book value as at 30 June	**155 691**	**666 740**	**233 539**	**4 994**	**1 060 964**	**1 083 130**

Note 11 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.
Designated for sale	Properties identified for sale due to rationalisation and consolidation of research sites and a joint property review by CSIRO and Department of Finance and Administration.
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. Where this is the case the property is valued at "existing use value".

(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	424 164	–	–	46 755	470 919
Accumulated depreciation	(203 127)	–	–	(22 646)	(225 773)
	221 037	–	–	24 109	245 146
Plant and equipment	8 165	147 976	29 345	15 383	200 869
Accumulated depreciation	(6 367)	(79 097)	(18 374)	(8 275)	(112 113)
	1 798	68 879	10 971	7 108	88 756
Net book value as at 30.6.01	**231 600**	**68 879**	**10 971**	**31 217**	**342 667**
Net book value as at 30.6.00	**244 631**	**71 630**	**12 458**	**28 223**	**356 942**

The operating expenses for the above National Facilities for the financial year amounted to $51 335 089 (2000 $49 651 704) are included in CSIRO's Statement of Financial Performance.

	Notes	2001 $'000	2000 $'000
Note 12 Inventories held for resale			
Books and media products – at lower of cost and net realisbale value	1.14	896	745
Total inventories held for resale		**896**	**745**
Note 13 Intangibles			
Computer software	1.7		
At June 2000 gross valuation		15 480	15 480
Accumulated amortisation		(10 486)	(9 155)
Total intangibles – net book value		**4 994**	**6 325**
Note 14 Other non–financial assets			
Contract research work in progress – at cost	1.3	19 272	17 985
Prepaid property rentals		1 611	781
Other prepayments		461	510
Total other non–financial assets		**21 344**	**19 276**
Note 15 Leases			
Finance lease liability is payable as follows:			
Within one year		4 380	1 656
Within one to five years		15 365	5 743
More than five years		30 313	16 809
		50 058	24 208
Service and maintenance charges		–	(1)
Minimum lease payments		50 058	24 207
Future finance charges		(6 824)	(3 810)
Total finance lease liability		**43 234**	**20 397**
Lease liability is represented by:			
Current		3 426	1 116
Non–Current		39 808	19 281
		43 234	**20 397**

	Notes	2001 $'000	2000 $'000

Note 16 Employees

Accrued wages and salaries		10 808	10 838
Provision for recreation leave		49 222	42 964
Provision for long service leave		97 283	91 614
Provision for severance pay		3 721	2 860
Provision for redundancy		9 014	6 330
Total employee entitlement liability		**170 048**	**154 606**

Note 17 Suppliers

Trade creditors		23 911	28 299
Total suppliers' liability		**23 911**	**28 299**

Note 18 Other liabilities

Contract research revenue received in advance		39 536	31 274
R&D Syndicates – under contract	9, 23	27 008	89 740
Other creditors		9 336	4 461
Provisions – other		3 740	2 500
GST payable		7 874	341
Total other liabilities		**87 494**	**128 316**

Note 19 Equity – movement summary 2000/2001

Description	Accumulated Surplus		Asset Revaluation Reserve		Total Equity	
	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000
Balance as at 1 July	555 044	577 960	397 824	397 824	952 868	975 784
Operating surplus	100 999	119 888	–	–	100 999	119 888
Revenue measure (a)	–	(30 000)	–	–	–	(30 000)
Equity repayment (b)	(59 591)	–	–	–	(59 591)	–
Capital use charge (note 1.16)	(104 936)	(112 804)	–	–	(104 936)	(112 804)
Net revaluation increase (c)	–	–	46 122	–	46 122	–
Balance as at 30 June	**491 516**	**555 044**	**443 946**	**397 824**	**935 462**	**952 868**

(a) Revenue measure – payment to Government

In agreeing to CSIRO's appropriation budget for the triennium (1997–1998 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 19 Equity – movement summary 2000/2001 (cont)

(b) Equity repayments

Following a joint (CSIRO/Department of Finance and Administration) review of CSIRO's property holdings, six properties (in ACT, NSW, QLD and WA) were identified for sale and leaseback over the next three years. CSIRO will make equity repayments to the Government of proceeds from the sale of these properties. The first property at North Ryde, NSW was sold and gross proceeds of $59 591 303 was repaid to the Government in June 2001.

To ensure these sales have no adverse financial impact on CSIRO's research activities, CSIRO will receive Government funding for additional sale and ongoing additional rental costs.

	Notes	2001 $'000	2000 $'000
(c) Asset revaluation reserve			
The net revaluation increase in the asset revaluation reserve comprises:			
Revaluation increase/(decrease) of properties designated for sale			
– land		55 369	–
– buildings and leasehold improvements		(9 247)	–
Net revaluation increase		**46 122**	**–**

Note 20 Statement of cash flows reconciliation

(a) For the purpose of the Statement of Cash Flows, cash is represented by:			
Cash at bank and on hand	7	43 327	15 160
Cash at bank – trust monies	7	8 477	9 464
Deposits – at call	7	57 909	30 000
R&D Syndicate deposits – under contract	9, 23	27 008	89 590
		136 721	**144 214**

(b) Reconciliation of operating surplus to net cash provided by operating activities:			
Operating surplus		**100 999**	**119 888**
Depreciation and amortisation of property, plant and equipment	6	76 372	77 310
Amortisation of intangibles	6	1 331	–
Increase/(decrease) in provision for diminution in value	9	(1 000)	1 245
(Profit)/loss on disposal of property, plant and equipment	5	(11 236)	(751)
(Profit)/loss on disposal of shares	5	998	(8 612)
(Increase)/decrease in receivables	8	(9 033)	(8 592)
(Increase)/decrease in intangibles	13	–	(6 325)
(Increase)/decrease in inventories	12	(151)	(196)
(Increase)/decrease in investment in joint venture, FSA	21	(361)	–
(Increase)/decrease in other assets	14	(2 068)	1 056
Increase/(decrease) in employee liabilities	16	15 442	10 663
Increase/(decrease) in liability to suppliers	17	(4 388)	2 460
Increase/(decrease) in other liabilities	18	14 692	(4 961)
Increase/(decrease) in GST liability	18	7 533	341
Increase/(decrease) in trust monies liability		(987)	(6 832)
Net cash provided by operating activities		**188 143**	**176 694**

Note 21 Joint ventures

CSIRO participates in a number of joint ventures. In accordance with AAS19, these are segregated into joint venture operations and joint venture entities.

(a) Joint Venture Operations – Cooperative Research Centres (CRCs)

The Cooperative 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.

During the financial year, CSIRO's total actual 'in kind' and cash contributions to CRCs from its own resources was $50.3 million; together with monies from the Commonwealth Government and external sources specifically for the CRCs, the total expended was $78.6 million. CSIRO's contributions and expenses are included in the Statement of Financial Performance. CSIRO's total actual contributions life to date for CRCs listed below amounted to $402.1 million. As the success of CRC's is dependent on uncertain R&D outcomes, the value of CSIRO's contributions does not necessarily represent equity value.

Approximately $16 million or 7% of CSIRO's total plant and equipment assets are used for CRC activities.

At 30 June 2001, CSIRO is a participant in 44 CRCs and CSIRO's interest in each of the CRCs is determined by the individual CRC agreement. These are:

Names of Cooperative 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
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
Costal Zone, Estuary and Waterway Management	27
Freshwater Ecology	9
Greenhouse Accounting	16
Sustainable Development of Tropical Savannas	12
Tropical Rainforest Ecology and Management	33
Waste Management and Pollution Control	8
Water Quality and Treatment	13
Weed Management Systems	31

Note 21 Joint ventures (cont)

Names of Cooperative Research Centres	CSIRO's Equity Interest (%) (excluding Commonwealth contributions)
INFORMATION AND COMMUNICATION TECHNOLOGY	
Advanced Computational Systems	34
Australian Telecommunications	4
Enterprise Distributed Systems Technology	21
Satellite Systems	25
MANUFACTURING TECHNOLOGY	
Bioproducts	61
Cast Metals Manufacturing*	30
Intelligent Manufacturing Systems and Technologies*	7
International Food Manufacture	11
Microtechnology	9
Polymers*	28
Welded Structures*	14
MEDICAL SCIENCE AND TECHNOLOGY	
Cellular Growth Factors	8
Diagnostic Technologies	20
Eye Research and Technology	21
Tissue Growth and Repair	22
Vaccine Technology	26
MINING AND ENERGY	
A J Parker CRC for Hydrometallurgy	50
Australian Mineral Exploration	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

Note 21 Joint ventures (cont)

(b) Joint Venture Operations – High Performance Computing and Communication Centre (HPCCC)

CSIRO participates in a joint venture operation with the Bureau of Meteorology (BOM) in a 50/50 ownership and operation of a 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 $8.5 million (2000 $6.5 million) written down value and its share of operating expenses are included in CSIRO's Statement of Financial Position and Statement of Financial Performance respectively.

(c) Joint Venture Operations – Graingene

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 Statement of Financial Performance.

(d) Joint Venture Operations – other

In addition, CSIRO has collaborative arrangements with other parties to perform research and share in the outputs (ie 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 Statement of Financial Performance.

(e) Joint Venture Entities – Food Science Australia (FSA)

CSIRO has a 50% interest in an unincorporated joint venture, 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 $722 000 (2000 $309 317). 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 $361 000 (2000 $154 658). CSIRO's investment in FSA has been accounted for using the equity method.

	2001	2000
	$'000	$'000
Investment/(liability) in FSA at 1 July	(316)	(584)
Share of FSA's reduction in 1998–99 operating deficit	–	114
Share of FSA's net operating surplus for the year	361	154
Investment in joint venture entity, FSA accounted for using the equity method as at 30 June	**45**	**(316)**

Note 22 Related entities

During the financial year CSIRO provided actual in–kind contributions in the form of scientific staff and research facilities totalling $1 390 146 (2000 $2 597 894) 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 Statement of Financial Performance.

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 2001 CSIRO has a 60.2% beneficial interest in the company and its in–kind contributions to 30 June 2001 amounted to $32 million.

Note 23 Research and development syndicates

As at 30 June 2001, CSIRO is a party to an agreement whereby the Research and Development Syndicate has 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 9) are held as security to meet CSIRO's obligations (Note 18) to purchase the intellectual property held by the Syndicate, at the guaranteed option price, should the investors elect to sell. Investors of two R&D Syndicates have exercised their put options during the year under the agreements and the R&D Syndicate deposits held under contract were paid to the investors.

Note 24 Resources made available to CSIRO and not included in the Statement of Financial Position

	Land	Buildings	Plant and equipment	Total
	$'000	$'000	$'000	$'000
At valuation or cost	12 376	60 837	34 345	107 558
Accumulated depreciation	–	(38 697)	(30 983)	(69 680)
Net value as at 30.6.2001	**12 376**	**22 140**	**3 362**	**37 878**
Net value as at 30.6.2000	**14 141**	**23 437**	**3 070**	**40 648**

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 1.6, 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 Statement of Financial Performance. 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 contributor of the above assets is Australian Wool Innovation Pty Limited.

Note 25 Monies held in trust

	2001 $'000	2000 $'000
Monies held in trust which are not included in the Statement of Financial Position.		
They are represented by cash at bank and the following investments in equities, bank securities and term deposits:		
Investments		
M F Cash Management Fund*	694	725
Potter Warburg Cash Management Ltd**	49	103
One Eleven Nominees Pty Ltd**	609	457
Members Australia Credit Union Ltd**	583	560
	1 935	1 845
Cash at bank	466	418
Total monies held in trust as at 30 June	**2 401**	**2 263**

* *Relates to the Ken and Yasuko Myer Plant Science Research Fund*
** *Relates to the Elwood and Hannah Zimmerman Trust Fund*

(a) The components of trust funds are as follows:

The Ken and Yasuko Myer Plant Science Research Fund	779	818
The Elwood and Hannah Zimmerman Trust Fund	1 241	1 120
The Australian National Wildlife Collection Foundation	381	325
Total monies held in trust as at 30 June	**2 401**	**2 263**

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.

Note 25 Monies held in trust (cont)

(b) Movements of trust funds summary

	Myer	Zimmerman	ANWC Foundation	Total 2001
	$'000	$'000	$'000	$'000
Balance at 1 July	822	1 120	325	2 267
Receipts during year	62	–	76	138
Interest and dividend	102	141	18	261
Expenditure	(207)	(20)	(38)	(265)
Balance at 30 June	**779**	**1 241**	**381**	**2 401**

Note 26 Remuneration of auditors

	2001 $	2000 $
Remuneration to the Auditor–General for:		
Auditing the financial statements for the reporting period	**195 000**	**205 000**

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

Note 27 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 main 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 SubAntarctic 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.

	2001 $	2000 $

Note 28 Remuneration of Board Members

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

Board Members' remuneration	820 502	692 934
Payments to superannuation funds for Board Members	74 263	93 479
	894 765	**786 413**

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

$			2001 Number	2000 Number
Nil	–	10 000	2	2
10 001	–	20 000	1	–
20 001	–	30 000	4	5
30 001	–	40 000	1	–
50 001	–	60 000	1	1
160 001	–	170 000	1	–
250 001	–	260 000	–	1
350 001	–	360 000	–	1
520 001	–	530 000	1*	–

* *Includes salary and other payments for the retiring acting Chief Executive*

Note 29 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
G G Garrett (appointed 8/1/2001)	3	3	2	2
A J Gandel	6	5	–	–
R A Higgins	6	6	–	–
C B Livingstone (appointed 1/1/2001)	3	2	–	–
D P Mercer	6	6	4	3
D F J McDonald	6	5	–	–
M J O'Kane	6	5	–	–
A E de N Rogers	6	5	4	4
V R Sara	6	4	–	–
C M Adam (term ended 7/1/2001)	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 30 Remuneration of Officers

	2001 $	2000 $
Remuneration received or due and receivable by Officers	**1 808 695**	**1 829 282**

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

$			2001 Number	2000 Number
Nil	–	100 000	–	1
160 001	–	170 000	1	–
190 001	–	200 000	–	2
220 001	–	230 000	–	2
250 001	–	260 000	–	1
260 001	–	270 000	1	–
270 001	–	280 000	1	1
280 001	–	290 000	1	–
290 001	–	300 000	1	–
350 001	–	360 000	–	1
520 001	–	530 000	1*	–

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

**Includes salary and other payments for the retiring acting Chief Executive.*

Note 31 Related party disclosures

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

D C K Allen (Chairman)	A J Gandel	G G Garrett (appointed 8/1/2001)
M J O'Kane	R Higgins	A E de N Rogers
D P Mercer	V R Sara	D F McDonald
C B Livingstone (appointed 1/1/2001)		C M Adam (term ended 7/1/2001)

Remuneration – Information on remuneration of Board Members is disclosed in Note 28.

Board Members' interests in contracts

Since 1 July 2000 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 28 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.

Note 31 Related party disclosures (cont)

Other transactions of Board Members – related entities

Dr C M Adam is a Director of an associate company, Ceramic Fuel Cells Ltd and Strategic Industry Research Foundation Ltd. These companies have had contractual relationships with CSIRO which are based on normal commercial terms and conditions in the field of research and development.

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, the Australian Research Council, Australian Tourist Commission, and the Australian Sports Commission. All contracts and transactions between these entities and CSIRO are based on normal commercial terms and conditions and there is no personal benefit to him.

Mr D P Mercer is the Chairman of Orica Ltd and Australia Pacific Airports Ltd. He is a Director of Australian Prudential Regulating Authority and Chancellor of Royal Melbourne Institute of Technology (RMIT). Orica Ltd has commercial relationships with CSIRO and 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 Adelaide University. There are transactions and other arrangements between CSIRO and the Adelaide University. 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 Ltd. 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 Pty Ltd, Chairman of the 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 Officer. She was Chair of the Australian Research Council from September 1997 to 30 June 2001, and from 1 July 2001 is Chief Executive Officer, Australian Research Council. She is also a member of several Government committees including the National Innovation Awareness Council, the Biotechnology Centre of Excellence Expert Panel, the ICT Centre of Excellence Advisory Panel, the Cooperative Research Centres Committee and the Coordinating Committee on Science and Technology. The transactions with these entities, if any, are based on commercial terms and conditions.

Note 32 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	7	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. 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	7	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	8	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.
R&D Syndicate deposits – under contract	9	These deposits are recognised at their nominal amounts. Interest is brought to account as it accrues in accordance with R&D Syndicate agreements (Notes 9 and 23).	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	9	These are carried at the lower rate of cost or recoverable amounts. No dividends have been declared or paid by the investee.	

Note 32 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	15	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 3.3% p.a. (2000 4.1%). The lease liabilities are secured by the lease assets and disclosed in Notes 10 and 11.
Trade creditors and other creditors	17 & 18	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	18	These liabilities are recognised at their nominal amounts. Interest is brought to account as it accrues in accordance with R&D Syndicate agreements (Notes 9 and 23).	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	18	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 2001.	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.

Note 32 Financial instruments (cont)

(b) Interest rate risk

Financial Instrument	Notes	Floating Interest Rate		Fixed Interest Rate: 1 year or less		Fixed Interest Rate: 1 to 2 years		Fixed Interest Rate: 2 to 5 years		Fixed Interest Rate: > 5 years		Non Interest Bearing		Total		Weighted Average Effective Interest Rate	
		2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 $'000	2000 $'000	2001 %	2000 %
Financial assets (recognised)																	
Cash at bank and cash on hand	7	43 327	15 160											43 327	15 160	6.0	6.2
Cash at bank - trust monies	7	8 477	9 464											8 477	9 464	6.0	6.2
Deposits - at call	7			57 909	30 000									57 909	30 000	6.3	6.5
Receivables for goods and services	8											43 125	30 875	43 125	30 875	n/a	n/a
Receivables for property sales	8											–	6 986	–	6 986	n/a	n/a
Other receivables	8											4 322	7 540	4 322	7 540	n/a	n/a
R&D Syndicate deposits	9									27 008	89 590			27 008	89 590	9.8	9.8
Shares	9											1 781	1 184	1 781	1 184	n/a	n/a
Total financial assets (recognised)		**51 804**	**24 624**	**57 909**	**30 000**	**–**	**–**	**–**	**–**	**27 008**	**89 590**	**49 228**	**46 585**	**185 949**	**190 799**		
Total Assets														**1 269 153**	**1 293 950**		
Financial liabilities (recognised)																	
Finance lease liabilities	15			–	13 728			7 053	6 669	36 181	–			43 234	20 397	3.3	4.1
Trade creditors	17											23 911	28 299	23 911	28 299	n/a	n/a
Research revenue received in advance	18											39 536	31 274	39 536	31 274	n/a	n/a
R&D syndicates - under contract	18									27 008	89 590	–	150	27 008	89 740	9.8	9.8
Trust monies		8 477	9 464											8 477	9 464	6.0	6.2
Other creditors	18											9 336	4 461	9 336	4 461	n/a	n/a
GST Payable	18											7 874	341	7 874	341	n/a	n/a
Total financial liabilities (recognised)		**8 477**	**9 464**	**–**	**13 728**	**–**	**–**	**7 053**	**6 669**	**63 189**	**89 590**	**80 657**	**64 525**	**159 376**	**183 976**		**n/a**
Total liabilities														**333 691**	**341 082**		
Legal claims & bank guarantees												324	1 800	324	1 800		n/a
Total financial liabilities (unrecognised)												**324**	**1 800**	**324**	**1 800**		

Note 32 Financial instruments (cont)

(c) Net fair values of financial assets and liabilities

	Notes	2001 Total carrying amount $'000	2001 Aggregate net fair value $'000	2000 Total carrying amount $'000	2000 Aggregate net fair value $'000
Financial assets					
Cash at bank and on hand	7	43 327	43 327	15 160	15 160
Cash at bank – trust monies	7	8 477	8 477	9 464	9 464
Deposits at call	7	57 909	57 909	30 000	30 000
Receivables for goods and services	8	43 125	43 125	30 875	30 875
Receivables for property sales	8	–	–	6 986	6 986
Other receivables	8	4 322	4 322	7 540	7 540
R&D Syndicate deposits – under contract	9	27 008	27 008	89 590	89 590
Shares	9	1 781	25 684	1 184	774
		185 949	**209 852**	**190 799**	**190 389**
Financial liabilities (recognised)					
Finance lease liabilities	15	43 234	43 234	20 397	20 397
Trade creditors	17	23 911	23 911	28 299	28 299
Research revenue received in advance	18	39 536	39 536	31 274	31 274
R&D Syndicate – under contract	18	27 008	27 008	89 740	89 740
Trust monies		8 477	8 477	9 464	9 464
Other creditors	18	9 336	9 336	4 461	4 461
GST Payable	18	7 874	7 874	341	341
		159 376	**159 376**	**183 976**	**183 976**
Financial liabilities (unrecognised)					
Legal claims & bank guarantees	Schedule of Contingencies	**324**	**324**	**1 800**	**1 800**

Note 32 Financial instruments (cont)

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.

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

CSIRO has specific forward exchange contracts to sell a total of $US 2 658 987 (2000 $US 900 000) with various maturity dates after 30 June 2001, at an average exchange rate of $US 0.529.

(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 Statement of Financial Position.

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

Appendix 1

Sector Advisory Committees as at 30 June 2001

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 >>

Built Environment Sector

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Mr Michael Delaney
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Mr Richard Dinham
Chief Executive Officer
DesignInc Sydney Pty Ltd

Mr David Evans
Managing Director
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Mr Ian Johnston
Chief Executive
Government Property Office (WA)

Mr John Murray
National Executive Director
Master Builders Australia

Mr Vincent O'Rourke
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USF Filtration & Separation Group

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PACIA

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Pastoralist

Mr Denis Flett

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Professor Helene Marsh
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Managing Director
Wood Fisheries Pty Ltd

Mr Peter Yuile
Deputy Secretary
Department of Transport & Regional Services

Sector Coordinator

Dr Nan Bray
CSIRO Marine Research
Tel (03) 6232 5212
Email nan.bray@csiro.au

Agribusiness Industries >>

Field Crops Sector

Chairman

Mr Trevor Flügge, AO
Chairman
AWB Ltd
Tel (03) 9209 2011
Email tflugge@awb.com.au

Members

Mr Harry Bonanno
Chairman
Australian Cane Growers Council

Dr Anthony Gregson
Farmer

Mr Michael Hedditch
Executive Director
Rice Growers Association of Australia

Mr Chris Henderson
Farmer

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 Ltd

Mr Brendan James Stewart
President
Grains Council of Australia

Sector Coordinator

Dr Jim Peacock, AC
CSIRO Plant Industry
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Email jim.peacock@csiro.au

Food Processing Sector

Chairman

Mr Steve Marshall
Group Director Corporate Technology
Goodman Fielder Ltd
Tel 0438011409

Members

Dr Geoff Annison
Scientific & Technical Director
Australian Food Council

Ms Robyn Charlwood
Executive Director, Victorian Division
National Heart Foundation

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

Mr Robert Wotzak
Technical Development Director
Arnotts Biscuits Ltd

Sector Coordinator

Mr John Buhot
Food Science Australia

Tel (07) 3214 2028
Email john.buhot@csiro.au

Forestry, Wood and Paper Industries Sector

Chairman

Mr Ronald Adams
Managing Director
Sotico Pty Ltd

Tel (08) 9351 6488
Email ron.adams@sotico.com.au

Members

Dr James Bonham
Product Development Manager, (Australian Paper)
Paperlinx Ltd

Dr David Brand
Deputy Chief Executive
State Forests (NSW)

Dr Tony Flowers
Development Manager (Australia)
Fletcher Challenge Paper

Mr Kevin J Lyngcoln
Chief Executive Officer
Plywood Association of Australia

Mr Ian Millard
General Manager
Forestry SA

Ms Vanessa Ranken
Company Director
Egaline Nursery

Mr Robert Rawson
General Manager, Forest Industries
Department of Agriculture, Fisheries & Forestry Australia

Mr Evan Rolley
Managing Director
Forestry Tasmania

Mr Geoff Sanderson
Managing Director
Ausply Pty Ltd

Mr James Witham
Managing Director
Treecorp Pty Ltd

Mr Peter Zed
National Resource Manager
CSR Timber Products

Sector Coordinator

Dr Glen Kile
CSIRO Forestry & Forest Products
Tel (02) 6281 8314
Email glen.kile@csiro.au

Horticulture Sector

Chairman

Mr David Pullar
David Pullar & Associates
Tel (03) 9415 1533
Email dpullar@bigpond.com

Members

Mr Laurence Ah Toy
Director
Koolpinyah Station 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

Sector Coordinator

Dr Nigel Scott
CSIRO Plant Industry
Tel (08) 8303 8626
Email nigel.scott@csiro.au

Meat, Dairy and Aquaculture Sector

Chairman

Mr John Keniry
Chairman
Ridley Corporation Ltd
Tel (02) 8227 6122
Email jkeniry@ridley.com.au

Members

Mrs Teresa Allen
Self-employed, Producer

Mr Gordon French
Queensland Dairy Farmers Organisation

Mr Robin Hart AM
Chairman
Kerwee Pastoral Company

Dr Peter Holdsworth
Director Scientific & Regulatory Affairs (Animal Health)
AVCARE

Mr Pheroze Jungalwalla
Manager R&D
Tassal Ltd

Dr Rod Kater
Chief Medical Officer
AMP Life Ltd

Dr Gardner Murray
Consultant

Sector Coordinator

Mr Shaun Coffey
CSIRO Livestock Industries

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Textiles, Clothing and Footwear Sector

Chairman

Mr John Blood
Textile & Garment Consultant

Tel (03) 9282 9685
Email jwb@maggie-t.com.au

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 John Dean
General Manager, Industry Contact & Policy Teams
Department of Industry, Science & Resources

Mr Guy Fitzhardinge
Livestock Producer
Thring Pastoral Company

Ms Collette Garnsey
General Manager, Buying
David Jones Ltd

Mr Lindsay Packer
Managing Director
Packer Tanning

Mr Peter Rea
Manager, Textile Industries
Department of State & Regional Development (VIC)

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

Sector Coordinator

Dr Peter Gordon
CSIRO Textile & Fibre Technology
Tel (03) 5246 4104
Email peter.gordon@csiro.au

Appendix 2

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 2001 CSIRO was a core participant in 44 CRCs still in operation. 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 was a participant 2000-01 >>

Manufacturing Technology

Bioproducts
(http://www.botany.unimelb.edu.au/labs/crc/CRC.html)

CAST Metals Manufacturing
(http://www.cast.crc.org.au)

Intelligent Manufacturing Systems and Technologies
(http://www.crcimst.com.au/)

International Food Manufacture
(http://www.foodpack.crc.org.au)

Microtechnology
(http://www.microtechnologycrc.com/)

Polymers
(http://www.crcp.com.au)

Welded Structures
(http://www.crcws.com.au)

Information and Communication Technology

Advanced Computational Systems
(http://acsys.anu.edu.au)

Australian Telecommunications
(http://www.arcrc.com)

Enterprise Distributed Systems Technology
(http://www.dstc.edu.au)

Satellite Systems
(http://www.crcss.csiro.au)

Mining and Energy

AJ Parker CRC for Hydrometallurgy
(http://www.parkercentre.crc.org.au)

Australian Mineral Exploration
(http://www.crcamet.mq.edu.au)

Australian Petroleum CRC
(http://www.apcrc.com.au)

Black Coal Utilisation
(http://www.newcastel.edu.au/department/black_coal_crc/)

Clean Power from Lignite
(http://www.cleanpower.com.au)

GK Williams CRC for Extractive Metallurgy
(http://proceng1.chemeng.unimelb.edu.au/gkw.html)

Landscape Evolution and Mineral Exploration Technologies
(http://leme.anu.edu.au/)

Agriculture and Rural Based Manufacturing

Aquaculture
(http://www.aquacrc.uts.edu.au/)

Australian Cotton CRC
(http://www.cotton.pi.csiro.au)

Cattle and Beef Quality
(http://www.beef.crc.org.au)

Premium Quality Wool
(http://woolcrc.une.edu.au)

Quality Wheat Products and Processes
(http://www.wheat-research.com.au)

Sustainable Rice Production
(http://www.csu.edu.au/faculty/sciag/crcr/)

Sustainable Sugar Production
(http://www-sugar.jcu.edu.au)

Sustainable Production Forestry
(http://www.forestry.crc.org.au/)

Tropical Plant Protection
(http://www.tpp.uq.edu.au)

Viticulture
(http://www.winetitles.com.au/crcv/)

Environment

Antarctica and the Southern Ocean
(http://www.antcrc.utas.edu.au)

Biological Control of Pest Animals
(http://www.pestanimal.crc.org.au)

Catchment Hydrology
(http://www.catchment.crc.org.au)

Freshwater Ecology
(http://enterprise.canberra.edu.au/WWW/www-crcfe.nsf)

Sustainable Development of Tropical Savannas
(http://savanna.ntu.edu.au)

Tropical Rainforest Ecology and Management
(http://www.rainforest-crc.jcu.edu.au)

Waste Management and Pollution Control
(http://www.crcwmpc.com.au)

Water Quality and Treatment
(http://www.waterquality.crc.org.au/)

Weed Management Systems
(http://www.waite.adelaide.edu.au/CRCWMS/)

Coastal Zone, Estuary and Waterway Management
(http://www.coastal.crc.org.au)

Greenhouse Accounting
(http://www.greenhouse.crc.org.au/)

Medical Science and Technology

Cellular Growth Factors
(http://www.ludwig.edu.au/crc-cgf)

Diagnostic Technologies
(http://www.crc.sci.qut.edu.au/cdt.html)

Eye Research and Technology
(http://www.unsw.edu.au/clients/crcert/CRCERT01.HTM)

Tissue Growth and Repair
(http://www.crc-tgr.edu.au/)

Vaccine Technology
(http://www.crc-vt.qimr.edu.au)

Appendix 3

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 Financial Reporting Requirements (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/ace/docs/fmos.rtf

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. Appendix A 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).	iv
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.	5
Outline the organisational structure and location of major activities and functions.	9-16
Review operations and future prospects.	17-80, 88-93
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.	6, 142
Details of the Audit Committee, number of Audit Committee meetings and attendance record.	95, 142
Details of indemnities and insurance for officers.	122
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:

	Page
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.	1-2, 17-80
A description of any developments in those policies that occurred during the year.	17-80
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*.	5
Any written direction or guideline given by the Minister to the Board dealing with the functions and powers of the Board.	5

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 *Requirements and Guidance for the Preparation of Financial Statements of Commonwealth Agencies and Authorities* are located at:

http://www.dofa.gov.au/ace/docs/fmos.doc

Schedule 2 to the FMOs under *CAC Act* requires the following information to be included in CSIRO's financial statements:

Reporting Requirements under Schedule 2, FMOs

3. Auditor-General's Report >>

The Auditor-General's Report on CSIRO's financial statements is on page 109-110

Appendix 4

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 5

Administrative Law Reporting 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 2001, CSIRO received 20 requests under the Act.

One application was made under subsection 29(1) of the *Administrative Appeals Tribunal Act* 1975 ('the Act') for a review by Administrative Appeals Tribunal of a decision taken under the *Freedom of Information Act*. This decision was upheld.

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 4 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 1.

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

Tel (02) 6276 6123

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

Privacy

The *Privacy Act* 1988 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 2000-01 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

Tel (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 2001, CSIRO received no requests for statements of reason under the AD(JR) Act.

Appendix 6

CSIRO Position on Gene Technology

CSIRO believes there is a window of great opportunity for Australia, its community and industries, based on research in gene technologies. It gives us the potential to improve our health, create a safer and more secure food supply, generate greater 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.

Appendix 7

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.

This project has been completed with Ms MacDiarmid's submission of her PhD thesis in September 2000. Of particular significance for future research and development was her successful isolation and characterisation of several novel antigens which are the subject of a provisional patent application. She has demonstrated that these antigens have potential as vaccine candidates to protect sheep against the three major gastro-intestinal parasites responsible for economic losses in the industry.

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 Dr Tony Miller of CSIRO Mathematical and Information Sciences for his skills on the complex problems surrounding the optimal design of spectacle lenses.

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, nine Fellowships were awarded in 2000-01, totalling $110 505. They were given to support eminent overseas scientists selected to work for a period in CSIRO Divisions.

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

The Ken and Yasuko Myer Plant Science Research >>

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 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. Sir Walter Bodmer (Head of the Cancer and Immunogenetics Laboratory, Institute of Molecular Medicine, Oxford University) gave a public lecture titled *Cancer, a genetic disease of cells* in Brisbane on 4th December, 2000.

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. No grants were made during the year. Applications to the fund are being sought in the second half of 2001.

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 2000-01 weevil research focussed on a contract research project on *Melanterius* weevils used in biological control of acacias in South Africa and on studies of the relationships of the Australian weevil fauna in a world context.

Australian *Melanterius* weevils introduced into South Africa as biocontrol agents of invasive Australian acacias were studied with the aim of determining their precise identities and host specificity and of producing an illustrated key to the species.

Results of studies into the phylogenetic relationships of some of Australia's endemic primitive weevil groups were presented at a weevil symposium during the XXIth International Congress of Entomology in Iguassu, Brazil. Parts of this work were published in a special issue of *Invertebrate Taxonomy*. These studies form vital contributions to current international efforts of resolving the higher classification of the weevils.

Work on Volume VII of the *Australian Weevils* monograph series was continued.

The application of weevil systematics to a broader ecological context in Australia was fostered by promoting studies of weevil pollination of native cycads and a postdoctoral project on the weevils pollinating Australian nutmegs has been developed. Further systematic and co-evolutionary projects on the Australian cycad weevils are planned in collaboration with local and overseas botanists.

A postdoctoral student from Japan, Dr Hiroaki Kojima, commenced a two-year study of the Australian flower weevils in July 2000 but had to terminate it after four months due to a job offer at Kyushu University in Japan. A joint paper on *dryophthorine* weevils was written in its place. Other postdoctoral projects were discussed with candidates in Argentina, Germany and South Africa, as were sabbatical visits by weevils specialists in Canada and South Africa.

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.

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