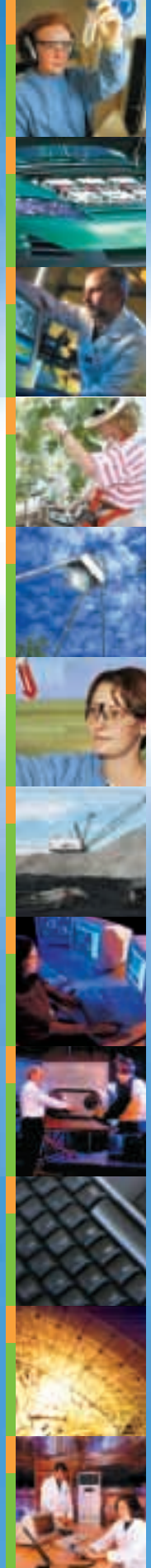


CSIRO

annual report

2001–2002

CSIRO

www.csiro.au

Letter of transmittal

The Honourable Peter McGauran

Minister for Science

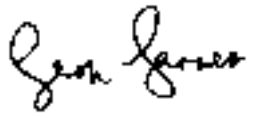
Parliament House

CANBERRA ACT 2600

We have pleasure in submitting to you, for presentation to Parliament, the fifty-fourth 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.

Catherine B Livingstone
Chairman of the Board



Geoff G Garrett
Chief Executive

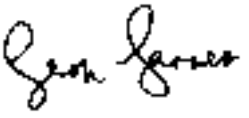
October 2002

Board resolution

The 2001–02 CSIRO Annual Report has been approved for presentation to the Minister for Science.

Signed this 9th day of September 2002 in accordance with a resolution of the Board Members.

Catherine B Livingstone
Chairman of the Board



Geoff G Garrett
Chief Executive

Contents

Chairman's foreword

Over recent years, Australia has achieved a deeper awareness of the importance and process of innovation. This has led to increased emphasis on integrated outcomes that deliver social, economic and environmental benefits.

In particular, we now recognise that science is no longer a stand-alone issue, but an integral and essential part of policy development in almost every area, from regional development to international trade and health. This awareness has significantly changed the approach of successive governments to science and research.

In this context, policy analysis and development need to address the National Innovation System (NIS) as a whole. The NIS is a complex system, founded on complementary roles and interdependent responsibilities, and it is important to recognise that every change produces a cascade of other changes. This requires all players involved in funding, performing and using research to work in concert, drawing on their complementary skill sets. CSIRO, by virtue of its size, track record and multidisciplinary capacity, has a distinctive capacity to tackle these increasingly large, complex, national and international problems.

In January 2001, the Government's watershed Report, *Backing Australia's Ability*, introduced initiatives aimed at developing an integrated NIS. In 2002, the Government has two major reviews underway that will build on this framework. One of these reviews seeks to identify national research priorities; the other focuses on the future of higher education.

Both these reviews, combined with the significant changes we are now making in CSIRO itself, provide an opportunity to increase substantially the return on Australia's investments in research and education. To do this effectively requires us to maintain the strengths of Australia's institutional 'brands', whilst building partnerships across a broad range of activities.

During 2001–02, CSIRO has continued to link its skills and capacity more effectively with other nodes in the NIS, to achieve clear innovation outcomes for industry, the community and the nation. A particular initiative has been our decision to establish a small number of *Flagship Programs*. These will focus significant CSIRO resources, (growing to more than 30 per cent of our total spending over the next five years) on major national challenges and opportunities in areas like energy efficiency and preventative health.

This requires CSIRO to work and consult closely with other research providers, the community and industry. Together we will identify major research goals, and coordinate and implement R&D activities, many of which will occur outside CSIRO.

If CSIRO is to be successful with these *Flagship Programs* and, at the same time, maintain its essential underlying knowledge base, the Organisation will need to increase its capacity to fund R&D. Over the last 12 months we have set about nurturing growth across the full range of our activities, from public good research to the provision of research services, to support a greater focus on relevance and impact.

Many advances in science and technology occur at the interfaces of the disciplines. CSIRO's size and breadth can facilitate active exploration of these opportunities. As such, the intensive drive over the last 12 months towards unleashing the potential of 'One CSIRO' seeks to maximise contact and delivery at these interfaces. Furthermore, the corresponding thrust to reach out across institutional boundaries and partner with other agencies in new and strategic ways will work to further exploit synergies and opportunities across Australia's NIS.

During 2001–02 we further improved our corporate governance framework. We evolved our advisory structure to embody a smaller number of Sector

Advisory Councils. These seven Councils comprise representatives from different industry sectors, who will enable greater interaction and focus across disciplines. We established a Board Commercial Committee that adopted a more rigorous approach to intellectual property management. We also updated the delegations framework within the Organisation.

The Board recognises the many challenges faced by our people over the last 12 months and wishes to express its sincere thanks for the willingness with which CSIRO's employees have embraced these challenges and moved forward as part of the continuous process of change. The Board is well aware that an Organisation in the global business of research can only be as good as its people and is conscious of the need to attract and retain the best and most committed individuals. We have worked during the past year to develop a better approach to rewards and recognition. This reflects the Board's belief in the need both to identify and celebrate success, and at the same time, provides benefits to all staff contributing to those successes.

The Board, too, has undergone change. In November 2001, Mr Charles Allen completed his term as Chairman. The Board and CSIRO wish to record their warmest appreciation to Charles Allen for the very active support, leadership and commitment he provided to the Organisation during his five-year term. There were also other changes on the CSIRO Board: Mr Norbury Rogers and Professor Mary O'Kane completed their terms; Mr Russell Higgins, formerly Secretary of the Department of Industry, Science and Resources, resigned as a result of a change in his responsibilities; and Mr John Gandel resigned at the end of June 2002. Their contributions are acknowledged with appreciation. In February 2002, we welcomed Dr Peter Shergold, Secretary, Department of Education Science and Training to the Board and at the August 2002 Board meeting we welcomed Professor Suzanne Cory, Dr Terry Cutler, Mr Peter Duncan and Dr Ed Tweddell to the Board.

CSIRO and Australia operate in a globalised environment that presents new opportunities and challenges. CSIRO will continue to respond to the challenges of this changing environment, as it has done for more than 75 years. Change brings with it risks but we cannot increase our already significant contribution to Australia's well being by being risk averse.

CSIRO and all its people are strongly committed to realising a more prosperous, productive, sustainable and healthy future for Australia.

Catherine Livingstone

Chairman

Chief Executive's foreword

CSIRO's Annual Report for 2001–02 is a snapshot of an organisation working hard to deliver the benefits of science and innovation to industry, society and the environment.

We are building on 76 years of accumulated knowledge to ensure CSIRO's ongoing contribution to the nation is strengthened and deepened. To look at the Organisation today is to see purposeful change in action.

CSIRO's standing as an international 'heavy hitter' in science was confirmed this year (see page 21). But, recognising that CSIRO exists to make a positive difference, we have embarked on serious change to ensure that we continue to make the greatest possible contribution. As an Organisation of over 6 300 committed and talented people, we owe it to Australia to search for new ways to maximize the impact, relevance and benefit of our science to the Nation.

As the Chairman stated in her Foreword, we introduced *Flagship Programs* in 2001–02 to better focus our effort on issues of national priority. CSIRO is committing substantial resources to form Australia-wide partnerships that will tackle audacious goals in domains such as: environmental well-being; clean, efficient energy; advanced communications; and, preventative health.

At the same time, we are working to ensure that our research and development in all other areas are closely aligned with Australia's needs and priorities. We are contributing actively to current national reviews of research priorities and higher education. We believe these reviews will result in further development of the National Innovation System and a 'Team Australia' approach to the significant issues facing our nation.

CSIRO's Science Forum was set up in 2001–02 to help identify promising areas of research opportunity. We are making significant investments in the emerging sciences of novel biotechnologies, complex systems science, new information and communications technologies, nanotechnology and social and economic integration. This Forum was also set up to maintain and enhance science excellence throughout the Organisation and to help foster partnerships across and outside CSIRO.

Our efforts to deliver significant benefit and real and immediate impact from our science to the Australian community and industry are well illustrated through the achievements described in the Adoption and Impact (Outcomes and Outputs) section of this Report (page 24). In addition, many other exciting CSIRO developments also took place throughout the year including:

- *The Square Kilometre Array (SKA)* – CSIRO is collaborating with institutions around the world to build a telescope to reveal the very early Universe. CSIRO provided seed funding for the SKA. In August 2001, the Government granted CSIRO's Australia Telescope National Facility and other institutions $23.5 million, much of which will be used to develop this exciting new venture for looking back at the early Universe. This new telescope will detect radio waves from the hydrogen gas that spawned the stars.
- *Smart Solutions for Clearer Vision* – As a participant in the Cooperative Research Centre (CRC) for Eye Research and Technology, CSIRO has developed a synthetic material used in the design of a lens that can be surgically implanted to provide lasting, but reversible, correction of refraction error. The CRC believes the new lens will enable some people to do away with the need to wear glasses ever again (see page 136 for details of the CRCs in which CSIRO participated during the year).
- *World Class Energy Centre* – CSIRO launched this centre, located in Newcastle to showcase the very best in energy technologies. It features a unique combination of energy efficient building design plus small-scale generation units capable of delivering

most of its power needs. This will be the hub for CSIRO's future energy research.

- *Lower Murrumbidgee United Nations Educational Scientific and Cultural Organisation (UNESCO) Reference Basin* – This priority catchment (part of the Prime Minister's National Action Plan for Water Quality and Salinity) has been recognised by UNESCO as a global reference point, given the progress made there in tackling the environmental, economic and social challenges of natural resource management. The modeling tools and hydrologic research methods used by CSIRO and its research and community partners have been earmarked for use in China and in other parts of the world.
- *New Bush Tucker Industry* – Aboriginal communities, Coles Supermarkets and CSIRO joined forces to help create a sustainable industry based on native food production. Drawing on the richness, diversity, nutritional and culinary values of bush foods, CSIRO is working in partnership with Aboriginal groups to establish new industries that will also help retain native species and develop new enterprises for Outback Australia.

We continued to nurture Australia's science talent in the past financial year by recruiting more than 40 new postdoctoral personnel, bringing the total to over 180. The many international and national awards and prizes received by CSIRO staff are testimony to the calibre and commitment of our people. These awards are described in Section 2 of this Report.

Through new management systems and processes, and the recruitment of particular skills into the Organisation, CSIRO seeks to ensure better exploitation of our science and technology as well as nurturing business development and growth. The challenge is to develop a new CSIRO, fully capable of responding, performing and seizing opportunities.

The tragic death, in December 2001, of our Australian Animal Health Laboratory technical officer, Mr Set Van Nguyen, deeply affected us all. CSIRO is a close-knit family and his loss has been felt acutely. We are redoubling our efforts in occupational health and safety to make sure that an event like this never happens again.

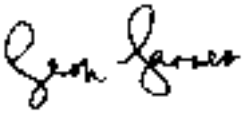
Reports from the Australian National Audit Office and CSIRO commissioned consultants have highlighted project management as an area where we need to adopt new and better practices. A major initiative is underway to make this happen.

Structural change has also taken place. Divisional Chiefs and Corporate Group leaders now meet regularly as the new Executive Management Council, fostering greater dialogue across the Organisation and helping create a shared, 'One CSIRO' view.

At the Board level, 2001–02 has seen the departure of Mr Charles Allen as Chairman. I gratefully acknowledge Charles's outstanding contribution to CSIRO and his warm and encouraging role in welcoming me to the position of Chief Executive. It is now my turn to welcome Catherine Livingstone as his successor and someone well equipped to have oversight of the Organisation in this exciting period of change. The Chairman has outlined other changes to our Board during 2001–02 in her Foreword.

These are just some of the initiatives that have taken place or are underway. This Annual Report will give you more detail on the progress that has been made.

As for the year ahead, we'll be working harder than ever to grow the benefits that CSIRO delivers to you.



Geoff Garrett

Chief Executive, CSIRO

Facts about CSIRO

Research and outputs

- CSIRO ranks in the top one per cent of world scientific institutions in 11 of 22 research fields (based on total citations of publications). Worldwide it ranks third in environment/ecology and fourth in agricultural science (*Science Watch*, July/August 2001);
- CSIRO transfers know-how through over 3 000 scientific publications, 9 000 client reports, and 300 media releases annually, plus secondments, industry workshops, seminars and specialist publications;
- CSIRO is the largest participant in the Cooperative Research Centre (CRC) Program (in 46 of the 64 centres, as at June 2002);
- worldwide, CSIRO is involved in over 700 current or recently completed research activities, working with leading scientific organisations and firms in the USA, Japan and Europe, and with developing countries, especially in Asia;
- CSIRO offers more than 50 specialised technical and analytical services. These include analyses for air pollutants and satellite imaging of natural resources through to fire testing of materials and calibration of standards;
- CSIRO is Australia's leading patenting enterprise, holding over 3 500 granted or pending patents; and
- more than 70 spin-off companies are based on CSIRO-generated intellectual property and expertise.

National facilities

- CSIRO hosts four major National Research Facilities (the Australian Animal Health Laboratory, the Australia Telescope, the Oceanographic Research Vessel *Southern Surveyor*, the National Measurement Laboratory) and over 30 other research facilities such as the Riverside Life Sciences Centre, CSIRO Discovery Centre and the Australian Resources Research Centre; and
- we manage 11 national reference collections including: the Australian National Fish Collection, the Australian National Insect Collection, the Australian National Herbarium, the Australian National Wildlife Collection, the National Tree Seed Collection and the Scientific Marine Data Collection.

Our staff

- CSIRO has over 6 300 staff located at 60 sites throughout Australia, and overseas;
- sixty per cent of staff hold university degrees, including more than 1 800 doctorates and 430 masters; and
- in collaboration with university colleagues, our staff supervise or co-supervise more than 600 postgraduate research students annually, one quarter in collaboration with CRCs.

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.

Responsible Minister

From 1 July 2001 to 26 November 2001, the Minister responsible for CSIRO was Senator the Honourable Nick Minchin, Minister for Industry, Science and Resources.

From 26 November 2001 to 30 June 2002 the Minister responsible for CSIRO was the Honourable Peter McGauran, Minister for Science.

Under the *Science and Industry Research Act 1949*, the Minister has the power to:

- add to the purposes for which CSIRO may carry out scientific research (sub-paragraph 9(1)(a)(iv)); and
- 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)).

Neither Minister exercised any of these powers during 2001–02.

Under the *Commonwealth Authorities and Companies Act 1997*, the Minister may, after consultation with the Board, notify the Board of a general policy of the Commonwealth Government. The Minister did exercise this power during 2001–02; see page 56.

CSIRO organisational structure

Ministers

Education, Science and Training – The Hon Dr Brendan Nelson MP
Science – The Hon Peter McGauran MP

CSIRO Board[1]

Ms Catherine Livingstone (Chairman)
Professor Suzanne Cory – Dr Terry Cutler – Mr Peter Duncan
Dr Geoff Garrett – Mr Donald McDonald – Mr Don Mercer
Professor Vicki Sara – Dr Peter Shergold – Dr Ed Tweddell

Executive Team

Dr Geoff Garrett – Mr Mehrdad Baghai – Dr Vijoleta Braach-Maksvytis
Dr Ted Cain – Dr Michael Eyles – Dr Graham Harris – Dr Rod Hill
Dr Bruce Hobbs – Ms Di Jay – Dr Warren King – Dr Steve Morton
Mr Peter O'Keefe – Dr Ron Sandland – Mr Mike Whelan

Executive Management Council[2]

Agri-food & Fibre Group
- Food Science Australia[3]
- Forestry & Forest Products
- Health Sciences & Nutrition
- Livestock Industries
- Plant Industry

Environment & Natural Resources Group
- Atmospheric Research
- Entomology
- Land & Water
- Marine Research
- Sustainable Ecosystems

Sustainable Minerals & Energy Group
- Energy Technology
- Exploration & Mining
- Minerals
- Petroleum Resources

IT, Manufacturing & Services Group
- Australia Telescope National Facility
- Manufacturing & Infrastructure Technology
- Mathematical & Information Sciences
- Molecular Science
- Telecommunications & Industrial Physics
- Textile & Fibre Technology

CSIRO-wide Support
- Business Development & Commercialisation
- Communications
- Finance & Property Management
- Flagship Programs
- Information Technology / e-CSIRO
- People Development
- Risk Management
- Science Planning

CSIRO Science Forum

[1] *Board and Executive Team as at 1 September 2002. For details of Board changes during 2001–02 see page 8.*

[2] *See page 137 for contact details.*

[3] *Joint venture with the Australian Food Industry Science Centre (Afisc).*

The CSIRO Board

Chairman
Ms Catherine Livingstone
BA(Hons) FCA
Company Director
1 January 2001 – 31 December 2005

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

Professor Suzanne Cory
AC BSc MSc PhD Hon DSc FAA FRS
Director
The Walter and Eliza Hall Institute of Medical Research
26 June 2002 – 25 June 2007

Professor Vicki Sara
BA(Hons) PhD DOC FTSE
Chief Executive Officer
Australian Research Council
15 July 1998 – 14 July 2003

Dr Terry Cutler
BA (Hons) PhD FAIM
Managing Director
Cutler and Company Pty Ltd
25 July 2002 – 24 July 2007

Dr Peter Shergold
AM BA MA PhD
Secretary
Department of Education, Science and Training
14 March 2002 – 13 March 2007

Mr Peter Duncan
BE(Hons) DBS
Company Director
26 June 2002 – 25 June 2007

Dr Ed Tweddell
BSc MBBS(Hons) FRACGP FAICD
Company Director
26 June 2002 – 25 June 2007

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

Terms completed during year:
Mr Charles Allen AO,
Mr John Gandel AO (resigned 30 June 2002),
Mr Russell Higgins, (resigned 24 January 2002),
Professor Mary O'Kane and
Mr Norbury Rogers AO

Staff demographics

CSIRO staff are employed under Section 32 of the *SIR Act 1949*.

At 30 June 2002 CSIRO had a total staff of 6 389, which has an equivalent full-time (EFT) value of 5 850.

The numbers of staff employed in different job categories as at 30 June 2002 are shown below.

Staff by gender and principal functional area (comparisons with 2000–01).

	Female		Male		Total	
	2001–02	2000–01	**2001–02**	2000–01	**2001–02**	2000–01
Research Scientists	**250**	228	**1 307**	1 290	**1 557**	1 518
Research Project staff	**939**	964	**1 476**	1 563	**2 415**	2 527
Senior Specialists	**5**	4	**37**	32	**42**	36
Research Management	**11**	12	**167**	197	**178**	209
Technical Services	**89**	104	**570**	604	**659**	708
Communication & Information	**240**	232	**132**	123	**372**	355
General Services	**81**	86	**62**	64	**143**	150
Administrative Support	**702**	696	**231**	237	**933**	933
Corporate Management	**13**	14	**77**	61	**90**	75
TOTAL	**2 330**	2 340	**4 059**	4 171	**6 389**	6 511

CSIRO locations

Townsville
- Davies Lab
- Woodstock

Rockhampton
- Belmont
- Rendel

Brisbane
- Cannon Hill
- Indooroopilly
- Pullenvale (Pinjarra Hills)
- St Lucia
- Cleveland

Sydney
- North Ryde
- Lindfield
- Marsfield
- Macquarie Uni
- Lucas Heights

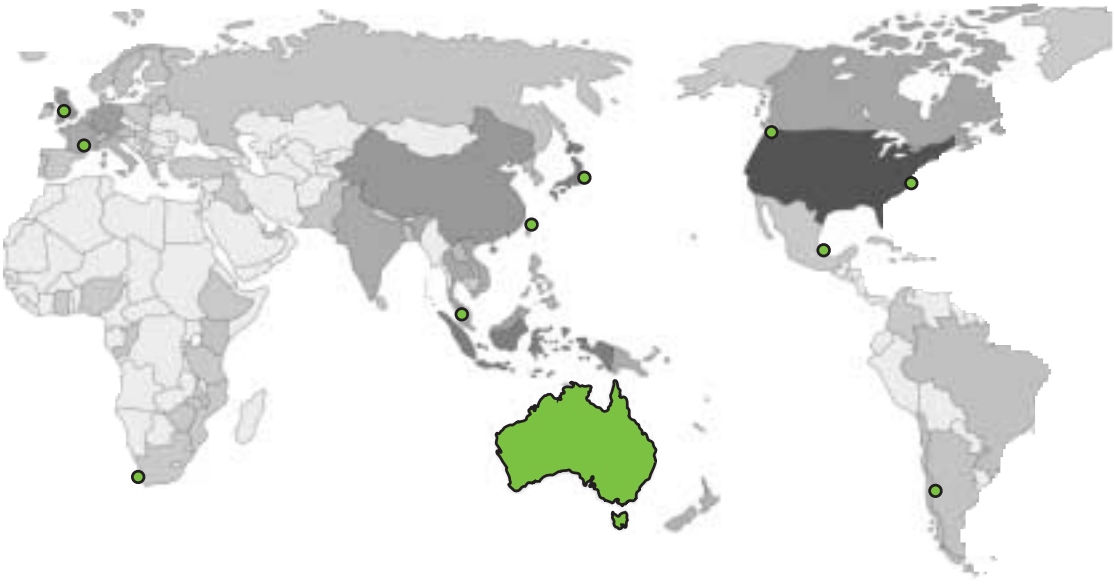
Melbourne
- Aspendale
- Clayton
- Nottinghill
- Blackburn Road
- Highett
- Parkville
- Preston
- Collingwood
- Syndal

Canberra
- Black Mountain
- Campbell
- Gungahlin
- Yarralumla
- ANU
- Ginninderra

Perth
- Floreat
- Waterford
- Kensington (Bentley)

Adelaide
- Urrbrae
- Woodville
- Kintore Avenue

CSIRO international activities



Locations of CSIRO Staff

Number of formal international CSIRO activities, current or recent, by country.

The square kilometre array

How did the first stars and galaxies form? That's still one of the big mysteries in astronomy. Now CSIRO and institutions around the world are collaborating to build a 'time machine' – a telescope to reveal the very early Universe. Called the Square Kilometre Array (SKA), it will detect radio waves from the hydrogen gas that spawned the stars.

The SKA will be 100 times bigger than today's biggest radio telescopes, with a total surface area of about a million square metres. This will be made up of tens of thousands of individual antennas, which could be dishes, flat plates or even giant spheres. The telescope's design and location will be decided in 2006, and it will be built 2010–2020.

The SKA offers challenges in the design and building of antennas, radio-frequency systems, signal-processing, and photonics communication. Useful solutions will have commercial applications. CSIRO, the University of Sydney, the Australian National University and Swinburne University of Technology are all working on the SKA.

In 1999 CSIRO provided $1.5 million seed funding for SKA R&D. Then in August 2001 the Commonwealth Government granted CSIRO's Australia Telescope National Facility and other astronomy institutions $23.5 million under the second round of the Major National Research Facilities (MNRF) program. A large slice of that will go to SKA development. With matching funds from other sources, that means Australia will spend about $20 million on SKA R&D over the next five years.

The funding will be used mainly to refine the two Australian concepts for the telescope. One is an array of small, unmoving antennas. The other uses Luneburg lenses – large spheres of dielectric material. The MNRF funding will be used to build 'demonstrator' systems of these two concepts, or a combination of them. The Luneburg lenses need to be made of a cheap, lightweight dielectric material. CSIRO has taken up the challenge and has now designed a new dielectric material that can be widely applied in electromagnetics engineering. The groups collaborating on this work will make a one metre diameter Luneburg lens by early 2003 to show the materials and manufacturing principles involved.

An artist's impression of one SKA concept. Credit: C Fluke, Centre for Astrophysics & Supercomputing, Swinburne University of Technology.

The year in review – and looking ahead

2001–02 saw the introduction of changes aimed to position CSIRO as a 21st Century global research enterprise. Change has been a constant theme in the last 12 months, as it has been throughout the Organisation's 76-year history.

Achievements

This Annual Report illustrates how we have been working with our partners to help build a healthy Australia, globally competitive industries and national knowledge assets. The Adoption and Impact section (page 24) reports on a cross-section of outputs and outcomes achieved during 2001–02.

For example, we have:

- worked with Polartechnics Ltd and the Sydney Melanoma Unit to develop SolarScan®, a diagnostic device to help general practitioners detect skin cancer sooner, saving vital time if treatment is necessary;
- seen the revolutionary CSIRO MultiBeam Antenna that can send and receive signals from multiple geostationary satellites simultaneously operating successfully in Europe;
- collaborated with the newly established Australian High Pressure Processors Pty Ltd to engineer high-pressure processes that can kill microbes in food without adversely affecting food quality;
- developed cost-effective, integrated management strategies for catchment and coastal zones which will reduce algal bloom and improve the ecological function of the Gippsland Lakes;
- produced a ballast water risk management system which provides details of marine pests in Australia, including how to manage a new outbreak;
- released a new version of The Air Pollution Model (TAPM), CSIRO software which allows planners to forecast the spread of emissions from proposed industrial plants, freeways or other pollution sources before they are built;
- seen Cienna, a new red wine grape variety, developed by CSIRO, released as a final product by collaborating wineries – this variety provides more consistent yield and quality, distinct flavours and requires reduced agrichemical use; and
- increased our national preparedness to deal with an outbreak of foot-and-mouth disease by introducing the latest techniques for laboratory diagnosticians.

These achievements reflect just a handful of the hundreds of activities that CSIRO has engaged in during 2001–02. They typify our collaborative approach to delivering meaningful results to industry, society and the environment.

As in past years, CSIRO has continued to make significant inputs to a broad range of policy matters under consideration by Government. During 2001–02, we contributed to policy development in areas such as ocean policy, greenhouse and climate change, air quality and a number of important land and water issues.

Focusing our scientific endeavours

During 2001–02, CSIRO has strengthened its processes to improve delivery of great science and innovative solutions to industry, government and the community. The blueprints for these new activities are a series of Strategic Action Plans that set specific actions and responsibilities over six-month timeframes in a range of priority areas, including our core business of science, our people, business and commercial strategies, and operational excellence in all that we do. Our plans build on the Federal Government's innovation policy articulated in *Backing Australia's Ability*.

Under these plans CSIRO delivers benefit from science in three ways:

- through ongoing research aligned to issues of national priority and industry need;
- through a small number of Flagship Programs to tackle 'audacious goals' around major national challenges and opportunities; Flagship Programs are a new way of assembling multidisciplinary teams and harnessing the Nation's skills, both inside and outside CSIRO; and
- through emerging science areas that can have a profound impact on Australia and the world community in years to come.

Flagships and Emerging Sciences

Substantial effort has gone into establishing the Flagship and Emerging Science programs. Broad consultation both outside and within CSIRO has been particularly important for the Flagship Programs, to clearly identify issues of national priority and to engage with a diverse range of potential partners, collaborators and stakeholders. Issues like salinity and preventative health, and opportunities like developing a world-leading light metals industry, are complex and involve many players. CSIRO is well-placed to help handle that complexity and engage and help coordinate the relevant participants, to achieve challenging goals in these areas.

CSIRO's recently established Science Forum played a central role in identifying five Emerging Science areas: novel biotechnologies, complex systems science, new information and communication technologies, nanotechnology and social and economic integration.

Organisational review

During the first half of the 2001–02 financial year, CSIRO was involved in an Outputs Pricing Review (OPR) with the Commonwealth Department of Finance and Administration (DoFA). OPRs have been a key way for the Government to assess whether it is getting value for money from funding provided to agencies. For CSIRO (and other similar agencies), price, quality and quantity of outputs are examined. In our case, the following outcome is expected from the Government's investment of appropriation funding:

> *"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."*

In evaluating the price, quality and quantity of CSIRO's Outputs the review team (involving CSIRO and DoFA staff) concentrated on two strategic issues:

- *demonstrated sustainability of the business, and*
- *demonstrated value for money.*

During this process we generated some first-rate information on the Organisation's operations and commissioned some very interesting and positive studies on cost benefit analyses and international benchmarking.

The main messages from the Output Pricing Review are:

- *CSIRO is a world-class research Organisation with a diverse research portfolio*: globally we have a well above average citation record. Rated by USA-based International Survey Research as one of the 'heavy hitters' of science, CSIRO stands in the top one per cent of the world's R&D organisations in 11 of 22 disciplinary areas;
- *the benefits of CSIRO research are substantially greater than their cost:* the quantitative techno-economic assessment by the Centre for International Economics (CIE) concluded, through cost-benefit analysis of just four CSIRO projects (fire behaviour prediction, the aXcessaustralia low emissions vehicle, robotic mining and rapid road crack detection), that their estimated benefits range from $5.7 to $7.8 billion, far greater than the Organisation's entire triennial budget of about $2 billion;
- *many of CSIRO's business processes are comparable with international best practice:* an independent study of nine international public-sector R&D organisations by Mullin Consulting (Canada) – covering many R&D management areas, eg use of performance indicators, forming alliances to commercialise technologies, avoiding unfair competition with private firms, overheads costs recovery, etc – showed CSIRO is performing as well as our overseas counterparts, with many elements of 'world's best practice';
- *CSIRO's outputs are valued by Australian industry, government agencies and the community*: customer feedback and advice from the independent Chairs of CSIRO's Sector Advisory Committees revealed that our clients have confidence in CSIRO's unique, multi-disciplinary capabilities, critical mass and good networks to increase the profitability and sustainability of their industries and to address issues of national significance;
- *CSIRO has achieved significant efficiency improvements and cost savings:* external reviews have confirmed CSIRO has a sound framework for corporate governance supported by effective planning, performance and accountability processes. For example, in a 2001 review of financial management capabilities it was KPMG's view that CSIRO was 'comfortably ahead of other large Budget-dependent Commonwealth agencies' in accrual budgeting and reporting frameworks. Similarly, CSIRO's Property Management was found to be performing at best practice in a government evaluation exercise. Where deficiencies are being identified these are being actively addressed as part of continuous improvement programs; and

- *CSIRO is providing excellent value for money justifying enhanced funding to sustain its critical mass as a multidiciplinary research agency:* given this, CSIRO is seeking to actively grow its current funding sources, and the relevance and impact of its science, in order to increase its productive capacity in the longer term.

Resource capacity building

In 2001–02 there was energetic activity to grow the Organisation's capacity to fund more priority-driven research, to develop and nurture the R&D business, and to engage more effectively with industry. Some senior appointments were made to bring additional technical, legal, business and communications expertise to CSIRO. Several State Relationship Managers have also been appointed to enhance the way in which CSIRO interacts with State Governments and industry. We have significantly strengthened internal communications processes and interactions with our key stakeholders.

In both the energy and ICT (Information and Communications Technology) domains we have, through review panels drawing on international expertise, re-evaluated our strategic approach and contributions in these areas. Recommendations from these reviews, involving changes to both activity emphasis and organisational arrangements (structure and reporting relationships), are currently being implemented.

Major programs are also underway to improve and simplify CSIRO's operations. Foremost among these are the Project Management Improvement (PMI) and e-CSIRO initiatives. PMI was advanced significantly over the latter part of 2001–02 through substantial new attention to our project management disciplines, including the initiation of organisation-wide implementation of effective resource allocation through effort logging. e-CSIRO – which is building a dynamic, secure web-enabled environment that supports cross-Divisional research activity, knowledge sharing and enhanced collaboration, as well as streamlining support for other operational activities – progressed with major new investments in infrastructure through better cabling, faster links and enhanced security, delivery of employee services via the web (including on-line recruitment) and enterprise record keeping. CSIRO's email services have also been unified and rationalised and the 'CSIRO Live!' project is well underway to enhance the Organisation's web presence.

In building Australia's future research capacity, CSIRO – through its Science Forum – has developed and funded plans to double the numbers of postdoctoral researchers and doctoral students in CSIRO by 2006 and, through recruitment over the past year, we are well on track to meet these targets.

Management changes

A significant change within CSIRO in 2001–02 has been in the style and operation of our senior management team. At the most senior level, the Executive Team and Executive Management Council bring together all Divisional Chiefs and Directors of specific Corporate Groups to develop and achieve a shared understanding and commitment to CSIRO's future direction and ensure active follow-through around the implementation of plans.

People matters

In October 2001, a staff *Insight* poll was conducted, providing all staff with an opportunity (for the first time in three years) to share their views about the organisation and (for the first time ever) for results to be benchmarked against a global pool of staff in R&D organisations. The survey will now be conducted annually.

Respondents rated CSIRO very highly overall, setting a new record against the global R&D benchmark for their pride in being associated with the Organisation, and exceeding global norms for satisfaction with working environment and consultation. Overall staff satisfaction is on a par with other R&D organisations. While staff are very committed to the Organisation and happy with their immediate managers, there is work to do in some areas, including organisational change and sustainability, working relationships (within and across Divisions), issues relating to leadership and management (such as visibility, communication of CSIRO's goals and performance), survey follow-up and performance management. All of these are being targeted in the Strategic Action Plan.

This year the Organisation renegotiated its Enterprise Agreement. CSIRO is committed to involving staff in this process so, in addition to working closely with unions, CSIRO established a Staff Consultation Group to inject further staff perspectives. The Agreement was swiftly concluded, a testament to the hard work, enthusiasm and cooperation of all parties. Current policies and practices were reviewed, options for change were canvassed with staff, and key elements of the Strategic Action Plan openly discussed.

Financial performance

Our Strategic Action Plan makes a commitment to 'Go for Growth' in the relevance and impact of our science and the solutions we deliver. Using revenue as a coarse indicator of impact and relevance, we have set some 'stretch' targets over the next five years to challenge ourselves to think of new ways to significantly increase the benefit we deliver to the nation. Our performance in the last financial year suggests that we are well on track.

External earnings from co-investment, consulting and intellectual property activities increased by $24.7 million (10.2 per cent) since 2000–01, in comparison to an equivalent compound annual growth rate of 0.6 per cent over the previous three years. Total external earnings (excluding a one-off Australian Magnesium Corporation arrangement) rose to $302 million, an increase of 15 per cent over the previous year. CSIRO's operating surplus of $49 million after the Capital Use Charge was primarily due to unforseen gains on sale of assets of $20 million and deferral of planned expenditure and commercial initiatives.

Looking ahead

Australia is building its future amid an increasingly turbulent, fast-changing and competitive world. Driving us into that future is the need to:

- sustain high levels of innovation, economic and employment growth;
- build a knowledge economy founded on world-class science;
- revolutionise how we communicate, share and use information;
- meet the needs of our ageing population efficiently;
- satisfy a growing demand for clean, sustainable energy and water; and
- cope with climate change, and reverse environmental degradation.

Taking its direction from *Backing Australia's Ability,* CSIRO's plans have been developed to strengthen these national aspirations, by linking science more intimately with innovation, economic development and a healthy, sustainable society.

The new CSIRO is a global research enterprise, built on the values and qualities that have given the Organisation its name for imagination, integrity, thoroughness and innovative spirit – but also on much more.

CSIRO's transition from national institution to global enterprise is already well advanced – in reaching towards our goal of growing our impact, in the fresh partnerships we are forging with other research bodies and industry, and in managing the business of innovation with flair and professionalism.

At the heart of our plans are our people. They are the creative source, delivering ideas, information, technologies and solutions to customers, stakeholders and citizens across Australia and beyond. Our aim is to help them achieve excellence through learning, raising skills, working with outstanding partners, reward and recognition – and by recruiting and retaining the best talent in the world for Australia.

Three watchwords are central to our plans – Focus, Grow and Simplify.

Focus: We are committed to focus on critical areas with potential for truly significant impact on Australia's future health, prosperity and environment.

Grow: We are determined to grow in every way – in our scientific quality and understanding, in our people, in our capacity to fund more research to benefit the nation and most importantly, in the difference we make.

Simplify: Science is complex, and needs to be supported by simple, efficient operational systems to deliver effectively its solutions and innovations to a complex world.

Our Strategic Action Plan commits us to listen carefully to what our customers and stakeholders tell us, study global trends, strive to be at the cutting edge, seek the best partners and then focus the top scientific skills and facilities on the issue. It calls for:

- a strong outward-looking emphasis;
- a 'service from science' culture;
- greater focus on key scientific opportunities and challenges for Australia;
- stronger partnerships with universities, other science agencies and industry;
- a unified CSIRO, making full use of its collective strengths; and
- growing our impact, with total business increasing by 50 per cent over the next five years as one indicator of this.

CSIRO's strength lies in its ability to assemble expert teams – from across the Organisation and across Australia – to tackle complex problems. We support a 'Team Australia' approach, enabling the nation to punch well above its weight in global innovation.

What our Plan means for Australia

The central goal of the CSIRO Strategic Action Plan is to help position Australia as a world leader in critical areas of science, industry, social advancement and environmental sustainability.

Through this we seek to provide the nation with creative science solutions, as well as:

- health (both human and environmental);
- wealth (innovation, competitive industries, efficient services); and
- wisdom (knowledge on which to base future industries and opportunities).

We aim to help Australia rank among the world's leading exporters of knowledge and creative ideas. CSIRO seeks to foster a national team spirit by partnering with business, government and other research organisations. We aspire to draw the world's best scientific and innovation talent to Australia.

'Smart' building for the future

CSIRO is building a world-class energy centre in Newcastle, New South Wales, that will be the new headquarters for the Energy Technology Division's research.

The $32 million *CSIRO Energy Centre*, scheduled to open in mid-2003, will show visitors what they can expect from the 'smart building' of the future.

One of the main purposes of the Centre is to demonstrate how effective one facility can be in reducing greenhouse emissions. Use of renewable energy and new gas technologies combined with energy saving initiatives will result in emissions savings of about 2 000 tonnes of greenhouse gas a year, equivalent to taking 700 cars off the road.

The NSW Government and the NSW Sustainable Energy Development Authority contributed towards the project, which will showcase the latest energy management technologies.

Roughly 400 kW of power will be generated locally, almost half from renewable sources. Three different kinds of photovoltaic cells (solar panels) will generate about 90 kW of electricity. A wind turbine system of 160 kW will consist of a mix of small and large wind turbines located around the site.

Two microturbines will produce 150 kW. Microturbines are fuelled by a mixture of natural gas and air, which expand to drive a turbine and an electricity generator. Their very low production of greenhouse emissions has resulted in this form of energy being dubbed 'dark green energy'. To reduce the Centre's energy costs and the demand on the grid, the turbines will be scheduled to run when demand is at its peak.

The Centre has been designed for the future installation of developing fuel cell technology and battery storage.

Energy saving features, such as shading, light shelves under windows to 'bounce' light into rooms, underfloor ventilation and 'smart glass' to minimise heat gain and glare all contribute to smart energy planning.

A building management system will monitor and control all building services such as heating, cooling and ventilation.

By demonstrating new and emerging technologies in a working building, CSIRO will show industry and government partners what can be achieved in practice. The key to the new Centre will be partnerships, both to undertake the research and demonstration, and to transfer technologies to market.

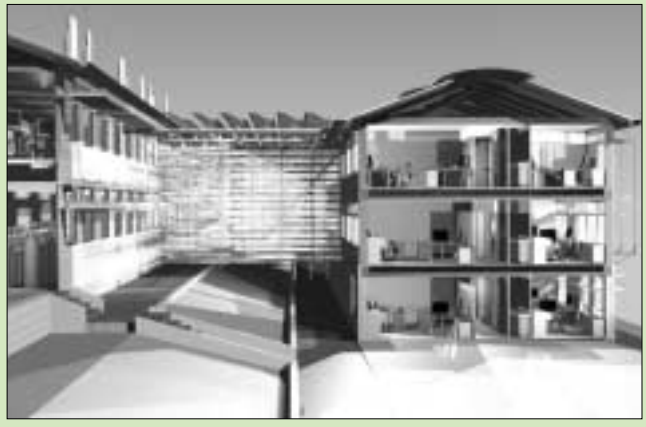


Illustration: Gary Jackson

Outcomes and outputs

This section describes CSIRO's performance in accordance with the Government's output-outcome performance reporting framework and the performance indicators in the Government's Triennial Funding Agreement with CSIRO for 2000–01 to 2002–03.

By delivering research products and services to 22 Sectors in four Output Groups (see Figure 1) [1], CSIRO contributes to the 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 outcome is pursued through strategies that deliver crucial advances in knowledge and its application, including:

- solutions for strategically important issues for the nation;
- new opportunities for small and medium enterprises;
- world-leading breakthroughs in basic research;
- new technologies to assist industries and create new export markets;
- environmentally friendly products and processes;
- new technologies and management systems that improve safety in industry; and
- environmental monitoring and management technologies.

Selected outcomes and outputs achieved in each Output Group are described on pages 29–46.

Figure 1: CSIRO's Outcome-Output Framework 2001–02

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.

Outputs

Research products and services – delivered in four Output Groups

Output Group 1: Manufacturing, Information and Service Industries

1.1 Built Environment	1.5 Measurement Standards
1.2 Chemicals and Plastics	1.6 Pharmaceuticals and Human Health
1.3 Information and Communication Technologies	1.7 Radio Astronomy
1.4 Integrated Manufactured Products	1.8 Services

Output Group 2: Minerals and Energy Industries

2.1 Energy	2.3 Mineral Processing and Metal Production
2.2 Mineral Exploration and Mining	2.4 Petroleum

Output Group 3: Management of the Environment and Natural Resources

3.1 Biodiversity	3.3 Land and Water
3.2 Climate and Atmosphere	3.4 Marine

Output Group 4: Agribusiness Industries

4.1 Field Crops	4.4 Horticulture
4.2 Food Processing	4.5 Meat, Dairy and Aquaculture
4.3 Forestry, Wood and Paper Industries	4.6 Textiles, Clothing and Footwear

[1] *Portfolio Budget Statements 2001–02, Industry, Science and Resources Portfolio. CSIRO's outcome statement and output framework have been revised for 2002–03.*

Key Performance Indicators

The following six key performance indicators are incorporated in CSIRO's current Triennium Funding Agreement with the Commonwealth Government. CSIRO will review its performance measurement framework and needs, and negotiate a new Triennium Funding Agreement with Government in 2002–03. The Government's review and removal (in September 2002) of CSIRO's external earnings target, and related discussions with the Chief Scientist, Dr Robin Batterham, may also influence future performance measures for CSIRO.

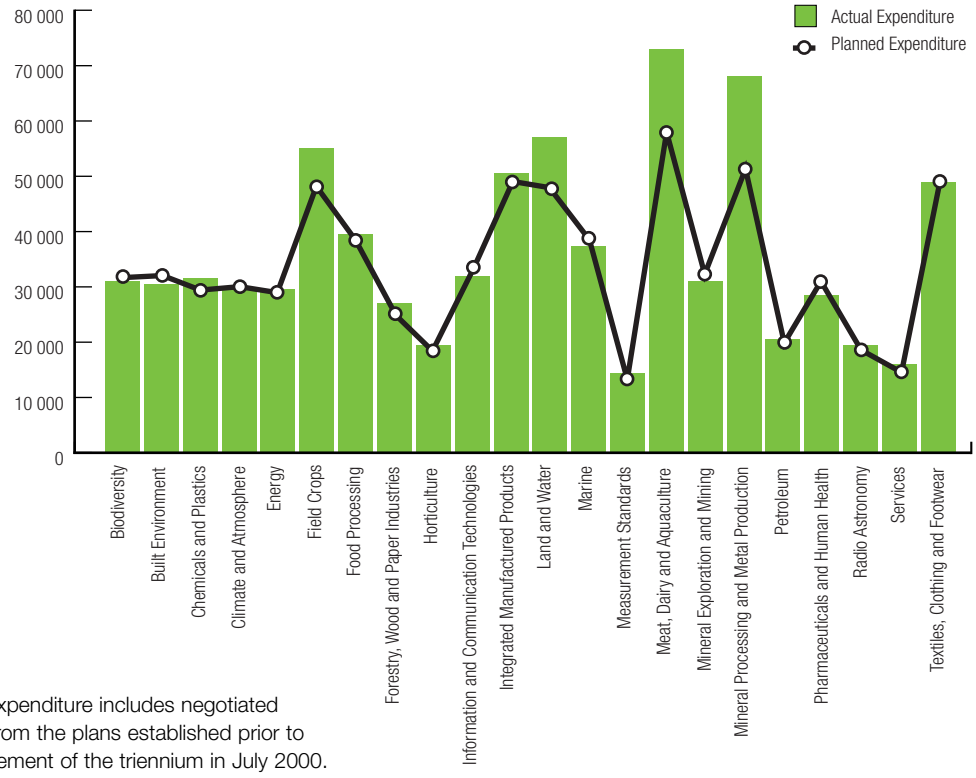
Indicator 1: Sector Profile

This indicator reflects CSIRO's shifting of resources in line with changing priorities determined in consultation with government, Sector Advisory Committees (SACs) and CSIRO customers in the public and private sectors.

Figure 2 charts actual expenditure by CSIRO Divisions in 2001–02 against the planned level of investment in each Sector as an indicator of CSIRO's performance in allocating resources against identified priorities. Priority decisions and resource allocation are based on an assessment of the attractiveness and feasibility of research opportunities in each Sector. CSIRO's external Sector Advisory Committees (SACs) play a key role in advising CSIRO on priorities. Members of SACs are listed in Appendix 1.

The differences between planned and actual expenditure are generally well within expected variations. Results for the Field Crops, Land and Water, and Meat, Dairy and Aquaculture Sectors reflect stronger than expected external earnings performance in those Sectors. The actual expenditure shown for the Mineral Processing and Metal Production Sector is inflated by $25 million reflecting Commonwealth and Queensland governments support for the establishment of a light metals industry (for further details see page 102). The chart estimates CSIRO's operational activities in Food Science Australia (a joint venture with the Australian Food Industry Science Centre).

Figure 2: CSIRO Expenditure by Sector, 2001–02, $'000.



* Planned expenditure includes negotiated changes from the plans established prior to commencement of the triennium in July 2000.

Indicator 2: External Earnings

This indicator (measured as the amount of external earnings for research and related services from various sources) reflects the demand for CSIRO's research and related services.

The trend in CSIRO's external earnings by source is shown in Figure 3. The increase in external earnings in 2001–02 is in line with the Organisation's overall five-year growth target. Reflecting proactive innovation policy on the part of state governments and the internationalisation of R&D, state and global entities have been the sources of strongest revenue growth. The external earnings ratio for 2001–02 was 34.7 per cent.

In September 2002, the Government, following a review by the Chief Scientist, Dr Robin Batterham, removed CSIRO's external earnings target of 30 per cent. Announcing the decision, the Minister for Science, the Hon Peter McGauran, said all three science agencies had been achieving external earnings around the target levels for several years. The Chief Scientist's report shows the targets policy to be inflexible and to have unduly constrained the CSIRO in pursuing business relationships. The return on investment in science by CSIRO can be measured in more sophisticated ways than revenue alone, such as social impact and benefit and productivity as well as economic return.

Figure 3: External Earnings by Source.

Source		1997–98	1998–99	1999–00	2000–01	2001–02
Australian Private Sector	$m	74.5	64.9	67.9	68.6	68.6
Commonwealth, State & Local Govt	$m	52.3	63.1	68.6	66.8	75.6
Rural Industry R&D Corporations	$m	40.3	40.8	40.7	40.8	41.6
Cooperative Research Centres	$m	32.5	31.3	30.0	27.6	26.7
Overseas Entities	$m	13.1	19.9	20.5	31.0	35.3
Other Revenue not classified by source	$m	8.1	4.1	4.9	5.2	0.2
Intellectual Property – Royalty and Licence Revenues	$m	5.3	6.5	8.3	9.3	16.9
Net adjustment – work in progress and deferred revenue	$m	10.7	-9.3	-0.1	-7.0	2.1
External Earnings (Sale of goods and services)	**$m**	**236.8**	**221.3**	**240.8**	**242.3**	**267.0**
External Earnings Ratio*	**%**	**32.6**	**32.7**	**33.3**	**32.3**	**34.7**

* The external earnings ratio, as defined in CSIRO's Triennium Funding Agreement, includes adjustments to revenue for items unrelated to the provision of research and technology services, (eg interest on investments) and for the capital use charge.

Indicator 3: CSIRO Publications, Reports and Patents

This indicator (measured as the number of patents, reports and other publications annually, with quality assessed through citation analysis on a five-yearly basis) reflects CSIRO's contribution to, and hence ability to access, the world's knowledge base.

Trend data for CSIRO's publication and patenting activity are shown in Figures 4 and 5. Overall publication numbers remain at impressive levels. In addition to patents, at the end of June 2002 CSIRO held 65 Australian and 17 foreign Plant Breeders Rights (registered and pending applications), 262 Australian and 84 foreign Trade Marks, and eight Australian and nine foreign Registered Designs.

CSIRO's contribution to scientific literature has had significant impact. In the July-August 2001 edition of the international journal *Science Watch*, published by the Institute for Scientific Information (ISI), CSIRO was ranked among the world's leading science institutions. CSIRO was rated third most influential research agency in the world in environmental science/ecology, and fourth most influential in agricultural science, over the decade to February 2001. The *Science Watch* ratings are based on an index of citations – the number of times an agency's scientific papers are cited (or drawn upon) by other researchers. It is used as an indicator of how much influence a research organisation and its scientists have on the work of their colleagues worldwide. 'These are the heavy hitters of science. In general each not only published in quantity but also exerted outsized influence on the world's research community, as reflected in their tremendous citation tallies,' *Science Watch* commented. Overall, ISI data show that CSIRO ranks in the top one per cent of scientific institutions in the world in 11 out of 22 scientific disciplines.

CSIRO's publications reflect a high level of national and international collaboration. A recent analysis by the Research Evaluation and Policy Project at the Australian National University found that 47 per cent of CSIRO's publications in journals indexed by ISI involved collaboration with other Australian institutions and 33 per cent involved collaboration with overseas institutions. The analysis also found that 73 per cent of CSIRO's publications in ISI-indexed journals appeared in journals in the two highest impact quartiles.

Figure 4: CSIRO Publications and Reports (number in each calendar year)

	1997	1998	1999	2000	2001
Journal Articles	1682	1472	1535	1619	1631
Conference Papers	1278	1183	1280	1035	1096
Technical Reports	318	194	229	175	153
Books & Chapters	207	123	236	178	128
Total	**3485**	**2972**	**3280**	**3007**	**3008**
Client reports	7075	8099	7339	8936	9324

Figure 5: CSIRO Patents (number as at 30 June each year)

	1998	1999	2000	2001	2002
Inventions (patent families)	723	735	705	751	733
New Inventions	96	74	79	93	80
Current PCT* applications	83	84	63	82	104
Granted patents			1749	1774	1801
Live patent cases	3182	3371	3436	3475	3537

* Patent Cooperation Treaty

Indicator 4: Research Training

This indicator (measured as the number of research students supervised or co-supervised by CSIRO staff) reflects CSIRO's contribution to developing the skills base of Australia and its own staff.

In 2002 CSIRO jointly supervised a total of 616 postgraduate research students. The number of students sponsored by CSIRO in 2002 rose to 180. Figure 6 shows the trend in student supervision and sponsorship numbers over recent years including the breakdown by PhD, Masters and Honours students and the number of full and partial scholarships.

CSIRO's contribution to the training and development of Australia's researchers and science-based professionals is being further enhanced as CSIRO pursues its goal to increase the number of postdoctoral appointments to 300 by 2006. With 183 postdoctoral staff at the end of June 2002, good progress has been made toward this goal. A new CSIRO Postdoctoral Program, established in October 2001 has granted 42 awards to date. The program will support 25 Postdoctoral Fellowships every year with emphasis on new areas of science and collaborative proposals. A new joint Postdoctoral Program between the Australian Research Council (ARC) and CSIRO will start in 2003. A new CSIRO PhD Program (initiated at the end of 2001) awarded over 30 scholarships across CSIRO.

CSIRO's own learning and development priorities, including team behaviours (as suggested by the Staff Consultative Group), have been re-evaluated in the light of the Strategic Action Plan and new strategies to enhance employee capability to contribute to organisational objectives are being implemented.

CSIRO staff contribute to student lectures and seminars, undergraduate and TAFE courses, short courses, summer schools, apprenticeship training and vacation student programs. CSIRO Education (see also page 47) continues to provide a range of highly regarded science-oriented programs for primary and secondary school aged students (and their teachers).

Figure 6: Number of Students Sponsored and Supervised (jointly) by CSIRO

Supervision	1997–98	1998–99	1999–00	2000–01	2001–02
PhD	585	579	379	475	482
Masters	158	176	143	57	55
Honours				77	79
Total	**743**	**755**	**522**	**609**	**616**
With CRCs*	26%	30%	30%	23%	26%

Sponsorship	1997–98	1998–99	1999–00	2000–01	2001–02
Full	34	30	32	42	55
Partial	98	97	69	86	125
PhD	114	103	91	110	163
Masters	18	24	10	8	9
Honours				10	8
Total	**132**	**127**	**101**	**128**	**180**

* Cooperative Research Centres

Indicator 5: Customer Satisfaction

This indicator (measured this year with a new customer value survey) reflects CSIRO's responsiveness to the needs of customers with whom the Organisation has a contractual arrangement.

During 2001–02, a new Customer Value Survey (CVS) has been rolled out across CSIRO, replacing a number of different customer surveys with a 'one-CSIRO' approach based on an internationally proven technique of comparative value analysis. One particular advantage of the CVS instrument is the ability to benchmark results with a large body of international data. On this basis, a customer rating for overall value of 8/10 (or higher), combined with a comparative value score of 110 (or higher), is indicative of 'world-class' performance. Any comparative score above 100 rates the organisation above alternative providers to the surveyed customers.

The survey is run quarterly but individual customers are surveyed no more than once in a year. The survey uses a questionnaire that explores several levels of 'attributes' that test the overall question of whether the results of the interaction of a particular customer with CSIRO were 'of value'. The survey instrument is based on a comparative analysis (asking our customers to rate us as well as our competitors). The results are analysed and modeled to identify the key drivers of value. Taking corrective actions in response to the survey results and advising our customers of what we have done, is a vital aspect of the process.

Results, based on the first three quarters of available data (to March 2002) are shown in Figure 7, confirming the generally high level of satisfaction found in previous customer surveys.

The Customer Value Survey has been introduced as part of our renewed focus on strengthening relationships with our many customers and partners. It will be used to:

- support our Project Management Improvement initiative by identifying those elements of project management which are important to our customers;
- reinforce the concept of value pricing, as opposed to cost pricing, and to identify the drivers of value from the customer's perspective;
- identify the processes in our operations which need to be improved if we wish to retain existing customers and win new ones; and
- demonstrate to our stakeholders the value of CSIRO's R&D services through the level of satisfaction of our customers.

Figure 7: Customer Value Survey Results *

	CSIRO's Score	Comparative Value Score
Rating of CSIRO overall on value	7.0	108
Rating overall on products or services	7.3	111
Rating overall on process or people	7.0	105

* *Results for the period July 2001 to March 2002. Comparative value scores are calculated as CSIRO's score (on a ten point scale) divided by our competitors' score times 100. For example, 7.81 / 7.65 * 100 = 102*

Indicator 6: Adoption and Impact: Achievements (Outcomes and Outputs)

This indicator (based this year on new indicators of how R&D contributes to the 'triple bottom line') reflects the economic, social and environmental significance of CSIRO's work by reporting examples of CSIRO outputs adopted by users in industry, government and the community.

A recent study conducted for CSIRO by the Centre for International Economics (CIE) identified four major 'types' of research products and services (outputs) that CSIRO delivers to stakeholders:

- new/improved technology and management systems;
- new/improved intermediate and final products;
- 'catalyst' services and advice for policy and business; and
- new knowledge and skills.

Furthermore, as illustrated in Figure 8, the CIE identified that these four types of outputs contribute to 'triple bottom line' economic, social and environmental benefits in a variety of different ways, specifically through:

- lower/more competitive production costs;
- improved quality of goods and services;
- new products, services and businesses;
- reduced risk (economic, environmental or social);
- development of skills (enhanced human capital);
- improved human health, safety and wellbeing;
- informing policy (cost-effective public programs);
- reduced pollution; and
- improved environmental health.

The following selection of recent achievements illustrates the enormous variety of ways in which CSIRO contributes to economic, social and environmental benefits for Australia.

These are only some examples of the adoption and impact of CSIRO's research. They are described in terms of outputs and outcomes using the above classification system and the four Output Groups (Manufacturing, Information and Service Industries; Minerals and Energy Industries; Management of the Environment and Natural Resources; Agribusiness Industries).

Some represent further milestones in achievements that have been reported in previous years. This reflects the cumulative nature of knowledge, the time-frames over which innovations are adopted, and CSIRO building ongoing research and commercial partnerships. CSIRO acknowledges that many achievements result from successful partnerships with clients and collaborators, both private and public. Space prevents specific acknowledgement of all partners.

Figure 9 provides a summary list of selected achievements. The darker shading represents the major output and outcome types associated with each achievement. Secondary outputs and outcomes are shown in lighter shading.

Figure 8: CSIRO's pathway to the Triple Bottom Line

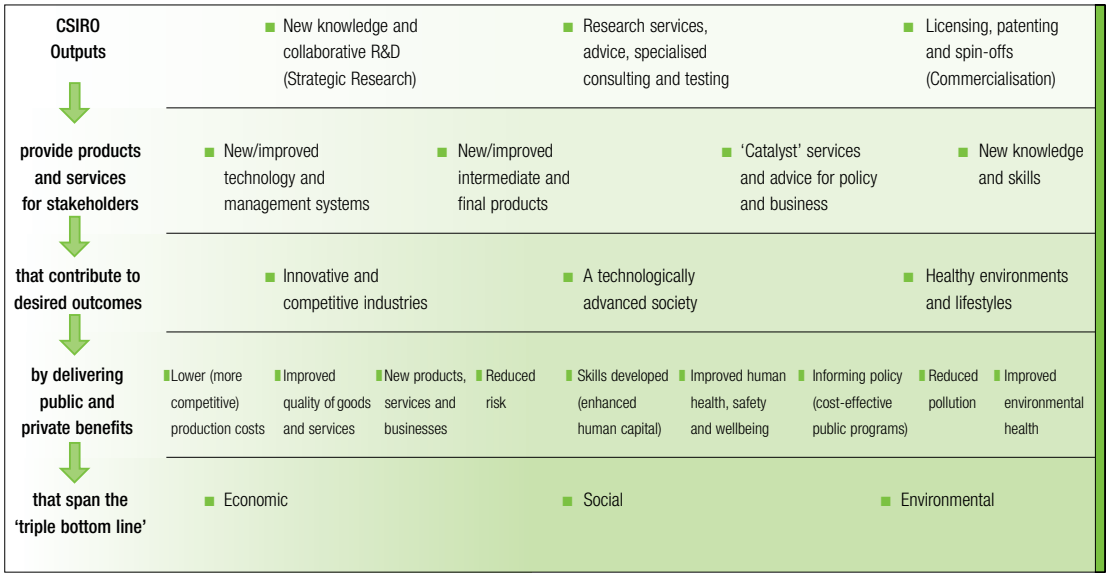


Figure 9: CSIRO Achievements: Outputs and Outcomes 2001–02 *

Outputs				Achievements	Outcomes								
New/improved technology or management system	New/improved intermediate or final products	Advice or 'catalyst services' for policy or business	New knowledge or skills		Lower (more competitive) production costs	Improved quality goods and services	New products, services or businesses	Reduced risk (economic, environmental or social)	Development of skills (enhanced human capital)	Improved human health, safety and wellbeing	Informing policy (cost-effective public programs)	Reduced pollution	Improved environmental health
Output Group: Manufacturing, Information and Service Industries													
■	■			Cleaner drinking water	■					▒		■	▒
■	■		▒	Improved concrete processing	■	■							
■			■	Microwave chemistry	■								
■	■			Polyimide technology	■			■					
	■			SVG for pocket PCs			■						
■	■			CSIRO MultiBeam antenna		■	■						
■	■			Panoptic search engine		■							
■	▒	■	■	CeNTIE^	■	▒	■	▒	▒				
	■	■	■	CSIRO/TRW Velocium strategic alliance	■		■	▒	■				
■			■	High speed haptic collaboration		■				■			
■		▒		Australian plant pest database		■	▒	■		■			
■	■		■	Bioinformatics algorithms for better diagnosis			■						
■				Efficient coal loading	■	■							
■	■			A new X-ray microscope			■		■				
	■			Airborne remote sensing system			■						
■	■			High performance material for engine bearings	■		■						
■	■			Optically variable coins			■						
■			▒	New bonding technology		■	■						
	■		■	Corner cubes for space applications		■	■	■					
■		▒		Gas mixture standards							■		■
■		■		EvoGenix Pty Ltd			■			■			
■			■	Measuring DNA damage in humans						■			
	■		▒	Oxygen/air mixer for premature babies			■			■			
■	■			Sales of anti-cancer palliative care drug	▒					■			
	■			Tuberculosis tests			■			■			
			■	Protein structure holds clues to cancer						■			
■			■	Entocosm Pty Ltd – a spin off for drug discovery			■			■			
■	■			Radiotelescope technology for Taiwan					■				
			■	Exploring the origin of black holes					■				
■		■		Enforcement system for road weigh-in-motion				■		■			
■	■			Second generation roadcrack vehicle		■				■			
	■		■	Finance software goes global		■		■					
	■			Cancer detection instrument			■			■			

* *This table highlights the major output and outcome types associated with each achievement and illustrates the differing pattern of outputs and outcomes across the four Output Groups. The major output and outcome types associated with each achievement are shown with dark shading. Other output or outcome types associated with the achievement are shown in lighter shading.*

^ Centre for Networking Technologies for the Information Economy

Figure 9: CSIRO Achievements: Outputs and Outcomes 2001–02 *

Outputs				Achievements	Outcomes								
New/improved technology or management system	New/improved intermediate or final products	Advice or 'catalyst services' for policy or business	New knowledge or skills		Lower (more competitive) production costs	Improved quality goods and services	New products, services or businesses	Reduced risk (economic, environmental or social)	Development of skills (enhanced human capital)	Improved human health, safety and wellbeing	Informing policy (cost-effective public programs)	Reduced pollution	Improved environmental health
Output Group: Minerals and Energy Industries													
		■	■	Centre for Distributed Energy and Power					■		■		
■			□	Reduced risk of coalmine explosions	■			□	□	■			
■				Ultra-clean coal			■					■	
■		□		Finding ore deposits using groundwater	■			□					■
■				Hydraulic fracturing in mining	■					■			
		□	■	Cost-effective nickel exploration	■			□	□				
■	■			Nuclear microprobe	■		■		□				
	■		■	Regolith geology in Western Australia	■	■		□	□				
■	□		■	SiroVision	■		□	□		■			
■	■			Aluminium pollution overcome				■				■	
■		■		Automated mineralogy	■	■							
■				World's largest magnesium smelter	■		■						
■		■		New ore standards		■						■	
■				SIROSMELT export success	■		■						
■			■	Mineral bioprocessing	■			□	□				
		■	■	Coal-bed methane	■							■	
■		■		Prospect risk management	■			■					
Output Group: Management of the Environment and Natural Resources													
■		■		Australia's virtual herbarium							■		■
■				Development of Ecowatch				□	■		□		■
			■	Fire management and biodiversity					■				■
		■	■	Managing grassy woodlands					■				■
		■	■	Integrating agriculture and biodiversity					■		■		
■			■	Significant impact on biodiversity threat				■					■
■		■		Carbon baseline study							■		■
■		■		Analysing greenhouse gases							■		■

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Output Group: Management of the Environment and Natural Resources – *cont.*													
		■		Climate variability and agribusiness			■	■					
■		■		New air pollution model							■	■	
		■	■	Southern ocean and climate					■		■		▫
	■	■		Soil carbon and land use			■				■		
■				FullStop for irrigation management			■						■
		■	■	Gippsland Lakes study							■		■
■		■		Improving catchment planning							■		■
■		■		Regional water quality							■		■
■			■	Partial rootzone drying	■			▫					■
■			■	Better salinity management				■	▫		▫		■
■			■	Underground dams for storing water			■	■					
■		▫	■	Environmental risk assessment	■			■			▫		▫
■		■	▫	Preventing marine pests	■			■	▫		▫		
		■	■	Turtle excluder devices	■	▫				▫			■
■			■	Native fungi and revegetation		■							■
■			■	Non-chemical rodent control								■	■
Output Group: Agribusiness Industries													
■	■			New wheat varieties	■								■
■				Novel pest control		■		■				▫	
■	■			Managing mouse plagues				■	■				
			■	Fast-track breeding of new rice varieties		■				▫			
		■		Carcinogen analysis in food		■				■			
		■	■	High pressure processing		■	■						
■	■			New dairy ingredients			■						
■	■			Biodegradable plastics	■		■						
■				Mechanisation in abbatoirs	■	▫				■			

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Output Group: Agribusiness Industries – *cont.*													
■			■	Protective packaging for exports		■	■						
		■		Better tree-farming decisions	■			■					
	■		■	Success in pine breeding	■		■						
		■	■	Managing the Monterey pine aphid	■			■					
	■			New red wine grape	■			■					
		■		Safety of Australian wine		■				■			
	■		■	Genetic analysis of wine grape varieties		■							
	■		■	New table grapes for northern Australia		■							
■				DNA pedigreeing of Kuruma prawns	■		■						
■	■	▒	▒	Boosting prawn productivity	■			■	▒				
■			■	Managing the screw-worm fly threat				■	▒		■		
			■	Preparing against foot-and-mouth disease				■	■				
■			■	New prawn disease kit	■			■					■
■		■	■	Feed supplement boosts milk yields	■	■			■				
■			■	Pinkeye vaccine	■		■						
■		■		Successful management of a pasture pest				▒				■	
	■		■	More sustainable farming	■			■					
■		■		Biological control of weeds		■		▒					■
		■	■	Building sustainable regions					■		■		
■			■	Ecograze–better grazing management					■				■
■	▒			Bleaching and dyeing textile blends	■		■						
	■		■	Managing pests in cotton	■							■	
	■		■	Satellite-based pasture analysis	■						■		
■			■	Wool staple strength	■	■							
			■	The role of crimp	▒	■							
■	■			Intelligent knee sleeve			■			■			

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Cleaner drinking water

Outputs:
The MIEX®DOC water treatment technology uses magnetic ion exchange resins to remove natural organic matter from drinking water more cheaply and with less waste than other processes.

Outcomes:
The MIEX®DOC process is used now at water plants in South Australia and Western Australia. It enables the building of lower cost water treatment plants and retro-fitted plants and delivers higher quality water. Orica Australia has built a $10 million pilot resin plant in Melbourne.

Improved concrete processing

Outputs:
Temperature Match Curing (TMC) is a system for simulating the temperature condition of curing concrete. An embedded process controller precisely regulates the curing temperature profile, removing the guesswork from concrete casting operations.

Outcomes:
TMC's range of successful applications include saving curing time and improving efficiency and profitability. Two very high-end TMC systems are being built for an overseas client.

Microwave chemistry

Outputs:
Two types of microwave chemical reactors – a batch processor and a continuous processor – that use radio waves and high pressure to make chemical reactions go up to 1 000 times faster than conventional methods.

Outcomes:
Improved speed, efficiency and optimisation of reactions represents a major advance in synthetic organic chemistry. CSIRO's patents are licensed to Personal Chemistry AB in Sweden, and a continuing research agreement is in place.

Polyimide technology

Outputs:
Polyimide technology facilitates an environmentally friendly low-cost water based manufacturing process for a range of high technology polymer applications in the aerospace and electronics industries. The new technology allows for the production of polyimide components with improved mechanical properties and fewer defects.

Outcomes:
CSIRO has licensed the technology to the Kabushikigaishi Toyobo Research Centre who will use the manufacturing technology to produce high temperature – high performance resins for the production of advanced composite materials and electronics packaging applications.

SVG for pocket PCs

Outputs:
CSIRO contributed to development of the SVG (scalable vector graphics) standard and produced the first commercial implementation of SVG. Now PocketSVG, a product that allows SVG applications to be developed on pocket PCs, has been released commercially.

Outcomes:
PocketSVG provides a means, using open standards, to display rich graphical content on a variety of portable devices such as personal digital assistants and mobile phones.

CSIRO MultiBeam antenna

Outputs:
A revolutionary MultiBeam antenna that has the ability to send and receive multiple signals from different satellites simultaneously.

Outcomes:
Three 4.5 metre diameter MultiBeam antennas are now operating successfully in Luxembourg. The antenna received three awards for engineering excellence in 2001.

Panoptic search engine

Outputs:
Panoptic is a high performance search engine designed specifically for enterprise web sites and portals that offers a unique combination of metadata and full text indexing.

Outcomes:
Panoptic reduces search time, improving productivity and communication with customers and other stakeholders. Early adopters include CSIRO, the Australian Broadcasting Corporation, the Department of Industry Science and Resources Research Finder and the Centre for Mental Health Research, at the Australian National University.

CeNTIE (Centre for Networking Technologies for the Information Economy)

Outputs:

Demonstrations of the potential for new services and modes of interaction in business, entertainment, health and education that only become possible over advanced networks.

Outcomes:

The first demonstration outside the United States of a 10 Gigabits per second metropolitan ethernet communications system with guaranteed quality of service.

CSIRO / TRW velocium strategic alliance

Outputs:

Strategic Alliance agreement signed with TRW Inc for the mutual development of high-performance GaAs (Gallium Arsenide) and InP (Indium Phosphide) MMICs (monolithic microwave integrated circuits).

Outcomes:

Participation in the FARADAY project, a major EU technology development program collaboration aimed at the development of multibeam focal plane array technology with integrated MMIC based receivers for radio astronomy and other telecommunications applications with emphasis on design, analysis and yield.

High speed haptic collaboration

Outputs:

Networked virtual environment technology combines 3D images with an artificial sense of touch, known as 'haptics'. Two Haptic Workbenches linked by the high speed (10 Gigabit per second) CeNTIE network demonstrated a working system which allows two operators in remote locations to collaborate and communicate in real time on a hands-on task.

Outcomes:

The system is the basis for developing collaborative training applications. Training applications for surgeons have been demonstrated at trials at Sydney's Nepean Hospital and networked haptics means a surgeon could train many students in different cities at the same time.

Australian plant pest database

Outputs:

CSIRO's Internet Marketplaces technology has been applied to integrate a collection of plant pest records from databases across Australia, providing comprehensive query access to these records via the Internet.

Outcomes:

The Australian Plant Pest Database enables researchers to better manage damaging exotic and local plant pests by providing Australian plant health scientists with access to specimen records including insects, nematodes, fungi, bacteria and viruses that attack plants of significance to Australian agriculture and biodiversity.

Bioinformatics algorithms for better diagnosis

Outputs:

CSIRO has developed sophisticated, patent-protected algorithms that improve methods for the identification of genes responsible for particular disease states, such as prostate cancer.

Outcomes:

These algorithms will allow bioinformatics and diagnostics companies to develop new software products which will in turn lead to new, more reliable diagnostics and prognostics for cancer.

Efficient coal loading

Outputs:

CSIRO's Operations Research team developed a simulation tool to streamline coal loading operations at Dalrymple Bay Coal Terminal in Queensland. The terminal has a throughput of 30 million tonnes of coal each year.

Outcomes:

CSIRO's software will enable optimal use of transport, storage and loading facilities. The simulation tool is able to schedule trains, determine the placement of incoming product, schedule the usage of the stockyard equipment and determine the ship loading sequences. As a management tool, it assists the terminal management with decision-making in a dynamic operational environment.

A new X-ray microscope

Outputs:

A new approach to X-ray projection microscopy using phase-contrast multi-spectral imaging, and a new instrument – the X-ray Ultra Microscope (XuM).

Outcomes:

The XuM provides spatial resolution more than 10 times better than its nearest competitor. X Ray Technologies (XRT) have acquired the rights, knowledge and interests in this area from CSIRO, and has delivered its first order for a XuM to the United States.

Airborne remote sensing system

Outputs:

Custom-designed airborne remote sensing equipment.

Outcomes:

A privately owned start-up company (Optical Engineering Associates Pty Ltd) will design and develop

optical equipment for the international market at its newly established world-class facility. There is a license agreement with CSIRO.

High performance material for engine bearings

Outputs:
New high-performance automotive bearing alloy made from light metal and a new method of manufacture by continuous roll casting.

Outcomes:
Completion of successful engine trials has stimulated adoption of the technology by automotive equipment manufacturers.

Optically variable coins

Outputs:
Optically variable coins or 'hologram coins' incorporating a new method for embossing microstructures into soft metals.

Outcomes:
A silver collector's coin known as the 'Finale Coin' was successfully released by the Royal Australian Mint in November 2002. Further coins are planned and export potential is being explored.

New bonding technology

Outputs:
SICOR is a versatile new generation technology for bonding coatings to polymers. It allows the 'sticking together' of previously un-bondable or hard-to-bond materials.

Outcomes:
SICOR technology has now been embraced by a number of leading local and international companies for applications in a variety of industries and markets. Polymer Surface Technology Pty Ltd has been established to commercialise the technology.

Corner cubes for space applications

Outputs:
The fabrication, coating and characterisation of high precision cube corners. Methods for the manufacture and certification of retro-reflecting cube corners to tolerances which have never been achieved previously.

Outcomes:
Enable high-precision dimensional metrology (to picometre level) in land and space-based astronomy.

Oxygen/air mixer for treating premature babies

CSIRO engineers have brought a new dimension to the world of biomedicine producing an inexpensive device for mixing oxygen with air for premature babies in third world countries.

In many developing countries premature babies are at risk of brain damage because there is no ready access to reliable supplies of compressed air and air/oxygen.

If premature children are given 100 per cent oxygen and then are suddenly exposed to atmospheric oxygen it can result in brain damage and blindness.

CSIRO and an Australian company have developed an oxygen/air mixer that is designed to reduce this from happening by allowing the selection of appropriate levels of oxygen. The device has been proven and is market-ready.

It is estimated two to five per cent of babies born in developing countries require the assistance of oxygen at birth. This translates into several million births each year where the availability of this device would provide immediate benefits.

Gas mixture standards

Outputs:

A versatile facility for preparing reference gas mixtures linked to national standards in environmental and industrial measurement, and to underpin Australia's position in international carbon trading.

Outcomes:

The accuracy of six and 12 component mixtures of natural gas has been demonstrated in international comparisons, raising confidence in national chemical composition standards and the measurement of gas quality for domestic and trade purposes.

EvoGenix Pty Ltd

Outputs:

Novel technology to generate processes for the discovery and development of reagents for diagnosis and therapy.

Outcomes:

A start-up company, EvoGenix Pty Ltd, has been created to exploit the new technology and to develop new or improved medical diagostics and therapeutics.

Measuring DNA damage in humans

Outputs:

Improved procedure for scoring DNA damage using the micronucleus assay. New database for use in determining acceptable DNA damage rates.

Outcomes:

Improved application of the assay to monitor the genetic health of human populations and individuals, and to assess the genotoxic effects of environmental pollutants. The United States Federal Drug Administration has adopted the technology to examine the safety of mobile phone radiation.

Oxygen/air mixer for premature babies

Outputs:

An oxygen/air mixer for the treatment of premature babies in developing countries. The mixer incorporates improved understanding of oxygen/air mixing and a new fan failure warning system.

Outcomes:

Prevention of brain damage in children in countries where compressed air and air/oxygen mixers are not standard equipment but pure oxygen is readily available. Manufacture of the mixer by an Australian company is now underway.

Sales of anti-cancer palliative care drug

Outputs:

An efficient, fast method of purification in the production process of anti-cancer drug, bleomycin sulfate.

Outcomes:

Bleomycin provides relief and assistance with palliative care for certain carcinomas. Bleomycin for Injection USP is being manufactured and sold in North America by Fauldings Pty Ltd.

Tuberculosis tests

Outputs:

Faster and more accurate tests for tuberculosis (TB) in cattle, humans, non-human primates and deer. BOVIGAM™ for cattle and QuantiFERON®-TB for humans both received approval for use in the United States during 2001–02.

Outcomes:

Cellestis Ltd, a public company located in Melbourne, was formed in 2000 to market and develop QuantiFERON®-TB. BOVIGAM™, co-developed with Commonwealth Serum Laboratories Ltd, is marketed in 25 countries.

Protein structure holds clues to cancer

Outputs

The three dimensional structure of the epidermal growth factor receptor, a protein found on the surface of cancer cells, has been solved by a team involving CSIRO scientists.

Outcomes

This information, published in the international journal 'Cell', provides the platform on which to develop several potential therapies to retard cancer growth.

Entocosm Pty Ltd – a spin off for drug discovery

Outputs

Formation of new company to develop pharmaceutical products from a unique library of insect extracts.

Outcomes

New classes of molecules for drug discovery based on Australia's unique biodiversity.

Radiotelescope technology for Taiwan

Outputs:

A prototype correlator and data acquisition system for the AMiBA (Array for Microwave Background Anistropy) telescope has been developed and constructed at the Australia Telescope National Facility and delivered to Taiwan.

Outcomes:

International recognition for Australia and advances in fundamental knowledge about the universe.

Exploring the origins of black holes

Outputs:

Evidence that the origin of 'Gamma Ray Burst' sources are associated with the death throes of very massive stars, supporting theoretical predictions concerning the formation of black holes.

Outcomes:
International recognition for Australia and advances in fundamental knowledge about the universe.

Enforcement system for road weigh-in-motion

Outputs:
Camera-based system for identifying vehicles disobeying directions to enter a checking station for further examination.

Outcomes:
Reduced risk of overweight vehicles causing damage to roads and danger to the safety of other road users.

Second generation roadcrack vehicle

Outputs:
Roadcrack, a four-channel machine vision system that can detect road surface cracks as fine as one millimetre wide while the road survey vehicle travels at highway speeds.

Outcomes:
Rapid and safe assessment of road condition leads to improved asset management, lower transport fuel costs, reduced travel times and lower pollution.

Finance software goes global

Outputs:
The first commercial option-pricing software to use the finite-element method, giving it unique flexibility for creating new, complex financial options and pricing existing ones.

Outcomes:
Reditus enables users to develop and trade exotic options types not readily solved by conventional methods and to find accurate, reliable prices and risk parameters for these new financial products. Global distribution by financial services company GFI.

Cancer detection instrument

Outputs:
The SolarScan® instrument uses advanced image capture and analysis techniques to provide high quality diagnostic assistance to physicians for diagnosing melanoma, the most deadly skin cancer. Released on the market this year by Polartechnics Ltd.

Outcomes:
More rapid and accurate detection of skin cancers leading to better health outcomes and lower costs.

Melanoma | diagnosis with SolarScan®

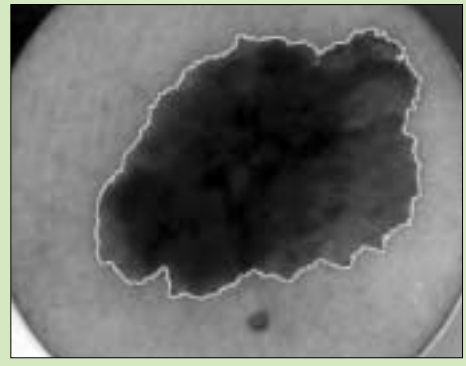
A new Australian device stands to save thousands of lives by helping general practitioners diagnose melanoma.

SolarScan® was developed over eight years by Australian company Polartechnics Ltd, CSIRO and the Sydney Melanoma Unit, University of Sydney at Royal Prince Alfred Hospital.

Prototypes have recently been installed in four medical centres in Queensland, adding to the seven that have been in use in other parts of Australia, the United States and Europe for several years.

Melanoma is the most deadly form of skin cancer killing around a thousand Australians a year. It is the most common form of cancer in men and women aged 15-44 years. If detected early, the cure rate for melanoma is almost 100 per cent. Late detection, when the melanoma is more than three millimetres deep, results in only a 59 per cent survival rate.

SolarScan® helps to save lives by detecting skin cancer warning signs early enough for medical treatment. The device will also save money by reducing the number of unnecessary surgical procedures. Almost 750 000 skin cancer removal operations are completed each year, costing Australian taxpayers more than $300 million.



CSIRO contributed the image analysis software that helps SolarScan® determine whether a patient's spot has the features of a melanoma. The device works by capturing an image of a patient's skin spot with a high resolution camera. The CSIRO software analyses the image for features which are indicators of melanoma and compares the features against images of melanomas and non-melanomas in a database. The system then returns advice to support the general practitioner's diagnosis.

SolarScan® will be appearing in doctors' surgeries from now on and enhancements to the device will be ongoing.

Minerals and energy industries

Centre for Distributed Energy and Power

Outputs:

The Centre for Distributed Energy and Power has been established as a 'one-stop-shop', providing advice, seminars and skill development in the introduction, use and adaptation of new micro generation technologies for industry and government.

Outcomes:

Enhanced contribution of distributed energy technologies to industry and policy development through more cost-effective access to comprehensive information.

Reduced risk of coalmine explosions

Outputs:

New strategies for use in underground coalmines during longwall sealing operations to produce an inert atmosphere much more quickly and reduce the potential explosion risk.

Outcomes:

Improved safety for the mine workforce due to reduced explosion risk during the longwall sealing process and a significant reduction in the time/cost to achieve an inert atmosphere.

Ultra clean coal

Outputs:

This technology for cleaning coal leaves ash of only 0.15 per cent after combustion and is suitable for direct firing into a gas-turbine combined-cycle power station.

Outcomes:

A new coal-based product that can be handled like coal but used where gas and oil are the only alternatives. Added value to Australia's largest export commodity.

Finding ore deposits using groundwater

Outputs:

A manual outlining the use of groundwater as an exploration medium for hidden mineral deposits. Describes methods for improved collection, analysis and interpretation of chemical data.

Outcomes:

Reduced exploration risk and costs through better targeting of drill holes. Cost-effective assessment of data for predicting environmental impacts.

Hydraulic fracturing in mining

Outputs:

Technology that enables the controlled caving of roof rock in coal mines and block caving in metal mines.

Outcomes:

The technology is being used by Australian coal mines and metal mines to deliver significant improvements in mine safety and efficiency. It enables underground mines to cut the costs of induced caving by a factor of four.

Cost-effective nickel exploration

Outputs:

Improved understanding of the eruptive processes associated with the formation of nickel sulphide orebodies in the Black Swan area of Western Australia. Specific recommendations regarding prospectivity and the possible locations of further mineralisation.

Outcomes:

Development of more cost-effective industry-wide exploration strategies based on enhanced knowledge of how nickel deposits form.

Nuclear microprobe

Outputs:

A new approach to ion beam focusing (CSIRO Quintuplet lens). Powerful mathematical tools for quantitative imaging packaged in a new software system (GeoPIXE II). Non-destructive methods for quantitative imaging and analysis of fluid inclusions.

Outcomes:

Application of the CSIRO Quintuplet lens system and GeoPIXE II software (now commercialised) leading to substantial cost savings in ore characterisation and minerals processing.

Regolith geology in Western Australia

Outputs:

A regolith-landform map of the Yilgarn Craton, in Western Australia. Models of landscape and regolith evolution with implications for mineral exploration. Understanding of landscape and regolith impacts on agriculture and the environment.

Outcomes:

Lower exploration and mining costs associated with enhanced services provided by geoscience consultants. Exploration strategies better tailored to the terrain. Appropriate selection of geochemical sampling data.

SiroVision

Outputs:

SiroVision, an easy-to-learn system for remotely mapping rock face structures, uses inexpensive off-the-shelf hardware and CSIRO-developed software for 3D imaging and data analysis for mining and construction.

Outcomes:

Improved safety and productivity in the mining and construction industries through improved operating practices and reduced risk of rock mass failure.

Centre for distributed energy and power (CenDEP)

The CSIRO's Centre for Distributed Energy and Power (CenDEP) is at the forefront of the energy and power revolution in Australia.

Established at North Ryde, Sydney, in March 2002, the Centre's key aim is to ensure that distributed power generation in Australia is undertaken as efficiently as available technologies will allow.

CenDEP is an alliance of industry, government and community organisations joining with CSIRO to promote the uptake of distributed energy (the decentralised generation and use of energy) through technology development and demonstration and associated scientific and engineering research.

More than any other country, Australian power and energy systems are dominated by centralised, coal-fired power generation, where large power stations are connected to markets via long-distance transmission lines.

The overall efficiency of Australia's coal-fired generators reflects world best practice but is nevertheless only around 33 per cent. A further loss of eight per cent of that energy through transmission and distribution gives an overall efficiency of below 30 per cent.

New gas utilising technologies, such as advanced gas engines, microturbines and fuel cells, in combination with some renewable sources, can generate enough energy and power locally to provide hospitals, shopping centres, commercial buildings, homes and remote properties with their needs. Excess power can be directed into the main grid where feasible.

By generating more power locally, much greater efficiencies will be achieved and fewer greenhouse gases generated. Distributed energy is the preferred future option for meeting the growth in Australia's power needs.

In other words, over two-thirds of the original fuel energy is wasted.

In the future, large scale generators will be supplemented by local power generation.

Aluminium pollution overcome

Outputs:

An improved strategy for the treatment of toxic spent pot linings from aluminium smelters. It creates a non-hazardous synthetic sand product and maximises the recovery of aluminium fluoride for re-use in smelting.

Outcomes:

Toxic waste, which would otherwise be stockpiled or buried, is converted into benign, useful products so reducing the risk of cyanide or fluoride contamination and volume of waste.

Automated mineralogy

Outputs:

QEM*SEM (Quantitative Evaluation of Minerals using Scanning Electron Microscopy) technology for rapid mineralogical assays that can identify phase-problems not detected by traditional chemical assays. Associated consulting services.

Outcomes:

New customer orders valued at $1 million. Operational benefits include savings through improved mineral recovery and grade. An industry funded user group project has been established to drive future developments.

World's largest magnesium smelter

Outputs:

The Australian Magnesium process has been developed by CSIRO and the Australian Magnesium Corporation (AMC), over 10 years. CSIRO continues to provide R&D services and technology advice related to the design of a commercial magnesium smelter.

Outcomes:
Funding has now been secured by AMC for a $1.3 billion magnesium plant at Stanwell, Queensland using high purity magnesite from Kunwarara, Queensland. It will be the world's largest magnesium smelter.

New ore standards

Outputs:
New International Standards Organisation standards for sampling, analysis and testing of iron ores. Systems for characterising ores to predict downstream processing performance. A versatile hydrocyclone pilot plant for desliming and upgrading lower grade iron ore deposits.

Outcomes:
Improved quality control of iron ore exports to ensure they meet contract specifications. Improved understanding of sintering performance to reduce environmental emissions.

SIROSMELT export success

Outputs:
Continuing R&D services to the companies commercialising the CSIRO-developed SIROSMELT top submerged lance technology, enhancing its capability and versatility.

Outcomes:
With major new contracts announced recently in India and China, SIROSMELT technology is now used in ten countries. The technology is being commercialised by Ausmelt Ltd and MIM Process Technologies.

Mineral bioprocessing

Outputs:
Novel mineral leaching microorganisms capable of growing well in the temperate range 80-90°C have been enriched and characterised. They are suited to industrial leaching applications where temperature fluctuations would severely limit the growth of bacteria.

Outcomes:
Ability to process marginal ores (resources become reserves), such as low grade ores or mine tailings, ores that contain unacceptable levels of contaminant elements such as arsenic, or small deposits, or those in remote locations.

Coal-bed methane

Outputs:
New insights into coal-bed methane (CBM) reservoir properties. Design of efficient exploration programs. A comprehensive R&D strategy to optimise CBM production.

Outcomes:
The insights are being applied in Sydney's 300 well Camden Gas Project to deliver lower exploration/exploitation costs, improved yields and additional cost-effective supplies of CBM gas (reducing the demand for electricity from coal-fired power stations).

Prospect risk management

Outputs:
Decision support software for mapping and managing the technical processes and non-technical issues involved in a drilling decision. Weighs evidence for each process to provide a risk range for the decision.

Outcomes:
The process resulted in a shared perception of risk between exploration geoscientists and drilling engineers, leading to a $30 million reduction in expected exploration costs, enhancing the prospectivity of the area and the chance of increasing oil reserves.

Australian magnesium vision turns into reality

The first sod has been turned at the Australian Magnesium Corporation's (AMC) $1.3 billion magnesium metal project at Stanwell near Rockhampton.

CSIRO and AMC have worked together for more than a decade to develop the Australian Magnesium process to be used at the Stanwell plant for producing magnesium metal from magnesite ore.

And the partnership continues, with CSIRO playing a key role to further advance the research and development of the Australian Magnesium process technologies.

Leighton Contractors Pty Ltd has been appointed the Principal Contractor at Stanwell and magnesium production is expected to start at the site in the December quarter of 2004.

When full production is reached in 2005, AMC will be the world's largest producer of magnesium metal.

Australia's virtual herbarium

Outputs:

Integrated on-line access to botanical species distribution information from herbarium collections of all State and Territory governments and the Australian National Herbarium.

Outcomes:

Enhanced accessibility nationwide to botanical data with improved accuracy and coverage leading to better decision making on the conservation and management of Australia's biodiversity assets.

Development of Ecowatch

Outputs:

A web site and methodologies to assist in the estimation of invertebrate diversity and abundance by a local community involved in restoration of Murray River floodplain habitats.

Outcomes:

Community users gained environmental understanding and skills in using environmental indicators. Estimates of environmental health aided the development of restoration programs for the region. The methodologies are widely applicable.

Fire management and biodiversity

Outputs:

Improved understanding of the ecological effects of different fire regimes in northern Australia; in particular, a greater appreciation of the importance of fire frequency.

Outcomes:

A wider public understanding of the role of fire in northern Australia. Improved conservation management across the Northern Territory through uptake by Parks Australia and Northern Territory park and fire management agencies.

Managing grassy woodlands

Outputs:

Principles and thresholds for ecologically sustainable land use on grazing lands in Queensland. Innovative packaging and presentation of the information.

Outcomes:

A project evaluation found the material reached 1 543 landholders, changed the understanding and awareness of conservation management of 942 landholders and resulted in 418 landholders changing their property management practices.

Integrating agriculture and biodiversity

Outputs:

Comprehensive database, Geographic Information System (GIS) and maps for landholders, researchers and the community on the diversity of species and processes found in the New South Wales Riverina. Landscape revegetation scenarios including predicted biodiversity benefits and capital costs.

Outcomes:

Farmers, local government and extension agencies using the information and skills developed make cost-effective decisions to improve the conservation of biodiversity in highly productive agricultural landscapes.

Significant impact on biodiversity threat

Outputs

Massive defoliation and significantly reduced regrowth of bridal creeper, one of Australia's worst environmental weeds, produced by attack of the rust fungus whose release was reported last year, in collaboration with the CRC for Weed Management Systems.

Outcomes

Environmentally sensitive management of one of the most serious threats to biodiversity in southern Australia. Successful long term control looks likely.

Carbon baseline study

Outputs:

Specifications for remotely mapping and monitoring land use change, which can be converted to greenhouse gas emissions. Reliable baseline data on land use change and greenhouse gas emissions.

Outcomes:

Better knowledge of woody vegetation cover and change in Australia from 1972 to 2000 provides a sound basis for government policy making in regard to greenhouse gas emissions under the Kyoto Protocol guidelines.

Analysing greenhouse gases

Outputs:

CSIRO's LOFLO carbon dioxide analyser, a major breakthrough in measurement technology enabling high-precision low-cost monitoring in the most remote corners of the globe.

Outcomes:

Improved global measurements and comparisons of greenhouse gas concentrations. LOFLO systems have been sold internationally and CSIRO's approach to CO_2 montitoring emulated in France and Germany.

Climate variability and agribusiness

Outputs:

Case studies with agribusiness service providers exploring the role for seasonal climate forecasts and simulation models. Incorporation of these in improved agribusiness operations to benefit farmer clients.

Outcomes:

Wesfarmers Landmark now offer clients advice based on Agricultural Production Simulation Model (APSIM) simulations and seasonal climate forecasts. Negotiations for a national delivery system for APSIM simulations are underway with a consortium of companies.

New air pollution model

Outputs:

A new user-friendly PC-based version of air pollution modeling software used by environment agencies, industrial operators and researchers in 11 countries.

Outcomes:

Modeling the spread of emissions before industrial plants, freeways and other pollution sources are constructed enables engineers and planners to minimise impacts on the environment.

Southern Ocean and climate

Outputs:

Quantification for the first time of the three-dimensional circulation of the Southern Ocean, demonstrating that Australian and global climate is more sensitive to Southern Ocean processes than previously thought.

Outcomes:

Enhanced ability to predict and respond to climate change. Establishment of a key plank in the United States-Australia Climate Action Partnership to reduce carbon emissions through coordinated research, technological innovation and policy.

Soil carbon and land use

Outputs:

A calibrated and verified model (RothC) that provides greatly improved estimates of soil carbon change and improves the accuracy and reliability of Australia's national inventory of net greenhouse gas emissions.

Outcomes:

The technology puts Australia at the forefront of estimating carbon dioxide emissions from land use and land use change, enhances knowledge for post-Kyoto negotiations, and has international market potential.

FullStop for irrigation management

Outputs:

FullStop is a water sensor, buried in the soil, that measures when irrigation water penetrates to a required depth within the root zone of plants. It then sends a message to turn off the irrigation.

Outcomes:

The use of this product greatly enhances water conservation and management in the irrigation industry. The marketing rights to FullStop for South Africa and South America have been licensed to Agriplas.

Gippsland Lakes study

Outputs:

System understanding of the biogeochemical function of the Gippsland Lakes (including algal blooms) and evaluation of the relative benefits of alternate strategies for managing the Lakes.

Outcomes:

Development of cost-effective management strategies for integrated catchment and coastal zone management including reduction of algal blooms and improving the ecological function of the Gippsland Lakes.

Improving catchment planning

Outputs:

Computer modeling program SedNet supports catchment management planning. It helps identify the major sources of river sediments and nutrient loads in catchments by combining decision support tools with a set of detailed maps, tables and geographical databases.

Outcomes:

SedNet is helping landholders and governments work together to determine how best to meet water quality targets for rivers, estuaries and coastal waters consistent with the National Salinity and Water Quality Action Plan and regional catchment plans.

Regional water quality

Outputs:

Best indicators of environmental health, an integrated Ecological Health Monitoring Program, and report cards for Moreton Bay and freshwaters in surrounding catchments.

Outcomes:
More efficient integrated monitoring of trends in ecosystem health enabling more complex issues of management and rehabilitation to be addressed by state and local governments and community groups.

Partial rootzone drying

Outputs:
Partial Rootzone Drying, an irrigation system that utilises the ability of some plants to regulate their water use under conditions of water stress, is reducing the amount of water applied to some irrigated horticultural crops by as much as 50 per cent.

Outcomes:
Partial Rootzone Drying was listed as one of the best 100 innovations of the past century. The list was compiled by the Australian Academy of Technological Sciences and Engineering and the Powerhouse Museum.

Better salinity management

Outputs:
Catchment characterisation helps farmers classify the types of catchments, their salinity risk status, how quickly the catchment will recover when management changes are implemented, and the management options available to the catchment community and ways to reduce the risk. The type of groundwater system underlying a catchment is one of the main factors in choosing how we manage salinity.

Outcomes:
An Australia-wide approach to classifying catchments according to their groundwater system. Catchment characterisation provides a framework to progress salinity management plans and enables identification of priority areas that need remedial action.

Underground dams for storing water

Outputs:
Pioneering a new way to store large amounts of water in underground water dams by pumping water into the aquifer during the wet season and taking it out during the dry season. It is a way to harvest city stormwater run-off and reclaimed water and save them in order to irrigate parks, ovals, golf courses during the dry season.

Outcomes:
A robust alternative to expanding water storage capacity. Australia is showing world leadership in pioneering this pathway to water re-use and will prove increasingly vital to both our human and environmental future.

Saving water

Australian scientists have created a low-cost device that can help farmers make more effective use of irrigation water used to grow food in both the developed and developing world.

By monitoring the water as it sinks into the soil, the FullStop device tells the farmer when to stop watering. This enables the best use of all the water applied whether from irrigation or rainfall. Detailed monitoring of irrigation practice shows that currently there is little relation between irrigation applied and yield.

Some growers apply too much water, others too little and yet others have poor yields caused by non-irrigation factors. The FullStop device allows growers to tailor the amount of water applied to the crop's needs.

In addition to learning how to use irrigation water efficiently, the FullStop device will also help farmers prevent fertiliser waste and lower the risks of drainage pollution from irrigated areas.

The marketing rights to FullStop for South Africa and South America have been licensed to Agriplas.

Environmental risk assessment

Outputs:

Integrated environmental models and management scenario simulations integrated into environmental risk assessment. Improved high-resolution 3D biophysical models of highly stratified estuaries.

Outcomes:

This approach has saved tens of millions of dollars in capital costs for effluent treatment in one instance and has been used subsequently in the evaluation of management of environmental flows for the Derwent Estuary.

Preventing marine pests

Outputs:

Improvements to the ballast water risk management system and web-based information system providing details on marine pests in Australia, including how to manage a new outbreak. Marine pest monitoring methods suitable for community groups.

Outcomes:

The risk management system became mandatory in July 2001. Estimated savings of $6 million per year have been achieved from lower environmental risk and reduced risks to vessels exchanging ballast at sea.

Turtle excluder devices

Outputs:

Information about the performance of different 'Turtle Excluder Devices', (TEDs), which are compulsory in the Northern Prawn Fishery to reduce the catch of non-target species.

Outcomes:

The use of TEDs has reduced the catch of large sea animals by up to 95 per cent and reduced damage to the prawn catch by between six per cent and 35 per cent, saving processing costs and gaining higher market prices.

International | front opens in war on invasive species

Australian and United States environmental managers are throwing a virtual net around their countries as the latest initiative in the costly war to limit invasive marine species.

Thousands of marine species are in motion around the world each day in the ballast water of ships. Untold others are fouling the hulls of commercial and recreational vessels plying international waters or being transported as part of the seafood and aquaria trade.

Hundreds of exotic species have now become established in coastal waters of both Australia and the United States, resulting from various forms of human-assisted transfer. Many of these species have significant impacts on the environment and economy, including commercial fisheries. Some also adversely affect human health. The impacts of exotic species invasions are considered one of the foremost threats to coastal ecosystems, and every indicator suggests the rate of new invasions is rapidly increasing.

In a pioneering joint project of unprecedented scale, authorities are equipping national and regional managers, and community organisations with key information to identify and respond rapidly to future invasions of species that have the potential to alter the marine ecosystem.

The National Introduced Marine Pest Information System has been developed over the last three years by scientists at CSIRO's Centre for Research on Introduced Marine Pests (CRIMP). It contains information on the identification, biology, distribution and management of over 80 of the known introduced species to Australia.

The project has been funded by Environment Australia through the National Heritage Trust, CSIRO and supported by State and Territory environmental authorities.

Native fungi and revegetation

Outputs:

Knowledge, concepts and techniques for placing a wide variety of native soil nutrient cycling fungi back into ecosystems with native plants, matching fungi and plants to soil type.

Outcomes:

Reintroduction of native soil fungi is being used to kickstart nutrient capture, retention and recycling processes, assisting the success of revegetation projects across Australia for groundwater control, farm forestry and biodiversity maintenance.

Non-chemical rodent control

Output:

An eight page brochure 'non-chemical control of rodents in lowland irrigated rice crops' has been produced in partnership with the Australian Centre for International Agricultural Research, (ACIAR) and translated into both Vietnamese and Indonesian.

Outcome:

Distribution to thousands of south-east Asian rice farmers will result in decreased chemical usage in rice crops, improving both environmental and human health aspects of rice farming operations.

Agribusiness industries

New wheat varieties

Outputs:

New plant breeding technologies that help to select new wheat varieties with improved water use efficiency and resistance to the Barley Yellow Dwarf virus.

Outcomes:

Higher yields of Drysdale in dry areas, and Rudd and Mackellar winter wheats in wetter regions are achieved with no additional inputs, resulting in higher returns to growers. Chemical pesticides are unlikely to be required, further increasing grower margins.

Novel pest control

Outputs:

Cost-effective process for rapid, in-line heat disinfestation of grain, suitable for both small and large-scale use to replace the use of methyl bromide and dichlorvos.

Outcomes:

More consistent grain quality. Reduced exposure of grain-handlers to chemicals. Reduction in ozone-depletion and improved security of access to export markets as the use of methyl bromide on grain is phased out under the Montreal Protocol.

Managing mouse plagues

Outputs:

MOUSER 2 is an interactive training and resource package that provides decision support for the management of mouse plagues in Australia. It incorporates population dynamics, ecology and economics.

Outcomes:

State agencies and others using improved management strategies minimising contact with humans or livestock, provide more options for limiting the economic impacts of mouse plagues and reduce chemical use when densities are high.

Fast-track breeding of new rice varieties

Outputs:

The semi-dwarfing (sd-1) gene that results in shorter, more productive rice varieties has been isolated in the rice genome and a perfect marker developed to detect it.

Outcomes:

This gene is the green revolution gene that boosted cereal grain yields and made plants more robust in the 1960s. The perfect marker will speed up the breeding of new rice varieties and help to identify semi-dwarfing genes in other cereal crops.

Carcinogen analysis in food

Outputs:

Fast and reliable measurements of the amounts of a known carcinogen, 3-mcpd, are being provided to Australian food manufacturers.

Outcomes:

The levels of 3-mcpd in Australian foods have been reduced. The rapid and robust analytical method developed by CSIRO enabled a major Australian producer to continue to trade and remain viable during an industrial crisis.

High pressure processing

Outputs:

Demonstration of the food safety and product quality benefits of high pressure processing of orange juice.

Outcomes:

Establishment of Australian High Pressure Processors Pty Ltd which has made a commercial investment in the technology, and of the High Pressure Processing Partnership to assist small to medium enterprises (SMEs) share the costs and risks of adopting the technology.

New dairy ingredients

Outputs:

New product formulation and cost-effective processing technologies for producing speciality, high fat, spray-dried dairy powders which do not need antioxidants, stabilisers and emulsifiers. New ways to produce bioactive dairy protein ingredients.

Outcomes:

Development of premium export and import replacement products. Less reliance on the export of lower-value minimally processed dairy powders. Premium prices for high-value dairy protein ingredients in export and expanding functional food markets.

Biodegradable plastics

Outputs:

Starch-based biodegradable polymer materials and thermoforming trays for food packaging.

Outcomes:

The environmentally friendly starch-based polymers eliminate the 'plastic odour' problem and are the cheapest biodegradable polymer packaging technology. A start-up company, Plantic, has been established to commercialise the technology.

Mechanisation in abattoirs

Outputs:

An automated saw guided by ultrasonic imaging has been developed for splitting of beef carcases.

Outcomes:

The saw improves operational efficiency, improves product safety and reduces occupational injuries. Further development and commercialisation are in progress.

Short rice | in the genes

A team of CSIRO Plant Industry scientists isolated the gene that produced shorter, more productive varieties of rice that led the 'green revolution' in the 1960s.

With funding from Graingene* and using information from the publicly available rice genome sequence, the team was able to isolate the 'semi-dwarfing' *(sd-1)* gene, and develop 'perfect' markers to identify it.

The 'green revolution' saw new varieties of rice with shorter stems producing record crop yields throughout Asia. The semi-dwarf varieties were less likely to fall over and responded better to nitrogen fertilisers.

Access to the publicly available rice genome sequence enabled the team to isolate this gene significantly faster than by conventional methods.

Once the semi-dwarfing gene was isolated the team developed a perfect marker directly from the gene sequence, which will enable rice breeders to produce new varieties, with this semi-dwarfing characteristic, more efficiently. A perfect marker is an easily detectable piece of DNA that identifies a gene, or group of genes. In this case it marks the location of the *sd-1* gene for semi-dwarfing.

Breeding a new variety of rice can take many years, as successive generations must be grown to near-maturity before it is known if the dwarfing gene is present. The marker for the *s-d1* gene will fast-track breeding of new rice varieties by enabling breeders to screen for the semi-dwarfing gene at a much earlier stage of plant development, saving time and resources.

Information from the *sd-1* gene can also be used to study and isolate related or similar gene sequences that are responsible for semi-dwarfing in other cereal crops such as wheat and barley. This will lead to further advances in improving these important crops.

** Graingene is a strategic alliance involving three of Australia's leading agricultural organisations – AWB Limited, CSIRO and the Grains Research and Development Corporation (GRDC).*

Protective packaging for exports

Outputs:

Protective packaging was designed using mathematical modeling techniques that allow the effects of a wide range of environmental factors to be assessed quickly and cheaply. The packaging will be applied predominantly to air freight.

Outcomes:

Improved quality and market access for foods and biomedical supplies exported from Australia.

Better tree-farming decisions

Outputs:

A decision support tool called CABALA used to design silvicultural management regimes that reduce drought risk, minimise offsite effects, estimate second rotation yields to inform purchase/takeover decisions, and validate productivity assessments.

Outcomes:

The model is being applied to identify drought risk and assess options to manage it in eucalypt plantations, and to validate productivity assessments made by prospectus companies, reducing investor risk. Improved management will deliver lower cost timber at the mill door.

Success in pine breeding

Outputs:

Identification of more specific breeding lines for radiata pine trees in the Southern Tablelands of New South Wales and other areas in southern Australia. Two software programs for genetic analysis.

Outcomes:

Lower cost wood at the mill door through further improvements in growth rate and tree quality of radiata pine. The software programs have been adopted by plant geneticists in the United States, Japan, Canada, France, Australia and China.

Managing the Monterey pine aphid

Outputs:

A protocol to measure defoliation and growth loss due to an exotic pest of radiata pine, the Monterey pine aphid. Documentation of its life cycle, and identification of management options to minimise the economic impact.

Outcomes:

Practical impacts on work flow are identified as a result of this work. Management practices to reduce the impact of the insect on production are proposed. This pest has caused an estimated $11 million loss of growth in 2001–02.

New red wine grape

Outputs:

Cienna is a new red wine grape variety with distinct flavours and balanced composition suited to a range of styles and market requirements.

Outcomes:

Cienna was developed by CSIRO and released as a final product by collaborating wineries. Relative to industry standard red varieties, it provides reduced costs through more consistent yield and quality, and favours reduced agrochemical use.

Safety of Australian wine

Outputs:

A new technique was developed for detecting ochratoxin A, a toxin produced by fungi that is of concern in international trade. An extensive survey of Australian wine was conducted. The incidence and levels of contamination were shown to be low.

Outcomes:

Assurance for Australia's customers that our wines are free from undesirable contamination.

Genetic analysis of wine grape varieties

Outputs:

The genetic basis for the difference between the wine grape varieties Pinot noir and Pinot Meunier has been discovered to be a single gene, which affects the plant's response to Gibberellic acid. A vine grown from the cells of Pinot Meunier is dwarfed, has hairy leaves and grows more bunches in place of tendrils.

Outcomes:

The discovery and a description of the work was published in the prestigious science journal 'Nature'.

New table grapes for northern Australia

Outputs:

Australian table grape growers in Queensland and Western Australia are assessing a range of table grape varieties from the CSIRO breeding program.

Outcomes:

A range of large-berried, variously coloured, crunchy grape varieties suited to conditions in the north of Western Australia and in Queensland are extending the growing range and length of season for northern Australian grape growers.

DNA pedigreeing of Kuruma prawns

Outputs:

Genetic markers that can be used to DNA pedigree Kuruma prawns, identifying their family of origin without the use of invasive internal tags.

Outcomes:
Better selective breeding programs for the Kuruma prawn leading to more efficient utilisation of food and water, increased productivity and a faster-growing prawn suitable for the Asian market.

Boosting prawn productivity

Outputs:
Infrastructure design and management protocols for on-farm production of domesticated prawn stocks to support genetic improvement and health management programs.

Outcomes:
Using domesticated broodstock alleviates risks associated with the supply of wild-caught spawners. The faster growing prawns shorten the production season, reducing production costs. A higher proportion reach the higher priced size categories.

Managing the screw-worm fly threat

Outputs:
The knowledge required to construct a mass-rearing facility and to use the sterile insect release method in the event of an incursion of the Old World Screw-worm Fly (OWSWF).

Outcomes:
Agriculture, Fisheries and Forestry Australia and our northern livestock industries are positioned to make informed decisions on handling the threat from the OWSWF, involving potential annual production losses of $281 million and impacts on native animals and humans.

Preparing against foot-and-mouth disease

Outputs:
Training in the latest diagnostic techniques for veterinary laboratory diagnosticians from around Australia. Increased stocks of diagnostic reagents that may be needed in the event of an outbreak of foot-and-mouth disease.

Outcomes:
Increased preparedness to deal with an outbreak of foot-and-mouth disease in Australia enhances the speed and accuracy of response and limits the potential costs. A major outbreak of foot-and-mouth disease is estimated by the Productivity Commission to cause national economic losses of $8 billion to $13 billion.

New prawn disease kit

Outputs:
Prawn virus test kit produced. Viral diseases have caused over $40 million in losses to the prawn industry. Gill-associated virus (GAV) test resulted from an ACIAR research project in collaboration with BIOTEC in Thailand and the Aquaculture Cooperative Research Centre.

Outcomes:
License granted to Farming IntelliGene Technology Corporation for commercial production and distribution of the Virus Test Kit for GAV and YHV (yellow head virus) that cause two of the major diseases of prawn stocks in Australia and Asia. Australian farmers now have technology to identify GAV presence in their stock and manage the disease more effectively.

Feed supplement boosts milk yields

Outputs:
Culmination of a three year project developing a feed supplement that provides cattle with a protein source that adds value to the nutritional quality of their diet. This ACIAR supported project in collaboration with India's National Dairy Development Board found that milk yields rose substantially when cows were fed a kilogram of rumen by-pass supplement each day.

Outcomes:
A feed supplement plant was opened at Itola in Gujarat, India. Increases in milk production and disposable income have huge economic and social implications for India's 11 million village dairy farmers.

Pinkeye vaccine

Outputs:
A collaboration with the University of Melbourne has resulted in a patented vaccine formulation against the cattle disease pinkeye which affects around ten per cent of cattle and calves in Australian feedlots.

Outcomes:
Commercial collaboration currently being investigated to develop the vaccine further.

Successful management of a pasture pest

Outputs
Extensive adoption throughout southern Australia of the package Timerite, that allows efficient control of Red Legged Earth Mite, a serious pasture pest, by one critically timed spray, based on predicting a specific development phase of the pest according to geographic location.

Outcomes
Environmental and economic best practice for pest management using the minimum of chemical inputs for maximum effectiveness.

More sustainable farming

Outputs:

GrassGro, a member of the GRAZPLAN family of decision support tools, tests management options to improve the use of farm resources for profit and sustainability. A major feature is the ability to predict problems caused by leakage of water and nutrients in mixed enterprises.

Outcomes:

GrassGro identifies the key profit drivers of grazing enterprises, quantifies production, financial and environmental risks, enables on-farm and district benchmarking, and objectively assesses production and sustainability criteria.

Biological control of weeds

Outputs:

Nodding Thistle now virtually under control and Paterson's Curse severely damaged from imported biological control agents integrated with standard pasture management practices. Increased skills and understanding of integrated weed management among land managers and government agencies.

Outcomes:

Reduced use of herbicides, reduced 'vegetable fault' in wool and improved livestock health. Estimated benefits from control of Nodding Thistle and Paterson's Curse are $9.4 million and $73 million a year respectively by 2015.

Building sustainable regions

Outputs:

Practical tools and techniques that help the Atherton tablelands region identify and debate future regional development pathways and opportunities.

Outcomes:

Regional strategies have been developed by Tablelands communities based on understanding of interactions between economic, social and environmental factors affecting regional development.

Ecograze–better grazing management

Outputs:

Guidelines and training on how to better manage open eucalypt woodland grazing country – incorporating innovative grazing systems. A book on managing open eucalypt woodlands.

Green packaging dissolves environmental problem

CSIRO research has led to the development of one of the world's most advanced biodegradable packaging products.

CSIRO Manufacturing & Infrastructure Technology (CMIT) in partnership with Melbourne company Plantic Technologies Ltd, and the CRC for International Food Manufacturing and Packaging Science (CRC) who developed the product, stand poised to earn Australia hundreds of million of dollars from international sales.

CSIRO began work on the development of the cornstarch-based packaging seven years ago as a participant of the CRC. CSIRO was instrumental in identifying the starch, additives and processing methods, as part of its involvement in the CRC.

Photo: Mark Fergus

The result is a material that can be used for dry biscuit trays, chocolates and potentially, shopping bags. The product, which looks and feels in every way like plastic, will, within a few weeks of being exposed to water, biodegrade completely. The CRC currently has 34 per cent equity in Plantic and CSIRO has a share in that equity.

Many European countries now impose taxes and charges on plastic packaging. In Japan, incineration of plastic has been linked to cancer rates. High population densities in countries like Japan also mean that landfill is no longer a disposal option, and green packaging provides a cost-effective alternative that is also environmentally benign.

Plantic anticipates dramatic growth given the worldwide plastics industry is worth $1 000 billion in annual revenues. It expects sales of $100 million within five years. The global dry foods goods tray market alone is worth $500 million a year.

Outcomes:
New grazing management strategies being adopted, leading to better economic and environmental outcomes in an environment susceptible to overgrazing and degradation. Demand for the book by users has led to a second print run.

Bleaching and dyeing textile blends

Outputs:
New and improved processes for dyeing and bleaching wool/cotton blends.

Outcomes:
Cost-effective continuous processing methods and a range of new and improved products incorporating wool and cotton.

Managing pests in cotton

Outputs:
CottonLOGIC computerised decision support system for cotton pest management now available on a Palm® operating system to allow in-field decisions and recording.

Outcomes:
CottonLOGIC promotes best management practices, and helps cost-effective and environmentally sound farming systems with reduced risk of off-farm pollution from pesticides.

Satellite-based pasture analysis

Outputs:
Accurate, timely quantitative measurements of pasture biomass and growth rate, taken by satellite, delivered directly to wool producers via the internet through the Department of Land Administration and Agriculture, Western Australia.

Outcomes:
Increased pasture utilisation rates, increased productivity per hectare and improved wool quality. Current and historical spatial pasture information for assessment of 'exceptional circumstances' relief. Commercial evaluation trial commencing.

Wool staple strength

Outputs:
On-farm management techniques for improving wool staple strength, developed through the Cooperative Research Centre for Premium Wool Quality and successfully implemented in Western Australia.

Outcomes:
Transfer of technology to south-eastern Australia leading to better use of pasture resources, improved productivity per hectare, improvements in staple strength and higher returns per kilogram of wool produced.

The role of crimp

Outputs:
New understanding of the influence of crimp on wool apparel quality and on variations in wool processing behaviour.

Outcomes:
Improved market signals about the importance of crimp, providing wool producers incentives to tailor their product to customer demands by breeding for certain wool attributes.

Intelligent knee sleeve

Outputs:
A new process for applying conducting polymers to fabrics to produce textile strain sensors for use in an intelligent knee sleeve bandage.

Outcomes:
A new product designed to assist elite athletes learn how to minimise the risk of crippling knee injury. The product is currently being trialled by Australian Football League clubs.

Education and outreach

During 2001–02, CSIRO Education continued to operate a range of projects to raise awareness of the value of scientific research and to encourage students to take up science careers. Activities involved over 240 000 students, parents and teachers this year as well as many more through a weekly national TV program.

Science by Email started operations in October 2001 and has proved popular with subscriptions growing to over 2 400. *Science by Email,* funded by Members Australia Credit Union, is a weekly e-newsletter that provides a brief current science news story with links to more detailed information, an experiment to try at school or at home and information on science events. Web forums on current science topics allow real-time interaction with scientists from CSIRO and elsewhere. The first forum was held in conjunction with the ABC.

CSIRO Science Education Centres (CSIROSECs) continued their operation in 2001–02. Located in every capital city plus Townsville, these Centres take students for workshops both by schools visiting the Centres and through each Centre's *'Lab on Legs'* travelling program. *Lab on Legs* reaches towns across Australia including most Aboriginal communities throughout the Northern Territory. The Centres provided classes for over 190 000 students and teachers during the year. They are supported by State and Territory Education Departments.

CSIRO's Double Helix Science Club offers two magazines, *The Helix* (circulation 15 000) and *Scientriffic* (circulation 10 000). Each CSIROSEC provides related events and activities for members and their families. Hundreds of Double Helix Chapters and School Groups also operate across Australia. *Scientriffic* offers a Teachers Guide in hard copy or on the web. School bulk subscriptions have proved to be popular.

CSIRO continues to jointly produce a top-rating national science TV program (*Totally Wild*, Tuesdays 4pm, Network Ten). This half-hour program features scientists explaining their research in an entertaining but clear manner together with activities to try at home. The program reaches over 250 000 people each week.

The CREativity in Science and Technology (CREST) project encourages and supports school students to undertake their own scientific research or technology-based project. It supports teachers in providing this experience to their students and is contributing to an important change in science and technology teaching in Australia. Over 5 000 students completed CREST projects this year. The project is supported by Alcoa World Alumina Australia, the Victorian Department of Education and Training and the Federal Department of Education, Science and Training.

Our Student Research Scheme is providing over 350 places for students in 2002. The Scheme places senior secondary students with research scientists and provides a powerful experience that encourages many students to continue or to take up further science studies. It is supported by The Ian Potter Foundation, University of New South Wales, University of Western Australia, Reckitt-Benckiser and the Australian Capital Territory Department of Education, Youth and Family Services. Additional support is being provided by the Australian National University and James Cook University.

CSIRO Education operates a number of other projects including the BHP Billiton Science Awards providing prestigious prizes for students undertaking research projects and for outstanding science teachers.

The CSIRO Discovery Centre successfully conducted student and industry outreach programs during 2001–02, with approximately 50 000 visitors viewing its exhibitions or participating in activities at the Canberra-based Centre.

The CSIRO Media Group actively promoted science and technology stories throughout the year in press, radio, television, industry journals and regional media. Around 250 media releases were issued by CSIRO Media in 2001–02.

CSIRO Publishing produced a total of 18 science journals (12 of which were in conjunction with the Australian Academy of Science); published 38 books; and five CD-ROM and Multi-Media products as well as four issues of *Ecos–Science for the Environment* magazine in 2001–02.

CSIRO Enquiries responded to approximately 40 000 calls during the year.

Awards and honours

In 2001–02, 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.

Australian Honours

Order of Australia

Officer (AO)

Mr Norbury Rogers, (Board member), for service to the accounting profession and executive membership of a range of financial, technology and research corporations.

Member (AM)

Dr Noel Barton, (Mathematical and Information Sciences), for services to the mathematical sciences and the application of mathematics to industry.

Mr Ross Kingsland, (CSIRO Education), for services to education through the development of science education outreach services.

Australian Awards

Dr Rao Balusu, (Exploration and Mining), won the *Australian Coal Association Research Program (ACARP) Research Excellence Award* for his work on optimisation of inertisation practice, (underground category).

Dr Bernie Bindon, (Livestock Industries), won the *Consolidated Meat Group, Queensland Red Meat Innovation and Development Awards* for leadership in research and development.

Dr Trevor Bird and the **MultiBeam antenna team**, (Telecommunications and Industrial Physics), won the *Institution of Engineers, Australia, Engineering Excellence Awards 2001*. The MultiBeam antenna project was highly commended in three categories: Information Technology & Telecommunications; Innovation and Inventions and International Projects and Exports for engineering excellence.

Mr John Blackwell, (Land and Water), won the *Irrigation Association of Australia MacLean-Iedema Award for Excellence in Irrigation* for outstanding contributions to the irrigation industry.

Dr Charles Butt, (Exploration and Mining), won the *Gibb Maitland Award* for substantial contributions to regolith geoscience in Western Australia.

Dr John Carras, (Energy Technology), won the *Australian Coal Association Research Program (ACARP) Research Excellence Award* for his work on the impact of spontaneous combustion in spoil piles on greenhouse gas emissions, (greenhouse gas mitigation category).

Mr Colin Chan, (Manufacturing and Infrastructure Technology), won the *WR Ahern Award* for his work on Car Park Ventilation Design.

Dr Gregor Christie and the **Biodegradable packaging team**, (Manufacturing and Infrastructure Technology), won the *CRC Association Technology Transfer Award* for 'transfer into the market place'. The team included the University of Queensland, Swinburne, Manufacturing and Infrastructure Technology and industry colleagues.

Mr Peter Clingeleffer and **team**, (Plant Industry), won the *Riverlink Researcher, Extension and Industry Development Award* for group achievements in developing winegrape crop forecasting and management methods.

The Agriculture, Fisheries and Forestry – Australia, (AFFA) Science Innovation Awards for Young People were awarded to: **Dr Tim Doran**, (Livestock Industries); **Dr Ben Hoffmann**, (Sustainable Ecosystems); **Dr Aaron Ingham**, (Livestock Industries); **Dr Dean Jerry**, (Livestock Industries); **Dr Soressa Kitessa**, (Livestock Industries); **Mr Barry Salter**, (Plant Industry); **Ms Nicole Schick**, (Plant Industry), and **Ms Kerri Tyrrell**, (Livestock Industries).

Mr Rick Daley, (CSIRO Education), won the *Unsung Hero of South Australian Science Australian Science Communicators* for his commitment to communicating science and furthering the understanding of science in the community, particularly among the young.

Dr Joan Esterle and **team**, (Exploration and Mining), won the *Leichhardt Award* for original contributions to the advancement of coal geology in Queensland.

Dr Roger Francey and **Dr Paul Steele**, (Atmospheric Research), won the *Victoria Prize* for their internationally acclaimed work on greenhouse gases and instrument development.

Dr Peter Hatherly, (Exploration and Mining), won the *Coal Field Geology Council of New South Wales, Excellence in Coal Geology* for his work during the past 20 years in applying geophysics in coal mines.

Dr John Ion, (Manufacturing and Infrastructure Technology), won the *Ramsey Moon Award* for the best published industry paper 2001. The paper was entitled 'Trends in Industrial Applications of Laser Welding'.

Dr Daniel McMichael and **team**, (Mathematical and Information Sciences), won the *Australian Design Award (Engineering Design)* for significant contributions to optimising the performance of the Polartechnics TruScan probe for detecting cervical cancer.

Mr Graham O'Brien, (Exploration and Mining), and **Mr Barry Jenkins**, (Jenkins-Kwan Technology), won the *Australian Coal Association Research Program (ACARP) Research Excellence Award* for the development of automated full phase maceral relectograms and for the coal grain analysis project, (coal utilization category).

Dr Clive Pankhurst, (Land and Water), won the *President's Medal, Australian Society for Sugar Cane Technologies* for contributions to understanding and developing solutions to the problems of yield decline in sugar cane.

CSIRO Publishing won the *Australian Geography Teachers Association 2002 Award* for *Resetting the Compass* in the geography teaching source material category. CSIRO Publishing was also joint winner of the *Whitley Award 2001* for *Butterflies of Australia*, and was the winner in the Scholarly Reference section in the *Australian 2002 Awards for Excellence in Education Publishing* for *Feather and Brush*.

Dr Peter Rayner, (Atmospheric Research), won the *Priestley Medal* for contributions to research in atmospheric and oceanic sciences.

The Mallee Sustainable Farming project, with major scientific design and inputs by **Mr David Roget** and **Dr Gupta Vadakattu**, for over six years, (technical assistance from **Mr Bill Davoren** and **Mr John Coppi** from Land and Water), won the *BHP Billiton National Landcare Award* for scientific research.

Mr Michael Rooney, (Food Science Australia), won the *Reister-Davis Award Food Packaging Division of the Institute of Food Technologies* for lifetime outstanding achievement in food packaging technology.

Dr Leon Rotstayn, (Atmospheric Research), won the *Frederick White Prize* for contributions to climate modeling.

Dr Ezio Rizzardo, (Molecular Science), won the *Most Prolific Inventor Award* for his authorship of 25 CSIRO patents found in the Derwent Innovation Index.

Dr Geoff Smithers, (Food Science Australia), won the *Loftus Hills Silver Medal* for lifetime contributions on behalf of the Australian dairy industry.

Dr Glen Walker, (Land and Water), won the *WE Wood Award* for innovation in salinity research and development.

Dr Judy West, (Plant Industry), won the *Nancy T Burbidge Memorial Medal* for contributions to systematic botany in Australia and internationally.

International Awards

Dr Denis Anderson and **Dr Frances FitzGibbon**, (Entomology), won the *Owen J Newlin Business Excellence Award* for contributions in overcoming the complex quarantine issues involved in importing leafcutter bees from Canada, and getting colonies into the field to increase lucerne seed yields in Australia.

Dr Rao Balusu and **team** (2002–03), (Exploration and Mining), won the *Iki Award (Japan*) for work on mine gas control.

Dr Cliff Mallett (2001-02), (Exploration and Mining), won the *Iki Award (Japan)* for contributions over the years in building collaboration between Japanese and Australian scientific institutions such as CSIRO and the Japan Coal Energy Centre, mining companies and government.

Mr Aaron Chippendale, **Dr Steven Tingay,** (Australia Telescope National Facility (ATNF)), and **Ms Melanie Johnston-Hollitt**, (ATNF co-supervised student), won the *International Union of Radio Science, Young Scientist Award* on the basis of their distinguished research outputs.

Mr Julian Cribb, (CSIRO Media), was awarded a resident scholarship to write a book *Sharing Knowledge* by the *Rockefeller Foundation*, Belagio Study Centre, Italy.

Mr Kevin Dodds and **Dr Alistair Fletcher**, (Petroleum Resources), won the *Silver Medal of the Schlumberger – Middle East/Asia Sector* for innovative research for collaborative teamwork between a research organisation and a service company.

Dr Peter Dillon and **team**, (Land and Water), won the prestigious US$20 000, *Great Man-Made River International Water Prize (UNESCO science prize)* for studying aquifer storage and recovery.

Dr Paul Fraser, (Atmospheric Research), won the *Environmental Protection Agency Ozone Protection Award, United States* for his exemplary efforts and achievements in protecting stratospheric ozone.

Dr Marc Goetz, (Plant Industry), won the *Strasburger Prize, Germany*. The prize is awarded every second year for an outstanding and especially original botanical work of a scientist less than 35 years old.

Dr Rob Helstroom, (Energy Technology), in association with Newcastle City Council won the *World Environment Day Award*. CSIRO was a major contributor to Newcastle City Council's ClimateCam, a web-based greenhouse gas measurement tool. It was given best specific environmental initiative award in the Local Government Award category.

Dr Tony Hughes and **team**, (Manufacturing and Infrastructure Technology), won the *BAE SYSTEM's Silver Award for Innovation* for the development of advanced materials for lighter and more durable aircraft structures.

Mr Stephen Midgley, (Forestry and Forest Products), was awarded the *Honourable Citizen of Zhanjian* for his work with eucalypt breeding programs.

Mr Ben Reddall, (Australia Telescope National Facility), won the *National Science Foundation Antarctica Service Medal* in recognition of valuable contributions to exploration and scientific achievement under the United States Antarctic Research Program.

Dr Maarten Ryder and **team**, (Land and Water), won the *Jaguar Award for Excellence for Innovation in Produce* for contributions to the development of the Native Foods Industry.

Dr Mikhail Prokopenko and **Mr Peter Wang**, (Mathematical and Information Sciences), won the *JSAI Award (Japanese Society for Artificial Intelligence)* for scientific contribution to the RoboCup Simulation League, and for their work in developing technology concerning the entropy of multi-agent beliefs.

Dr Vute Sirivivatnanon, (Manufacturing and Infrastructure Technology), won the *Canada Centre for Minerals and Energy Technology and the American Concrete Institute Mohan Malhotra Award for Supplementary Cementing Materials* in recognition for his research on developing useful applications for industrial waste fly ash, slags and silica fume.

CSIRO Awards

The Chairman's Medal

The 2001 Chairman's Medal was presented by Ms Catherine Livingstone, Chairman, and the CSIRO Medals were presented by The Hon Basil Hetzel, AC, on 29 November 2001.

From back left to right: Mr Malcolm Boyd, Dr Tim Gureyev, Mr Murray Hughes, Mr David Menz, Mr Bruce Coley, Dr Geoff Downes, Ms Catherine Livingstone (Chairman), Ms Kirsty Siu, Mr Chris Kohle, Mr John Van der Touw, Mr David Tuttleby, Dr Geoff Garrett (Chief Executive), Dr Robert Evans, Dr Sue-Anne Stuart and Ms Sharee Harper. (other winners absent from event: Ms Leanne Bischof, Dr Ronald Jones and Dr Laurence Schimleck. Photo: Festival Photography, Adelaide

The SilviScan team won the 2001 Chairman's Medal for the development of SilviScan technology and its application to the rapid assessment of wood quality in forest resources, increasing the efficiency and environmental sustainability of the forest based industries.

The winners of the Chairman's Medal were: **Dr Robert Evans** (team leader), **Ms Leanne Bischof, Mr Malcolm David Boyd, Mr Bruce Coley, Dr Geoff Downes, Dr Tim Gureyev, Ms Sharee Harper, Mr Murray Hughes, Dr Ronald Jones, Mr Christoph Kohle, Mr David Menz, Dr Laurence Schimleck, Dr Sue-Anne Stuart, Ms Kirsty Siu, Mr John Van der Touw** and **Mr David Tuttleby.**

CSIRO Medals

The CSIRO Medals for 2001 for CSIRO staff were awarded for:

- increasing commercial opportunities for environmental tree plantings to assist rural Australia and reduce greenhouse gas emissions by **Dr Paul Fung**, (team leader), **Mr Adrian De Vos, Ms Vanessa Dusting, Mrs Kaye Harvey, Mr Velauthapillai Muruganathan** and **Mr Soo Ng**.
- enabling the safe control of caving for coal mine roof-rock and cost-effective inducement of caving for block caving metal mines through development of hydraulic fracturing in mining by **Dr Robert Jeffrey**, (team leader), **Mr Michael Camilleri, Mr Timothy Ferguson, Dr Kenneth Mills**, (Strata Control Technology Pty Ltd) and **Mr Andre van As**, (Northparkes Mines).
- developing and implementing a new plant breeding methodology resulting in improved crop performance in dry environments by **Dr Richard Richards**, (team leader), **Dr Anthony Condon, Professor Graham Farquhar**, (Australian National University), and **Dr Gregory Rebetzke**.

The CSIRO Business Excellence Medal

The CSIRO Business Excellence Medal was awarded to the Growth Factor (GroPep Ltd) Team, **Dr John Ballard** (team leader), **Mr Geoff Francis, Dr Chris Goddard, Dr David Belford**, (GroPep Ltd), **Dr Frank Tomas, Professor Paul Nestel**, (Baker Medical Research Institute), **Professor Richard Head, Mr Terry Healy** and **Mr Stephan Wellink**, (formerly CSIRO Commercial Advisor Agribusiness). The company exports novel growth factors that regulate cell growth and is now involved in three principal markets internationally.

The external CSIRO medal

Dr Mohan Singh, University of Melbourne, won the external CSIRO Medal for research with grass pollen allergen.

The 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 2002 Award was presented on 29 April 2002 by Mr David Miles, Senior Partner, Corrs Chambers Westgarth and Chairman, National Innovation Awareness Council. The winner was **Dr Pathiraja Gunatillake** of Molecular Science for research innovations and commercialisation of biostable polymers for medical implants.

From left to right: Mr Charles Allen, winner Dr Pathiraja Gunatillake, Mr David Mills and Sir Peter Derham.

Photo: Mark Fergus

Fellowships and International Societies

Dr Dennys Angove, (Energy Technology), was awarded a Visiting Scientist Fellowship for collaborative research in Seoul, Korea by the *Australian Academy of Science* in conjunction with the *Korean Science and Engineering Foundation*.

Dr Simon Apte, (Energy Technology), was elected as President of the *Royal Australian Chemical Institute*, Environment Division.

Dr Sukhvinder Badwal, (Manufacturing and Infrastructure Technology); **Dr Nan Bray**, (Marine Research); **Dr Michael Eyles**, (Food Science Australia); **Dr Gary Fitt**, (Entomology); **Dr Danny Llewellyn**, (Plant Industry); **Dr Mike Raupach**, (Land and Water); and **Dr Nigel Scott**, (Plant Industry) were elected as Fellows to the *Academy of Technological Sciences and Engineering*.

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

Dr Peter Corke, (Manufacturing and Infrastructure Technology), was elected as President of the *Australian Robotics and Automation Association*.

Professor Ron Ekers, (Australian Telescope National Facility), has been awarded a *Federation Fellowship* by the Commonwealth Government for his leadership of the Australia Telescope National Facility to pursue a research project, 'A clearer view of the evolving universe'. Professor Ekers was also elected as next President of the *International Astronomical Union*.

Mr Ian Galbally, (Atmospheric Research), was elected as Fellow of the *Clean Air Society of Australia and New Zealand*.

Dr Graham Harris, (Chair, Flagship Programs), was elected as a Fellow of the *International Water Academy*.

Dr John Jacobsen, (Plant Industry), and **Dr Ezio Rizzardo**, (Molecular Science), were elected as Fellows of the *Australian Academy of Science* and **Professor Charley Krebs**, (Sustainable Ecosystems), was elected as a corresponding Fellow.

Dr Swee Liang Mak, (Manufacturing and Infrastructure Technology), was elected as State President of the *Concrete Institute of Australia*.

Dr Wayne Meyer, (Land and Water), was elected as Fellow of the *Australian Institute of Agricultural Science and Technology*.

Professor Bernhard Neumann, (Mathematical and Information Sciences), was appointed Chancellor of *The Global Foundation, Mexico*.

Dr Jim Peacock, (Plant Industry), was elected as President of the *Australian Academy of Science*. Dr Peacock was joint winner of the 2000 Prime Minister's Prize for Science.

Dr Chris Rossouw, (Manufacturing and Infrastructure Technology), was elected as a Member of the Commission on Electron Diffraction of the *International Union of Crystallography Commission on Electron Diffraction*.

Dr Jenny Stauber, (Energy Technology), was elected as President of the *Australasian Society for Ecotoxicology.*

Professor David Trimm, (Petroleum Resources), was awarded a *Federation Fellowship* by the Commonwealth Government for research into gas to liquid fuel conversion.

Dr Brian Walker, (Sustainable Ecosystems), was elected as Fellow of the *Santa Fe Institute, United States*.

Corporate governance

Economic dependency

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

Factors, Trends and Events Influencing Performance

Many factors, trends and events impact on CSIRO's performance as an organisation.

While at the forefront of promoting technological change it is also subject to a rapidly changing environment.

Internally it has been a year of refining and consolidating the major change program, set out initially in CSIRO's Strategic Action Plan in May 2001, which heralded the shift from 'research institution' to 'global research enterprise'.

The events of 11 September 2001 and the devastating bushfires of last summer precipitated a new focus on security technologies and bushfire research respectively – in collaboration with users and other research agencies. Economic conditions in various industry sectors affect the R&D investment that companies are prepared to make, which influences the demand for CSIRO's services.

The Government's response to the *Backing Australia's Ability'* report led to CSIRO's active involvement in bids for Centres of Excellence. Other Government initiatives of particular relevance to CSIRO during the year include the Chief Scientist's Review (and subsequent removal) of the External Earnings Target and the commencement of a process to identify national research priorities. The outcomes of these activities will be fully reflected in CSIRO's Strategic Plan and Funding Agreement for the forthcoming triennium (commencing 1 July 2003). In the latter half of 2001, CSIRO also participated in an Output Pricing Review with the Department of Finance and Administration.

Developments since 30 June 2002

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.

On 1 July 2002 the divisions of Building, Construction and Engineering and Manufacturing Science and Technology merged to form the division of CSIRO Manufacturing and Infrastructure Technology (CMIT).

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 *CAC Act* requirements are currently being met.

The Board meets formally every second month for one or two days. Additional meetings may be scheduled as required. In accordance with the *SIR Act*, Board members, with the exception of the Chief Executive,

are not involved in the day-to-day running of the Organisation.

The Board has a formal agenda for each meeting. It receives regular papers from management on its science activity, financial and business performance, and specific issues relevant to Organisational performance and conformance.

The Board has established an Audit Committee and Remuneration Committee and more recently a Commercial Committee. Other committees can be established from time to time to assist in the execution of the Board's duties and to assist detailed consideration of complex issues.

The Audit Committee and Commercial Committee operate under written terms of reference. All matters considered and determined by the Audit Committee, Remuneration Committee and Commercial Committee are submitted to the Board for information and, where appropriate, ratification or decision.

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 2001–02 Board members**,** including qualifications and terms of appointment, are shown on page 8. The Financial Statements contain details of remuneration of Board members and their attendance at Board, Audit Committee and Commercial 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 2002, the Audit Committee comprised Mr D P Mercer (Chairman), Ms C Livingstone, and Ms E Alexander (external advisor). Mr A E de N Rogers completed his term on 27 May 2002. Mr D C K Allen completed his term on 5 November 2001 and served on the sub-committee for part of the year.

The Chief Executive, Corporate Secretary and the General Manager responsible for Finance, together with the General Manager of CSIRO's Risk Assessment and Audit Unit, and representatives of the Australian National Audit Office, attend meetings at the invitation of the Audit Committee Chairman.

The Audit Committee's purpose as detailed in the Committee's Terms of Reference is:
'to assist Board members in fulfilling their responsibilities in relation to:

- accounting and reporting practices;
- overseeing and reviewing risk management strategies and practices;
- monitoring internal controls in relation to financial and commercial activities, legislative and regulatory conformance and asset protection;
- complying with external obligations, in particular, under Section 32 *Commonwealth Authorities and Companies Act 1997*, and internal policies and procedures; and
- ensuring the preparation and presentation of accounts which show a true and fair view, and comply with all relevant accounting standards and statutory requirements.'

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

Commercial Committee

The establishment of the Board Commercial Committee (BCC) was approved at the 10 October 2001 Board meeting. The first meeting was held on 19 September 2001. The BCC meets at least three times per year and as at 30 June 2002 comprised

Ms C Livingstone (Chairman), Mr A J Gandel, Mr D P Mercer, Dr G Garrett (Chief Executive), Mr J Read and Mr M Baghai. Mr D C K Allen (term completed 5 November 2001), served on the BCC for part of the year.

The Corporate Secretary, General Counsel and General Manager Commercial Operations attend meetings at the invitation of the BCC Chairman.

The functions of the BCC as detailed in the Committee's Terms of Reference are:

- to review CSIRO's commercial policies and strategies and where appropriate to propose improvements in these to the CSIRO Board and CSIRO management;
- to ensure that CSIRO has appropriate people and processes involved in the conduct of its commercial activities;
- to determine, in consultation with the Board and CSIRO management, appropriate performance criteria for CSIRO's commercial activities, and monitor CSIRO's performance against those criteria;
- to review CSIRO's equity shareholdings;
- to maintain a watching and consultative/advisory brief over the 'pipeline' of projects which would eventually come to the BCC and Board arena for decision;
- to consider and approve individual commercial project proposals;
- to consider and make recommendations to the full Board on transactions;
- to specify the composition, frequency and formats of reports and recommendations to the Committee on commercial activities from CSIRO management; and
- to report on its activities to the CSIRO Board at each meeting.

The Board Commercial Committee is supported by the Executive Management Commercial Committee – ComEx. ComEx comprises senior management personnel, who provide advice on internal management processes and oversee commercial activities.

Other committees

Other sub-committees are established from time to time to address specific issues but are not permanent committees.

Executive team

The Chief Executive, who is a member of the Board, is responsible for the Organisation's activities. In the reporting year – as shown in the Organisation Chart on page 7 – an Executive Management Council (EMC) supported the Chief Executive in this role. The EMC met approximately once per month and comprises the Chief Executive, Deputy Chief Executives, Senior Corporate Managers and the Chiefs of CSIRO's 20 research Divisions. The 20 Divisions, which represent the research-performing business units of CSIRO, are organised into four 'self-managed' groups. The chairmanship of each group rotates amongst the member Chiefs annually and the Chair represents his or her colleagues on a smaller Executive Team (ET) that met at least monthly.

Risk management program

The Board has 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 contract and project specific risk assessments**.** These are designed to identify, evaluate and prioritise risks and develop risk-mitigation strategies. The Risk Assessment and Audit Unit facilitates this process utilising a methodology consistent with the Australian Risk Management Standard AS/NZS–4360.

An organisational risk profile is completed semi-annually and reported to the Audit Committee.

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.

CSIRO management is responsible for developing and implementing risk-mitigation strategies. In appropriate circumstances, insurance is used as a method to transfer the financial impact of risk.

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 financial statements to be signed by the Board.

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.

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

CSIRO has conducted fraud risk assessments and has in place fraud control plans that comply with the Commonwealth Fraud Control Guidelines. CSIRO has in place appropriate fraud prevention, detection, investigation, and reporting procedures and processes. Annual fraud data has been collected and reported in compliance with the Commonwealth Fraud Control Guidelines. The most recent fraud risk assessment was undertaken in March 2002.

The Audit Committee receives a regular six-monthly fraud report from the Fraud Control Officer.

Independent professional advice

In the pursuit 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.

Outsourcing of Information Technology Infrastructure Services Notice of General Government Policy

Following formal consultation with the Board of CSIRO, as required under s28 of the *Commonwealth Authorities and Companies Act 1997* (the '*CAC*' *Act*), the Minister for Science on 16 April 2002 notified the Board of CSIRO of certain general policies of the Commonwealth Government relating to the outsourcing of IT Infrastructure services. As required under s51(e) of the *Science and Industry Research Act 1949*, the notice (which is dated 15 April 2002) is set out on the following page.

Under s28(2) of the *CAC Act*, the Board must ensure that the notified policies are carried out in relation to CSIRO. The Board has considered and endorsed CSIRO's strategy for the provision of IT services, noting that the strategy takes full account of the requirements under the General Notice.

NOTICE OF GENERAL POLICIES OF THE COMMONWEALTH GOVERNMENT

To the members of the Board of the **Commonwealth Scientific and Industrial Research Organisation**

In accordance with subsection 28(1) of the *Commonwealth Authorities and Companies Act 1997*, I, Peter McGauran, Minister for Science.

1. Notify the Board of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) that the following general policies of the Commonwealth Government apply in relation to CSIRO and the Board:

(a) Outsourcing of IT Infrastructure services across all Budget-funded agencies, including CSIRO ("Agency"), should proceed, but only following careful decision on what, if any, elements should be outsourced; and should not proceed until the CSIRO Board is satisfied that the transitional and implementation risks have been adequately addressed.

(b) Each Agency must undertake a competitive tendering process for IT Infrastructure services to be outsourced in accordance with an appropriate outsourcing model within a reasonable timeframe. The competitive tendering process is to have regard to value for money in IT, industry development outcomes, grouping wherever possible to achieve economies of scale and outsourcing within a reasonable timeframe.

(c) Conduct of a competitive tendering process, including implementation of any services agreement must have regard to the Government's response to the Review of the Whole of Government Information Technology Outsourcing Initiative, by Mr R Humphry, December 2000 as it applies to each Agency.

(d) The outsourcing process is to include cooperation with, and participation in, the industry development framework. The Department of Communications, Information Technology and the Arts will retain policy responsibility for the industry development component of this initiative.

(e) Implementation of this notice shall be an explicit consideration in the performance assessment of the Chief Executive of CSIRO by the CSIRO Board.

Peter McGauran
15/4/2002

Commonwealth Authorities and Companies Act 1997

CSIRO policies

The Organisation is reviewing CSIRO policies and revising the way it conducts its operations. The Strategic Action Plan internal document, described in the CSIRO Annual Report 2000–01, Chapter 9, contains the key drivers for these changes.

Occupational Health and Safety is a top priority and is receiving a major overhaul. The death of Mr Set Van Nguyen at the Australian Animal Health Laboratory highlighted weaknesses in current policy and procedures to which we are paying particular attention.

From 1 July 2002 research in CSIRO will be managed on a project basis, regardless of funding source. The project is the base level at which resources are managed within a Division or at Corporate level. Projects will be defined in terms of:

- specified and approved objectives/deliverables;
- timeframe;
- milestones;
- budget;
- client (internal and/or external); and
- a single business domain in which they reside.

Projects will be categorised either as support (projects to manage support activities and indirect costs) or output (projects that contribute to the outputs agreed with the Government, as specified in the CSIRO Strategic Plan and related Investment Model).

During the financial year, policies were updated or created in the following areas:

Operational area	New/updated Policies
Occupational health and safety	■ The Working Alone procedure was updated. ■ A new Managing Alcohol and Drugs procedure was developed. ■ A new Management of Cooling Towers procedure was developed. ■ The Work in Remote Locations procedure was updated. ■ The Noise Management and Hearing Protection procedure was updated. ■ A new Energy–Efficient Vehicles procedure was developed. ■ The First Aid procedure was updated. ■ The Manual Handling procedure was updated. ■ Occupational Health Safety and Environmental Purchasing procedure.
Research management	■ Management by Project will take effect from July 2002.
Financial procedures	■ Changes have been made in quotation thresholds. ■ Changes in financial and commercial delegations, new accounts payable policy, changes to motor vehicle and property management.
General administrative procedures	■ Management of electronic mail procedures updated. ■ Procedures for creation and management of records updated to conform with national standards and incorporate electronic systems. ■ New policy on establishment of trusts in CSIRO.

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 2002, CSIRO received 24 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.

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.

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 postdoctoral 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. CSIRO Publishing material is listed at www.publish.csiro.au.

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 2001–02 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 2002, CSIRO received no requests for statements of reason under the *AD(JR) Act*.

Occupational health and safety

In 2001 CSIRO's Occupational Health, Safety and Environment (OHS&E) function and structure was reviewed to determine the best delivery model for the Organisation.

A strategy to shift OHS&E accountabilities to Divisions was accepted and a transitional plan to achieve this was adopted.

The new structure has each Division appointing a professional OHS&E Manager, supported by OHS&E Officers at regional sites. The new, smaller Corporate OHS&E Group consists of a Corporate OHS&E Manager, two OHS&E Advisors and two support staff who will work with Divisional staff to develop the expanded OHS&E network and implement CSIRO corporate OHS&E strategies.

Improved OHS performance is expected in the 2002–03 year as management has significantly increased its focus on OHS and a compliance culture is being developed. Communication and reporting mechanisms have been reviewed and improved. The expanded OHS&E network is being consolidated and additional Divisional professional staff appointed which will also improve performance.

OHS policy

CSIRO's Occupational Health and Safety Policy reflects the principles for protecting all staff and others that might be affected by the work of the Organisation.

OHS agreement

The existing OHS Agreement between CSIRO and involved Unions was extended for a further 12 months and is due for review at the end of 2002.

OHS committees

The Corporate Health and Safety Committee advises on the development of OHS policies and programs and broad OHS priorities. The Corporate OHS Committee meets every three months and all staff have access to the minutes of these meetings on the CSIRO OHS&E intranet. A CSIRO OHS Committee Procedure has been developed to provide guidance to Divisional and site OHS committees to improve their effectiveness.

Health and Safety Representatives

Health and Safety Representatives (HSRs) are elected in accordance with the Act and the CSIRO OHS Agreement and are trained by Comcare accredited providers.

The CSIRO OHS Committee procedure details the role of HSRs and a recommendation for formal recognition of their contribution to assisting with OHS improvements via feedback in the annual performance appraisal process.

OHS management strategies

Measures taken during the year to ensure the health, safety and welfare of employees and people within the workplace include:

- reviewing and updating Corporate OHS policies to reflect legislative changes and better OHS practices;
- the incorporation of OHS strategies into the CSIRO Strategic Action Plan;
- implementation of CSIRO-wide OHS recommendations resulting from the Australian Animal Health Laboratory (AAHL) incident investigation;
- targeted review across CSIRO of the management of specific OHS hazards, such as electrical safety, asbestos management and gas safety practices;
- in conjunction with the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), radiation safety and environmental management has been reviewed and the CSIRO Radiation Safety manual updated;
- quarterly reporting of OHS key performance measures to analyse positive OHS management strategies and incident occurrence, upon which OHS improvement strategies are determined;
- continued implementation of the OHS Management system, based on Australian Standard/New Zealand Standard (AS/NZS) 4801 OHS Management Systems; and
- bi-monthly reporting to the Board on OHS management and performance.

Notifiable incidents

Notifiable Incidents are required to be reported to Comcare under the *Occupational Health and Safety (Commonwealth Employment) Act 1991* and prescribed under the Regulations. The type of incidents to be reported are the death of any person, a serious personal injury to any person, the incapacity of an employee of more than 30 successive days or shifts or a dangerous occurrence which could have caused any of the previous types of incidents.

A total of 37 notifiable incidents were reported to Comcare over the year. This included one fatality, eight serious personal injuries, no cases of work incapacity greater than 30 days, and 28 dangerous occurrences. This figure is an increase over previous years which is due to an improved awareness of reporting requirements.

It is with deep regret that CSIRO reports the workplace death of a staff member, Mr Set Van Nguyen, at the Australian Animal Health Laboratory of the Division of Livestock Industries in December 2001.

A Committee of Inquiry was formed, headed by the Chief of Entomology, Dr Jim Cullen. The Inquiry identified a series of failures of the laboratory's complex engineering and control systems, coupled with inadequacies in relation to staff being alerted to, and understanding the seriousness of, these failures. The Inquiry handed down very comprehensive recommendations that are being adopted across the Organisation. Twenty-four recommendations were made for the laboratory and a further eight recommendations relating to the broader operation of CSIRO were made, accepted and are currently being implemented.

OHS statistics

Injury statistics

CSIRO's OHS performance was similar to the previous year, as indicated in the table below. The Lost Time Incident Frequency Rate (LTIFR) and Medical Treatment Frequency Rate (MTFR) is similar to previous years. The Average Time Lost Rate (ATLR) has recently been added to the Injury Performance statistics providing three injury performance measures reported quarterly.

Figure 1: CSIRO's OHS Performance for the past five years

Indicator	1997–98	1998–99	1999–00	2000–01	2001–02
LTIFR	8	5	6	7	7
MTFR	31	29	25	25	27
ATLR	3.1	2.9	4.0	2.9	2.7
Time lost–weeks	316	185	274	225	222
No of incidents reported	796	925	834	975	1035
No of compensation claims	377	343	307	290	318

Definitions:

- *Lost Time Incident Frequency Rate (LTIFR) is the number of incidents involving lost time from work greater than or equal to one full day or shift per million hours worked.*
- *Medical Treatment Frequency Rate (MTFR) is the number of compensation claims per million hours worked.*
- *Average Time Lost Rate (ATLR) is the average time lost for the number of incidents during the period.*

OHS investigations

Provisional improvement notices (PINS)

There were no PINS issued by HSRs.

Prohibition and improvement notices

An Improvement Notice is a written direction, issued by a Comcare Investigator, requiring a person or organisation to improve a workplace or system of work to bring it into compliance with the law. A time limit is included on the Notice for the improvement to be completed.

Comcare issued two Improvement Notices at the Division of Livestock Industries AAHL facility following the fatality in December 2001. These were raised to ensure that procedures are established to prevent employees entering liquid nitrogen facilities when alarms indicate low oxygen levels or a positive pressure. These notices were appealed and revoked by Comcare.

A Prohibition Notice is a written direction, issued by a Comcare Investigator, prohibiting an activity that the investigator believes involves an immediate risk to the health and safety of any person. The activity cannot be started again until the investigator notifies the employer that the investigator is satisfied adequate action has been taken to remove the risk.

Comcare issued one Prohibition Notice at the Division of Manufacturing, Science and Technology, Woodville, South Australia following a dangerous occurrence in June 2002. This related to a furnace that caused an electric shock. A competent and experienced person was employed to assess the plant and certified its unsuitability for continued use. The furnace was scrapped and the Prohibition Notice withdrawn.

Comcare investigations

Comcare conducted four planned investigations on CSIRO sites during the year. In response to subsequent recommendations by Comcare, CSIRO has developed plans to improve gas management procedures and assessment and control of work procedures.

Comcare conducted an investigation at the Land and Water Laboratories, Griffith, New South Wales following safety complaints from the Staff Association. These complaints were identified in a report and CSIRO responded formally to the complaints to the satisfaction of Comcare.

Figure 2: CSIRO Aggregated OHS Performance Indicators June 01–June 02

Positive Performance Indicators

CSIRO Divisions commenced quarterly reporting on OHS positive performance indicators in June 2000. The positive performance indicators are:

- % of supervisors trained in OHS;
- % of new staff who have received formalised OHS induction within two weeks of arrival;
- % of staff covered by a completed HS&E Assessment of Work; and
- % of incidents that are fully investigated.

Commonwealth disability strategy reporting

For the purposes of the Commonwealth Disability Strategy (CDS), CSIRO's 'Role' is that of an 'Employer'. Activities relevant to the Strategy form part of CSIRO's Workplace Diversity Plan. A new Plan will be released shortly, and includes a number of strategies supporting the Commonwealth Disability Strategy. In the early stages of the Plan there is a particular emphasis on enhancing the data available on staff with disabilities, across a broad range of employment and development related issues, in order to better target future strategies.

CSIRO conducted a staff opinion poll at the end of 2001. The responses of staff with disabilities are being analysed to identify trends that vary from the rest of the Organisation and therefore require specific attention.

Performance against the indicators issued by the Office of Disability is detailed in the following table:

Performance Indicator	Performance Measure
Employment policies, procedures and practices comply with the requirements of the *Disability Discrimination Act 1992*	CSIRO expects to complete a review of all its employment policies and practices over the next two years. In this reporting period seven policy areas have been reviewed, covering topics such as performance appraisal, classification system, promotion and rewards.
Recruitment information for potential job applicants is available in accessible formats on request	In the past 12 months, CSIRO has increased the use of the Internet for recruitment. All web authors must comply with the Web Content Accessibility Guidelines.
Agency recruiters and managers apply the principle of 'reasonable adjustment'	All CSIRO managers have access to information on 'reasonable adjustment' through a CSIRO publication *What is fair, what is not?*, which will be reviewed in the next year. In addition, as part of the introduction of mandatory effort logging, staff with disabilities are being asked to identify whether any further adjustment is needed to enable them to use the effort logging system.
Training and development programs consider the needs of staff with disabilities	Corporate development programs are conducted at venues that can cater to the needs of participants with disabilities. However, results from the staff opinion poll suggest that more development opportunities are needed for these staff.
Training and development programs include information on disability issues as they relate to the program	Past leadership/management training in CSIRO on managing the diversity and personal needs of the members of a team is currently under review.
Complaints/grievance mechanism, including access to external mechanisms, in place to address issues and concerns raised by staff	CSIRO has internal mechanisms for resolving complaints that, in the formal stages, involve investigation by an independent investigator, as well as scope to refer the matter to the Human Rights and Equal Opportunity Commission.

Organisational Activities in accordance with Ecologically Sustainable Development (ESD)

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.

Legislative compliance

CSIRO is implementing an Environmental Management System (EMS) based on International Standards Organisation (ISO) 14001. This process was commenced in 1999 and quarterly reporting is conducted by Divisions on how well their implementation is progressing in a status report.

A program of independent environmental audits of all significant operating sites was completed, and many sites have completed their Preliminary Environmental Audits.

Legal Obligations Directories for each State and Territory are being developed to assist CSIRO to comply with Commonwealth, State and Territory environmental legislation, including the *Commonwealth Environmental Protection and Biodiversity Conservation Act (EPBC) 1999* at all operating locations.

Environmental Policy

CSIRO's Environmental Policy reflects the principles for managing environmental aspects affected by the work of the organisation.

Environmental Management Systems Committee

The Corporate Environmental Management Systems Committee advises on the development of Environmental policies, programs and environmental priorities. The Corporate Environmental Management Systems Committee meets every three months and all staff have access to the minutes of the meetings on the CSIRO OHS&E intranet.

Appropriation outcomes contributing to ESD

CSIRO's research directly contributes to ESD. 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.

Effects of CSIRO's activities on the environment

Environmental incidents and legislative breaches

There were no reportable breaches of environmental legislation within CSIRO during the past year.

CSIRO reports and investigates any incident deemed to have environmental impact via its incident reporting system.

Environmental remediation on sites

A number of CSIRO sites were subjected to remediation management during the past year.

The Prospect Park site in New South Wales has been vacated by the Division and is subject to remediation. Stage 1 of contamination remediation is completed and stage 2 will be completed by October 2002. Contamination was more than had been mapped by the Division.

The Bradfield Park site in New South Wales has had low-level asbestos contamination removed. Remediation of the asbestos building rubble was completed by the end of August 2002.

Low-level radioactive waste stored at Woomera has been monitored during the year. Drum conditions were assessed and all security arrangements are being met.

Environmental aspects and effects

CSIRO's activities during this year have had minimal detrimental effect upon the environment.

Via environmental audits and the Health, Safety and Environment Risk Assessment of work processes, CSIRO has identified any potential risks its business activities may pose to the environment. The key environmental aspects identified include:

- storage and disposal of radiation sources; there is a stockpile at Woomera and North Ryde;
- the use, management and removal of underground fuel storage tanks; a planned phased removal of unused underground storage tanks is underway; a system to monitor the conditions of tanks in use has been adopted; and
- the management and disposal of asbestos in buildings and equipment; an asbestos status survey was undertaken to indicate the completion of asbestos management requirements at all sites; asbestos registers, risk assessments, labelling of materials, identification of responsibilities, and appropriate disposal methods are in place in most locations.

Comprehensive management strategies and reporting systems are in place for these identified environmental aspects.

Environmental risk management and review processes

Environmental risk management

CSIRO has introduced an Environmental Management System (EMS) to assist to minimize the impact of its business activities on the environment. CSIRO uses a risk management process whereby all project groups are required to identify potential environmental impacts, assess the risk and implement control strategies.

As part of the EMS, each Division is required to develop an annual Environmental Improvement Plan. These identify improvement strategies such as waste management strategies.

This year CSIRO has continued with the program of independent environmental audits. It has instigated a program to remove underground fuel storage tanks where possible and has reviewed the processes for managing and removing asbestos from sites. In conjunction with the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), radiation safety and environmental management has been reviewed and the CSIRO Radiation Safety manual updated.

CSIRO recently appointed a Corporate Biotechnology Coordinator and a Corporate Biotechnology Strategy Liaison Group to manage the health, safety and environmental considerations associated with genetic manipulation work.

Monitoring and review

The mechanisms CSIRO uses to review environmental management processes and to achieve continual improvement include:

- annual reporting on environmental performance indicators;
- quarterly reporting on Divisions' progress with implementing the EMS;
- updating the environmental reporting process;

- quarterly meetings by the Corporate EMS Committee to review policies and actions to improve the management of environmental activities; and
- bi-monthly reporting to the Board on environmental management.

The first annual reporting on environmental performance indicators occurred in June 2002, with data analysis on these reports underway to establish performance trends.
Key performance indicators include:

- rate of water use;
- rate of energy use;
- percentage of environmental risk assessments completed;
- percentage of supervisory staff trained on environmental management; and
- implementation of waste management plans (reduce, re-use, recycle) at sites.

Energy services

The Corporate Energy Services Unit (CESU) monitors usage and advises Divisions and users on energy consumption. It also recommends methods to reduce CSIRO's overall energy usage and greenhouse emissions in line with Government annual reduction targets and when relevant, provides staff awareness and training programs.

Electricity usage at most sites is now effectively monitored by the installation of a metering system. During the reporting period a five per cent reduction was achieved on the CSIRO-wide purchase price of energy.

Heritage sites

Corporate Property maintains a Heritage Register for Land and Buildings and is conducting a review of its holdings in conjunction with the Australian Heritage Commission. Consultation with community groups and other interested parties are ongoing. Results of the review have been provided to all State and Local Government bodies that maintain their own registers. The information is available from the Australian Heritage Commission.

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 broad sectors of the economy, and other means, the input of senior industry and government officials in deciding its research priorities;
- the organisation will seek and respond to feedback from the client for each major research project undertaken;
- the organisation will utilise its scientific capability as effectively as possible when addressing the needs of its customers;
- advice given will be independent and based on appropriate expertise; and
- 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 as required 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) 6246 4558
Email customer-relations@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.

Review process

This service charter has been changed based on the feedback obtained during the year. The amendments have taken into account input from both within the organisation and from external stakeholders.

CSIRO | Independent Audit Report

Australian National
Audit Office

INDEPENDENT AUDIT REPORT

To the Minister for Education, Science and Training

Scope

I have audited the financial statements of Commonwealth Scientific Industrial and Research Organisation for the year ended 30 June 2002. The financial statements comprise:

- Statement by Board Members;
- Statements of Financial Performance, Financial Position and Cash Flows;
- Schedules of Commitments and 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 the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards, to provide reasonable assurance as to whether the financial statements are free of material misstatement. Audit procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial statements and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial statements are presented fairly in accordance with Accounting Standards and other mandatory professional reporting requirements in Australia and statutory requirements so as to present a view which is consistent with my understanding of the Commonwealth Scientific Industrial and Research Organisation's financial position, its financial performance and its cash flows.

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

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

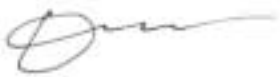
Audit Opinion

In my opinion the financial statements:

(i) have been prepared in accordance with Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*; and

(ii) give a true and fair view, in accordance with applicable Accounting Standards and other mandatory professional reporting requirements in Australia and the Finance Minister's Orders, of the financial position of Commonwealth Scientific Industrial and Research Organisation as at 30 June 2002, and its financial performance and cash flows for the year then ended.

Australian National Audit Office



David C McKean
Executive Director

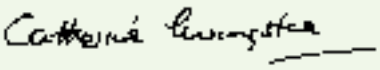
Delegate of the Auditor-General

Canberra
23 September 2002

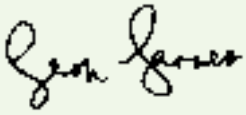
Statement by Board Members

In our opinion, the attached financial statements for the year ended 30 June 2002 give a true and fair view of the matters required by the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997.*

Signed on the 16th day of September 2002 in accordance with a resolution of the Board Members.



Catherine Livingstone
Chairman of the Board



Geoff G Garrett
Chief Executive and Board Member

Statement of Financial Performance for the year ended 30 June 2002

	Notes	2002 $'000	2001 $'000
Revenues from ordinary activities			
Revenues from Government	5.1	612 491	611 042
Sales of goods and services	5.2	267 042	242 301
Interest	5.3	7 572	6 444
Net gains from sales of assets	5.4	21 614	10 238
Net foreign exchange gains	5.5	–	59
Contributions	5.6	13 290	668
Other	5.7	37 557	14 551
Total revenues from ordinary activities		**959 566**	**885 303**
Expenses from ordinary activities			
Employees	6.1	422 408	445 269
Suppliers	6.2	276 967	259 821
Depreciation and amortisation	6.3	77 335	77 703
Write-down of assets	6.4	6 376	(430)
Net foreign exchange losses	6.5	9	–
Other	6.6	25 000	1 240
Total expenses from ordinary activities		**808 095**	**783 603**
		151 471	**101 700**
Borrowing costs expense	6.7	(1 642)	(1 062)
Share of net operating surplus of joint ventures accounted for using the equity method	23 (e)	62	361
Net operating surplus from ordinary activities	21	**149 891**	**100 999**
Net surplus attributable to the Commonwealth Government	21	**149 891**	**100 999**
Net credit to asset revaluation reserve	21	37 305	46 122
Total valuation adjustments recognised directly in equity	21	**37 305**	**46 122**
Total changes in equity other than those resulting from transactions with owners as owners		**187 196**	**147 121**

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

Statement of Financial Position as at 30 June 2002

	Notes	2002 $'000	2001 $'000
Assets			
Financial Assets			
Cash	7	148 389	109 713
Receivables	8	135 940	47 447
Investments accounted for using the equity method	9	107	45
Investments – other	9	2 302	28 744
Total financial assets		**286 738**	**185 949**
Non-Financial Assets			
Land and buildings	10	834 106	822 431
Plant and equipment	11	236 669	233 539
Inventories	12	790	896
Intangibles	13	3 662	4 994
Other	14	22 844	21 344
Total non-financial assets		**1 098 071**	**1 083 204**
Total assets		**1 384 809**	**1 269 153**
Liabilities			
Interest Bearing Liabilities			
Loans	15 (a)	52 800	–
Leases	16	61 829	43 234
Deposits – trust monies	17	36 495	8 477
Total interest bearing liabilities		**151 124**	**51 711**
Provisions			
Capital use charge	1.16	892	527
Employees	18	178 483	170 048
Total provisions		**179 375**	**170 575**
Payables			
Suppliers	19	29 777	23 911
Other	20	52 257	87 494
Total payables		**82 034**	**111 405**
Total liabilities		**412 533**	**333 691**
Net Assets		**972 276**	**935 462**
Equity			
Reserves	21	481 251	443 946
Accumulated surpluses	21	491 025	491 516
Total equity		**972 276**	**935 462**
Current assets		**250 163**	**292 609**
Non-current assets		**1 134 646**	**976 544**
Current liabilities		**177 786**	**177 815**
Non-current liabilities		**234 747**	**155 876**

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

Statement of Cash Flows for the year ended 30 June 2002

	Notes	2002 $'000	2001 $'000
Operating Activities			
Cash received			
Appropriations	5.1	612 491	611 042
Sales of goods and services		311 273	282 151
Interest		7 095	6 444
GST recovered from Australian Taxation Office		1 347	8 593
Other – trust monies		28 018	–
		960 224	**908 230**
Cash used			
Employees		413 971	429 851
Suppliers		315 256	288 187
Borrowing costs		1 642	1 062
Other		–	987
		730 869	**720 087**
Net cash provided/(used) by operating activities	22(b)	**229 355**	**188 143**
Investing Activities			
Cash received			
Proceeds from sale of property, plant and equipment		64 104	110 539
Proceeds from sale of shares and intellectual property		1 660	3
		65 764	**110 542**
Cash used			
Purchase of property, plant and equipment		117 840	101 733
Purchase of equity investment		7 181	551
Other investments		32 800	–
		157 821	**102 284**
Net cash provided/(used) by investing activities		**(92 057)**	**8 258**
Financing Activities			
Cash received			
Proceeds from debt		**51 395**	**22 837**
Cash used			
Repayment of debt		27 008	62 731
Capital use charge – paid to Government		100 413	104 409
Proceeds from property sales – paid to Government	21	49 604	59 591
		177 025	**226 731**
Net cash provided/(used) by financing activities		**(125 630)**	**(203 894)**
Net increase/(decrease) in cash held		**11 668**	**(7 493)**
Cash at 1 July		136 721	144 214
Cash at 30 June	22(a)	**148 389**	**136 721**

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

Schedule of Commitments as at 30 June 2002

	2002 $'000	2001 $'000
By Type		
Commitments payable		
Capital commitments		
Land and buildings	55 985	46 820
Plant and equipment	689	3 342
Total capital commitments	**56 674**	**50 162**
Other commitments		
Operating leases	442 685	329 524
Research and development commitments	291 617	284 069
Other commitments	12 797	8 583
Total other commitments	**747 099**	**622 176**
Total commitments payable	**803 773**	**672 338**
Commitments receivable		
Research and development commitments	253 807	246 670
Other receivables	7 080	6 490
Total commitments receivable	**260 887**	**253 160**
Net commitments payable	**542 886**	**419 178**
By Maturity		
All net commitments		
One year or less	98 988	79 657
From one to five years	114 105	91 843
Over five years	329 793	247 678
Net commitments payable	**542 886**	**419 178**
Operating lease commitments		
One year or less	22 758	19 198
From one to five years	88 279	58 228
Over five years	331 648	252 098
Total net operating lease commitments	**442 685**	**329 524**

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

Schedule of Contingencies as at 30 June 2002

	Notes	2002 $'000	2001 $'000
Contingent losses			
Bank guarantees		–	109
Interest on Commonwealth Government loans	15	5 740	–
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.		205	215
Total contingent losses		**5 945**	**324**
Contingent gains			
Receivable from AMC	15	5 740	–
Legal claims expected to succeed from recovery of debts.		–	190
Total contingent gains		**5 740**	**190**
Net contingent losses		**205**	**134**

Schedule of Unquantifiable Contingencies as at 30 June 2002

Preliminary investigation by the CSIRO Environmental Management Committee identified 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 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.

Notes to and Forming Part of the Financial Statements for the year ended 30 June 2002

Notes to and Forming Part of the Financial Statements for the year ended 30 June 2002

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:

- Finance Minister's Orders (being the Commonwealth Authorities and Companies (Financial Statements 2001/2002) Orders);
- Australian Accounting Standards and Accounting Interpretations issued by Australian Accounting Standards Board;
- other authoritative pronouncements of the Board; and
- the Consensus Views of the Urgent Issues Group.

In addition, the statements have been prepared having regard to:

- the Explanatory Notes to Schedule 1 of the Orders issued by the Department of Finance and Administration; and
- Finance Briefs issued by the Department of Finance and Administration.

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

Assets and liabilities are recognised in the Statement 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 Statement 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 seven fully owned R&D Syndication companies listed in Note 9 when investors in the Syndications exercised their put options under the Syndications' agreements. These companies are in the process of being wound up by members' voluntary liquidation. In addition CSIRO has established the subsidiary companies listed in Note 9 as vehicles for the commercialisation of its intellectual properties.

These R&D Syndication companies and fully owned subsidiaries did not have material transactions in 2001/02 which would affect CSIRO's financial position and/or performance and as a result they have not been consolidated.

1.3 Revenue Recognition

The full parliamentary appropriation for outputs is recognised at the time CSIRO becomes entitled to receive the revenue.

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 20). 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 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 when 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.

1.6 Property, Plant and Equipment

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost, 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 Finance Minister's Orders every three years using the deprival method of valuation, so that no asset has a value more than three years old.

Land and buildings were revalued as at 30 June 2002. Land, which will continue to be used for research activity, was valued by CSIRO's registered valuer 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 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, fitouts, fixtures and fittings, which form an integral part of the building.

Land and buildings designated for possible sale were valued at market value by registered independent valuers.

Plant and equipment with historical costs of $75 000 and over were revalued by the Australian Valuation Office as at 1 July 2001 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 26.

Depreciation and Amortisation

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

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.

1.6 Property, Plant and Equipment – *continued*

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.

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 in June 2000 using the "deprival" method (Note 13). In accordance with AASB1041 the carrying value of software as at 30 June 2002 is deemed to be at cost. 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, AASB1041 on "Revaluation 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 to value its investments at cost, where this is not in excess of their recoverable amounts. However, in June 2002 CSIRO's investment in a listed company, Australian Magnesium Corporation Ltd had been written down to its recoverable amount (Note 9 (c)).

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

CSIRO has adopted the cost basis to account for its interest in unlisted R&D 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 2002 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 2002. 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 or 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 determined by regular actuarial review and calculated to cover existing and emerging obligations. In addition a 3% Employer Productivity Superannuation Contribution is paid for CSS and PSS members. For term employees who have chosen not to join the CSS or PSS, an 8% employer productivity superannuation contribution is paid to the 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 and trust monies. 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 11% (2001 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 23.

1.22 Financial Instruments

Accounting policies for financial instruments are stated in Note 35.

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.

Note 1 Summary of significant accounting policies – *continued*

1.24 Reporting by Outcome and Outputs

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.

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 Outcome and Outputs

(a) Reporting by outcome

The requirement to report by outcomes reflects the introduction of outcome-focused accrual budgeting by the Commonwealth Government from 1 July 1999. The budget for CSIRO formed part of the Portfolio Budget Statements 2001/2002, Industry, Science and Resources Portfolio. CSIRO's outputs contribute to a single 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".

	2002 Actual $'000	2002 Budget $'000	2001 Actual $'000	2001 Budget $'000
(i) Reporting by outcome for 2001/2002				
Revenues				
Revenue from Government Appropriations	614 713	614 713	610 032	610 032
Additional/(reduced) estimates of revenue from Government – Appropriation Acts 3 & 4	(2 222)	(2 222)	1 010	1 010
	612 491	**612 491**	**611 042**	**611 042**
Revenue from other sources	347 137	287 542	274 622	276 169
Increase to original revenue from other sources	–	973	–	–
	347 137	**288 515**	**274 622**	**276 169**
Total revenues	**959 628**	**901 006**	**885 664**	**887 211**
Net cost to budget outcome	**910 515**	**901 006**	**889 601**	**887 211**
Total assets deployed as at 30 June	**1 384 809**	**1 352 036**	**1 269 153**	**1 318 447**
Net assets deployed as at 30 June	**972 276**	**954 616**	**935 462**	**944 709**
(ii) Reporting by outcome by funding source for 2001/2002				
Expenses against revenue from Government Appropriations	612 491	612 491	611 042	611 042
Expenses against revenue from other sources	298 024	288 515	278 559	276 169
Total expenses against output	**910 515**	**901 006**	**889 601**	**887 211**
Net cost to budget outcome comprises:				
Total expenses from ordinary activities	808 095	795 531	783 603	773 303
Borrowing costs expense	1 642	7 789	1 062	2 324
Capital use charge	100 778	97 686	104 936	111 584
	910 515	**901 006**	**889 601**	**887 211**

Note 4 Reporting by Outcome and Outputs – *continued*

(b) Major Organisational Revenues and Expenses by Output Groups

	Output Group 1		Output Group 2		Output Group 3		Output Group 4		Total	
	Manufacturing & Information Services Industries		Minerals & Energy		Environment & Natural Resources		Agribusiness Industries			
	2002 $000	2001 $000	2002 $000	2001 $000	2002 $000	2001 $000	2002 $000	2001 $000	2002 $000	2001 $000
Operating revenues										
Revenues from Government	195 813	195 775	102 194	103 210	130 081	129 609	184 403	182 448	612 491	611 042
Sale of goods and services	63 316	59 509	48 174	44 244	52 153	46 376	103 399	92 172	267 042	242 301
Contributions	–	–	13 290	668	–	–	–	–	13 290	668
Reinstatement of receivable from AMC	–	–	25 000	–	–	–	–	–	25 000	–
Other	9 897	7 685	7 531	5 714	8 152	5 989	16 163	11 904	41 743	31 292
Total operating revenues	**269 026**	**262 969**	**196 189**	**153 836**	**190 386**	**181 974**	**303 965**	**286 524**	**959 566**	**885 303**
Operating Expenses										
Employees	120 978	132 913	80 976	73 737	85 115	91 591	135 340	147 028	422 409	445 269
Suppliers	79 323	77 557	53 095	43 026	55 809	53 445	88 740	85 793	276 967	259 821
Depreciation and amortisation	22 149	23 194	14 825	12 868	15 583	15 984	24 778	25 658	77 335	77 704
Write-down of assets	226	(830)	151	94	159	117	5 839	188	6 375	(431)
Reinstatement of Government loans	–	–	25 000	–	–	–	–	–	25 000	–
Other	473	687	316	381	333	474	529	760	1 651	2 302
Total operating expenses	**223 149**	**233 521**	**174 363**	**130 106**	**156 999**	**161 611**	**255 226**	**259 427**	**809 737**	**784 665**

(c) Major classes of organisational assets and liabilities cannot be allocated reliably into the four output categories. As a result, this information is not provided.

Note 5 Operating Revenues

		Notes	2002 $'000	2001 $'000
5.1	**Revenues from Government**			
	Appropriations for outputs	4	**612 491**	**611 042**
5.2	**Sales of goods and services**			
	Strategic R&D – co-investment activities		228 319	212 916
	Services and consulting		21 813	20 109
	Intellectual property revenues (eg. royalties and license fees)		18 508	8 278
			268 640	241 303
	Less, Net gains/(loss) on sale of shares and intellectual property included in intellectual property revenue above	5.4	1 598	(998)
			267 042	**242 301**
	Cost of goods sold – inventory items only		*835*	*726*
5.3	**Interest**			
	Bank and term deposits		**7 572**	**6 444**
5.4	**Net gains/(losses) from sales of assets**			
	Property, plant and equipment			
	Proceeds from sale		84 235	103 554
	Less, Net book value		(64 219)	(92 318)
	Net gains		20 016	11 236
	Shares and intellectual property			
	Proceeds from sale		1 660	3
	Less, Net book value		(62)	(1001)
	Net gains/(loss)	5.2	1 598	(998)
			21 614	**10 238**
5.5	**Net foreign exchange gains**			
	Non-speculative		**–**	**59**
5.6	**Contributions**			
	Contributions of capital assets		**13 290**	**668**

Note 5 Operating Revenues – *continued*

		Notes	2002 $'000	2001 $'000
5.7	**Other revenues**			
	Vehicle contributions – staff		137	141
	Donations		177	3 527
	Rental		3 204	2 874
	Sale of primary produce		1 619	986
	Reinstatement of receivable from AMC	15	25 000	–
	Other		7 420	7 023
			37 557	**14 551**
	Total operating revenue		**959 566**	**885 303**

Note: CSIRO's share of the joint venture entity, FSA's external revenue of $12,059k (2001 $11,907k) is not included in the above total revenue of $959 566k (2001 $885 303k). This represents 83.07% (2001 83.21%) of FSA's external earnings of $14,517k (2001 $14,309k), based on CSIRO's percentage contribution to FSA. CSIRO's interest in FSA has been accounted for using the equity method (Note 23 (e)).

Note 6 Operating Expenses

		2002 $'000	2001 $'000
6.1	**Employees expenses**		
	Remuneration for services provided	417 252	432 833
	Separation and redundancy	5 156	12 436
		422 408	**445 269**
6.2	**Suppliers**		
	Supply of goods and services	258 847	250 583
	Operating lease rentals	18 120	9 238
		276 967	**259 821**
6.3	**Depreciation and amortisation**		
	Buildings and leasehold improvements	35 465	35 275
	Plant and equipment	40 538	41 097
	Intangibles	1 332	1 331
		77 335	**77 703**

Note 6 Operating Expenses – *continued*

		Notes	2002 $'000	2001 $'000
6.4	**Write-down of assets**			
	Bad debts		466	102
	Increase/(decrease) in provision for doubtful debts		(643)	468
	Increase/(decrease) in provision for diminution in value of investment		5 586	(1 000)
	Write down of investments to recoverable amount		967	–
			6 376	**(430)**
6.5	**Net foreign exchange losses**			
	Non-speculative		**9**	**–**
6.6	**Other expenses**			
	Contamination clean up and other		–	1 240
	Reinstatement of Commonwealth and Queensland Government loans	15	25 000	–
			25 000	**1 240**
6.7	**Borrowing costs expense**			
	Finance charges on lease liabilities		**1 642**	**1 062**
	Total operating expenses		**809 737**	**784 665**

Note 7 Cash

	Notes	2002 $'000	2001 $'000
Cash at bank and on hand		23 429	51 804
Deposits – at call		124 960	57 909
Total cash		**148 389***	**109 713***
*Total cash includes trust monies totalling $36 494 535 (2001 $8 477 221)	17		

Note 8 Receivables

	Notes	2002 $'000	2001 $'000
Goods and services		51 541	44 124
Provision for doubtful debts		(346)	(999)
		51 195	43 125
Property sales		20 250	–
Receivable from AMC	15 (b)	57 800	–
GST receivable		1 461	–
Other		5 234	4 322
Total receivables		**135 940**	**47 447**
Gross receivables which are overdue are aged as follows:			
Not overdue		**124 296**	**34 904**
Overdue by:			
Less than 30 days		7 414	7 364
30 to 60 days		2 288	3 723
60 to 90 days		774	885
More than 90 days		1 514	1 570
		11 990	**13 542**
Total gross receivables		**136 286**	**48 446**
Receivables are categorised as follows:			
Current		78 486	48 446
Non-current		57 800	–
		136 286	**48 446**

Note 9 Investments

	% CSIRO interest	Notes	2002 $'000	2001 $'000
Investment – accounted for using the equity method		23 (e)	**107**	**45**
Investment – others				
R&D Syndicate deposits – under contract		20, 25	**–**	**27 008**
Unlisted companies (a) – at cost				
Dunlena Pty Ltd	47.0		5	5
Gene Shears Pty Ltd	50.0		580	580
XRT Limited	26.1		1 290	1 290
Ceramic Fuel Cells Ltd	14.5		1 879	1 879
Quickstep Holdings Pty Ltd	19.8		480	480
Barley Plus Pty Ltd	90.0		3 600	–
Evogenix Pty Ltd	3.2		90	–
NWIRC Pty Ltd	41.0		1 894	–
			9 818	4 234
Provision for diminution in value	1.8		(9 818)	(4 234)
			–	**–**
Unlisted subsidiary companies (b) – at cost	1.2		**–**	**–**
Listed companies (c) – at cost				
Ambri Ltd	3.8		1 597	–
Australian Magnesium Corporation Ltd	–		–	1 126
Gropep Limited	20.3		545	545
Woolstock Australia Limited	–		–	55
			2 142	1 726
Listed companies (c) – at recoverable amount				
Australian Magnesium Corporation Ltd	0.2		159	–
			2 301	**1 726**
Other unlisted companies – at cost				
Unlisted entities			**1**	**10**
Total investment – others			**2 302**	**28 744**
Investment – others are categorised as follows:				
Current			–	27 008
Non-current			2 302	1 736
			2 302	**28 744**

Note 9 Investments – *continued*

(a) Unlisted Companies

Names	Principle Activities
Dunlena Pty Ltd	A trustee company for an unincorporated joint venture to develop agricultural chemicals.
Gene Shears Pty Ltd	Conduct research projects based on the Ribozyme technology and investigate licensing and development of its commercial applications hereof.
Quickstep Holdings Pty Ltd	Development and sale of the Quickstep™ process manufacturing technology for uses with polymer composite.
XRT Limited	Identifying applications for phase contrast imaging technology and completing the first concept development prototype of an ultramicroscope. Previously called X-Ray Technologies Pty Ltd.
Ceramic Fuel Cells Ltd	Research and development of fuel cell technologies and analysing their market application opportunities.
Barley Plus Pty Ltd	Developing value added foods utilising a new cereal with nutritional and functional characteristics.
Evogenix Pty Ltd	Develop technologies for the production of high affinity targeting reagents for the diagnosis and treatment of diseases.
NWIRC Pty Ltd	Research and development in the Australian grape and wine industry.

(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 5 Pty Ltd
Exsynd 2 Pty Ltd	Exsynd 6 Pty Ltd
Exsynd 3 Pty Ltd	Exsynd 7 Pty Ltd
Exsynd 4 Pty Ltd	

(b) Subsidiary Companies – Fully Owned – *continued*

(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:

	2002 $	2001 $
Aries Information Services Pty Ltd	2	2
CSIRO Bioinformatics Pty Ltd	12	12
Goldwood Holdings Pty Ltd	2	2
ATM Casting Technologies Pty Ltd	12	12
Polymer Surface Technology Pty Ltd	12	–
Entocosm Pty Ltd	–	–
	40	28
Provision for diminution in value	(40)	(28)
	–	**–**

(c) Listed Companies

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

	2002 $'000	2001 $'000
Ambri Ltd	1 769	–
Australian Magnesium Corporation Ltd	148	671
Gropep Limited	6 600	24 904
Woolstock Australia Limited	–	54
	8 517	**25 629**

Note 10 Land and buildings

	2002 $'000	2001 $'000
Land		
At cost	–	1 238
At June 1999 valuation	–	109 070
At July 2000 valuation	–	45 383
At June 2002 valuation	140 280	–
	140 280	**155 691**
Buildings		
At cost	–	23 861
At June 1999 gross valuation	–	1 044 711
At July 2000 gross valuation	–	43 195
At June 2002 gross valuation	1 273 495	–
	1 273 495	1 111 767
Accumulated depreciation	(731 119)	(548 649)
	542 376	563 118
Capital works in progress – at cost	50 830	27 173
	593 206	**590 291**
Leasehold improvements		
At cost	–	3 227
At June 1999 gross valuation	–	65 815
At June 2002 gross valuation	83 362	–
	83 362	69 042
Accumulated amortisation	(42 982)	(31 149)
	40 380	**37 893**
Buildings under finance lease		
At cost	–	22 524
At June 1999 gross valuation	–	20 827
At June 2002 gross valuation	71 536	–
	71 536	43 351
Accumulated amortisation	(11 296)	(4 795)
	60 240	**38 556**
Total land and buildings	**834 106**	**822 431**

Note 11 Plant and equipment

	2002 $'000	2001 $'000
Plant and equipment		
At cost	48 962	112 081
At July 1998 gross valuation	–	439 991
At July 2001 gross valuation	515 810	–
	564 772	552 072
Accumulated depreciation	(346 137)	(343 761)
	218 635	**208 311**
Research vessels		
At cost	160	670
At July 1998 gross valuation	–	46 093
At July 2001 gross valuation	12 855	–
	13 015	46 763
Accumulated depreciation	(1 738)	(25 822)
	11 277	**20 941**
Plant and equipment under finance lease		
At cost	3 349	5 108
At July 1998 gross valuation	–	100
At July 2001 gross valuation	4 994	–
	8 343	5 208
Accumulated amortisation	(1 586)	(921)
	6 757	**4 287**
Total plant and equipment	**236 669**	**233 539**

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

Movement summary 2001/2002 for all assets irrespective of valuation basis

Description	Land $'000	Buildings $'000	Total Land and Buildings $'000	Plant and Equipment $'000	Intangibles (Note 13) $'000	Total $'000
Gross value as at 1.7.01	155 691	1 251 333	1 407 024	604 043	15 480	2 026 547
Additions	2 345	74 693	77 038	40 802	–	117 840
Revaluations increase/(decrease)	15 598	188 616	204 214	(28 732)	–	175 482
Disposals	(33 354)	(35 419)	(68 773)	(29 754)	–	(98 527)
Write-offs	–	–	–	(229)	–	(229)
Gross value as at 30.6.02	**140 280**	**1 479 223**	**1 619 503**	**586 130**	**15 480**	**2 221 113**
Accumulated depreciation/ amortisation as at 1.7.01	–	584 593	584 593	370 504	10 486	965 583
Depreciation/amortisation	–	35 465	35 465	40 538	1 332	77 335
Revaluations increase/(decrease)	–	172 851	172 851	(34 674)	–	138 177
Adjustment for disposals	–	(7 512)	(7 512)	(26 796)	–	(34 308)
Write-offs	–	–	–	(111)	–	(111)
Accumulated depreciation/ amortisation as at 30.6.02	**–**	**785 397**	**785 397`**	**349 461**	**11 818**	**1 146 676**
Net book value as at 30.6.02	**140 280**	**693 826**	**834 106**	**236 669**	**3 662**	**1 074 437**
Net book value as at 30.6.01	**155 691**	**666 740**	**822 431**	**233 539**	**4 994**	**1 060 964**

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

Description	Land $'000	Buildings $'000	Plant and Equipment $'000	Intangibles $'000	Total 2002 $'000	Total 2001 $'000
Freehold	96 030	587 535	–	–	683 565	544 438
Commonwealth Crown Leases	4 150	178 874	–	–	183 024	150 258
Leasehold	–	79 308	–	–	79 308	69 042
National Facilities	9 000	465 087	206 599	–	680 686	680 553
Finance leases	5 000	71 536	8 343	–	84 879	53 059
Designated for sale	26 100	46 052	–	–	72 152	88 578
Capital works in progress	–	50 831	–	–	50 831	27 173
	140 280	1 479 223	214 942	–	1 834 445	1 613 101
Plant and equipment	–	–	371 188	–	371 188	397 966
Intangibles	–	–	–	15 480	15 480	15 480
Gross value	140 280	1 479 223	586 130	15 480	2 221 113	2 026 547
Accumulated depreciation/amortisation	–	(785 397)	(349 461)	(11 818)	(1 146 676)	(965 583)
Net book value as at 30 June	**140 280**	**693 826**	**236 669**	**3 662**	**1 074 437**	**1 060 964**

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.
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	**9 000**	**–**	**–**	**–**	**9 000**
Buildings	465 087	–	–	–	465 087
Accumulated depreciation	(232 651)	–	–	–	(232 651)
	232 436	**–**	**–**	**–**	**232 436**
Plant and equipment	9 096	175 389	5 856	16 258	206 599
Accumulated depreciation	(6 694)	(98 647)	(1 194)	(8 675)	(115 210)
	2 402	**76 742**	**4 662**	**7 583**	**91 389**
Net book value as at 30.6.02	**243 838**	**76 742**	**4 662**	**7 583**	**332 825**
Net book value as at 30.6.01	**231 600**	**68 879**	**10 971**	**7 105**	**318 555**

The operating expenses for the above National Facilities for the financial year amounting to $68 445 952 (2001 $51 335 089) are included in CSIRO's Statement of Financial Performance. NML's operating expenses include the costs of leasing buildings from CSIRO.

Note 12 Inventories held for resale

	Notes	2002 $'000	2001 $'000
Books and media products – at lower of cost and net realisable value	1.14	**790**	**896**

Note 13 Intangibles

Computer software	1.7		
At cost		15 480	15 480
Accumulated amortisation		(11 818)	(10 486)
Total intangibles – net book value		**3 662**	**4 994**

Note 14 Other non-financial assets

Contract research work in progress – at cost	1.3	20 995	19 272
Prepaid property rentals		1 475	1 611
Other prepayments		374	461
Total other non-financial assets		**22 844**	**21 344**

Note 15 Commonwealth and Queensland Governments/CSIRO/AMC Agreements

(a) Loans – non-current

Payable to the Commonwealth Government (interest bearing)		52 800	–
Payable to the Queensland Government (non interest bearing)	20	5 000	–
Total loans		**57 800**	**–**

(a) Loans – non-current – *continued*

In 1992 the Commonwealth and Queensland Governments provided $20m and $5m respectively of non-recourse loans to CSIRO for it to contribute to a program to demonstrate the commercial feasibility of producing magnesium from magnesite in Australia. The initial program was conducted for CSIRO by a consortium comprising Mount Isa Mines Limited (MIM), Queensland Metals Corporation Limited (QMC) and UBE Magnesium (Australia) Pty Limited (UBE). MIM and UBE withdrew from the consortium and QMC (now Australian Magnesium Corporation Limited (AMC)) and CSIRO each assumed a 50/50 joint interest in the AM Process technology. The Commonwealth Government loan of $20m is repayable in real terms (CPI adjusted) and the Queensland Government loan of $5m (Note 20) is interest free. CSIRO expects to receive monies from AMC (see Note 15 (b)) to repay the loans to the Commonwealth and Queensland Governments. These loans were not recognised as a liability by CSIRO in prior years as the decision on the construction of commercial production facilities by AMC had not occurred.

In 2001 the Commonwealth Government provided an additional non recourse loan of $50m to CSIRO to facilitate the commercialisation of the new magnesium production technology by AMC. The $50m loan will incur a commercial interest rate during the term of the loan. As at 30 June 2002, $32.8m has been drawn down by CSIRO and the balance of $17.2m will be drawn down in 2002/2003.

As at 30 June 2002 CSIRO has recognised $57.8m as a loan liability. The $57.8m loan liability will be increased to $75m when the balance of the $17.2m is drawn down in 2002/2003.

During the pre commercial phase of the project, CSIRO has not recognised its liability for interest on the Commonwealth Government loans. Interest amounting to $5.74m on the Commonwealth loan of $52.8m as at 30 June 2002, has been disclosed as a contingent liability and therefore has not been recognised in the Statement of Financial Position and Statement of Financial Performance as at 30 June 2002.

To the extent that future royalties exceed the total Government loans plus accrued interest they will be accounted as revenue to CSIRO and interest expense.

		Notes	2002 $'000	2001 $'000
(b)	**Receivable from AMC – non-current**	8	**57 800**	**–**

The agreement with AMC provides that AMC will 'cause to be paid to CSIRO' a minimum payment of $75m and on this basis CSIRO expects to receive a minimum payment of $75m.

Based on payments made to AMC as at 30 June 2002, CSIRO has recognised $57.8m as a receivable. The receivable will be increased to $75m when the balance of $17.2m is paid to AMC in 2002/2003. The recoverability of this amount will be reviewed annually.

Note 16 Leases

	Notes	2002 $'000	2001 $'000
Finance lease liability is payable as follows:			
Within one year		5 452	4 380
In one to five years		18 431	15 365
In more than five years		48 130	30 313
Minimum lease payments		72 013	50 058
Future finance charges		(10 184)	(6 824)
Total finance lease liability		**61 829**	**43 234**
Lease liability is categorised as follows:			
Current		4 149	3 426
Non-Current		57 680	39 808
		61 829	**43 234**

Note 17 Deposits

Trust monies	**36 495**	**8 477**
Represents monies held in trust for:		
Cescade Pty Ltd	20 401	–
Cooperative Research Centres	8 656	4 263
National Aeronautical Space Agency (NASA)	1 285	3 000
Department of Communications, Information Technology and Arts	4 961	–
The Australian National Wildlife Collection Foundation	353	303
Others	839	911
	36 495	**8 477**

Note 18 Employees

	Notes	2002 $'000	2001 $'000
Accrued wages and salaries		12 495	10 808
Provision for recreation leave		53 248	49 222
Provision for long service leave		103 435	97 283
Provision for severance pay		4 432	3 721
Provision for redundancy		4 873	9 014
Total employee entitlement liability		**178 483**	**170 048**
Employees entitlement liability is categorised as follows:			
Current		59 216	53 980
Non-current		119 267	116 068
		178 483	**170 048**

Note 19 Suppliers

Trade creditors		**29 777**	**23 911**

Note 20 Other liabilities

Contract research revenue received in advance		39 199	39 536
R&D Syndicates – under contract	9, 25	–	27 008
Other creditors		6 058	9 336
Provisions – for clean up and others		2 000	3 740
GST payable		–	7 874
Loan payable to the Queensland Government	15 (a)	5 000	–
Total other liabilities		**52 257**	**87 494**
Other liabilities are categorised as follows:			
Current		47 257	87 494
Non-current		5 000	–
		52 257	**87 494**

Note 21 Equity – movement summary 2001/2002

Description	Accumulated Surplus		Asset Revaluation Reserve		Total Equity	
	2002 $'000	2001 $'000	2002 $'000	2001 $'000	2002 $'000	2001 $'000
Balance as at 1July	491 516	555 044	443 946	397 824	935 462	952 868
Operating surplus	149 891	100 999	–	–	149 891	100 999
Equity repayment (a)	(49 604)	(59 591)	–	–	(49 604)	(59 591)
Capital use charge (Note 1.16)	(100 778)	(104 936)	–	–	(100 778)	(104 936)
Net revaluation increase (b)	–	–	37 305	46 122	37 305	46 122
Balance as at 30 June	**491 025**	**491 516**	**481 251**	**443 946**	**972 276**	**935 462**

(a) 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 between 2000 and 2003. CSIRO has made 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. Three properties (ie Campbell, Gungahlin and Yarralumla) in ACT were sold and the gross proceeds of $49 604 275 was paid to the Government in June 2002. The Government has now decided that the remaining properties will not be sold.

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

(b) Asset revaluation reserve

	2002 $'000	2001 $'000
The net revaluation increase in the asset revaluation reserve comprises:		
Net revaluation increase/(decrease) in property, plant and equipment:		
– land	15 598	55 369
– buildings and leasehold improvements	15 765	(9 247)
– plant and equipment	5 942	–
Total net revaluation increase	**37 305**	**46 122**

Note 22 Statement of cash flows reconciliation

		Notes	2002 $'000	2001 $'000
(a)	**For the purpose of the Statement of Cash Flows, cash is represented by:**			
	Cash at bank and on hand	7	23 429	51 804
	Deposits – at call	7	124 960	57 909
	R&D Syndicate deposits – under contract	9, 25	–	27 008
			148 389	**136 721**
(b)	**Reconciliation of operating surplus to net cash provided by operating activities**			
	Operating surplus		**149 891**	**100 999**
	Depreciation and amortisation of property, plant and equipment	6	76 003	76 372
	Amortisation of intangibles	6	1 331	1 331
	Increase/(decrease) in provision for diminution in value	9	5 584	(1 000)
	Increase/(decrease) write down to recoverable amount	9	967	–
	(Profit)/loss on disposal of property, plant and equipment	5	(20 016)	(11 236)
	(Profit)/loss on disposal of shares	5	(1 598)	998
	(Increase)/decrease in receivables	8	(8 980)	(9 033)
	(Increase)/decrease in inventories	12	106	(151)
	(Increase)/decrease in investment in joint venture, FSA	23	(62)	(361)
	(Increase)/decrease in other assets	14	(1 500)	(2 068)
	Increase/(decrease) in employee liabilities	18	8 435	15 442
	Increase/(decrease) in liability to suppliers	19	5 866	(4 388)
	Increase/(decrease) in other liabilities	20	(5 355)	14 692
	Increase/(decrease) in GST liability	8, 20	(9 335)	7 533
	Increase/(decrease) in trust monies liability	17	28 018	(987)
	Net cash provided by operating activities		**229 355**	**188 143**

Note 23 Joint ventures

CSIRO participates in a number of joint ventures. In accordance with AASB 1006, 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.

CSIRO has interests in 4 incorporated CRCs. While they are joint venture entities the equity method to account for its interest in CRC has not been applied as they are not considered material and they have been accounted for as joint venture operations. Should CSIRO's interest in these incorporated CRCs become material and are commercially successful in their research and development and intellectual property, the equity accounting method will be adopted.

During the financial year, CSIRO's total actual 'in kind' and cash contributions to CRCs from its own resources was $44.8 million; together with monies from the Commonwealth Government and external sources specifically for the CRCs, the total expended was $72.0 million. CSIRO's contributions and expenses are included in the Statement of Financial Performance. CSIRO's total actual contributions to date for CRCs listed below amounted to $314.7 million. As the success of CRCs is dependent on uncertain R&D outcomes, the value of CSIRO's contributions does not necessarily represent equity value.

Approximately $26 million or 11% of CSIRO's total plant and equipment assets are used for CRC activities.

At 30 June 2002, CSIRO is a participant in 46 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	
Australian Cotton	26
Australian Sheep Industry	34
Cattle and Beef Quality	29
Innovative Dairy Products	7
Sustainable Aquaculture of Finfish	14
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
Australian Weed Management	18
Biological Control of Pest Animals	57
Catchment Hydrology	29

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

Names of Cooperative Research Centres	CSIRO's Equity Interest (%) (excluding Commonwealth contributions)
Coastal Zone, Estuary and Waterway Management	27
Freshwater Ecology	9
Greenhouse Accounting	16
Plant-based Management of Dryland Salinity	7
Tropical Rainforest Ecology and Management	37
Tropical Savannas Management	19
Waste Management and Pollution Control	8
Water Quality and Treatment	13
Information and communication technology	
Australian Telecommunications	4
Enterprise Distributed Systems Technology	21
Satellite Systems	25
Manufacturing technology	
Bioproducts	61
Cast Metals Manufacturing*	47
Construction Innovation	22
Functional Communication Surfaces	29
Innovative Wood Manufacturing	5
Intelligent Manufacturing Systems and Technologies*	7
International Food Manufacture and Packaging Science	11
MicroTechnology	9
Polymers*	28
Welded Structures*	14
Medical science and technology	
Cellular Growth Factors	9
Diagnostics	22
Eye Research and Technology[(a)]	21
Tissue Growth and Repair	21
Vaccine Technology	26
Mining and energy	
A J Parker CRC for Hydrometallurgy	50
Australian Petroleum[(b)]	50
Clean Power from Lignite	15
Coal in Sustainable Development	14
Landscape Environments and Mineral Exploration	28
Predictive Mineral Discovery[(c)]	16

(a) CSIRO is a participant in the CRC for Eye Research and Technology, which has a beneficial interest in Biocure Inc.

(b) CSIRO is a participant in the Australian Petroleum CRC, which has a beneficial interest in APCRC Commercial Ventures Pty Ltd.

(c) CSIRO is a participant in the CRC for Predictive Mineral Discovery, which has a beneficial interest in Ausmodel Pty Ltd.

(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 $4.4 million (2001 $8.5 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 (i.e. mainly intellectual property) in proportion to each participant's research input, initial intellectual property or cash contributions. These collaborative arrangements also share the characteristics of joint venture operations. The principal activities of these joint venture operations are scientific research and development with the ultimate aim of sharing in the output (ie intellectual property). The numbers of this type of arrangement make it impractical to list separately. CSIRO's contributions to these joint ventures are included in CSIRO's Statement of Financial Performance.

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

CSIRO's investment in FSA has been accounted for using the equity method. It 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 (unaudited) of $124 000 (2001 $722 000). 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 $62 000 (2001 $361 000).

Movements in carrying amounts of investments in joint venture entity, FSA is as follows:

	2002 $'000	2001 $'000
Carrying amount at beginning of the financial year	45	(316)
Share of FSA's net operating surplus for the year	62	361
Carrying amount at the end of the financial year	**107**	**45**

Note 24 Related entities

Biomolecular Research Institute Limited (BRI) is principally a research and development company involved in the development of pharmaceutical and biological products. It is a company limited by guarantee. CSIRO's cumulative in-kind contributions to 30 June 2002 amounted to $34.9m. During the financial year CSIRO did not provide any in-kind contributions in the form of scientific staff and research facilities to BRI. In 2000/2001 the total in-kind contributions provided was $1.4m. The contributions in accordance with formal agreements between CSIRO and BRI were accounted for as expenses in CSIRO's Statement of Financial Performance last year. As at 30 June 2002, CSIRO has a 60.2% interest in any repayments that may, under certain circumstances, be made by the company to CSIRO and Strategic Industry Research Foundation Limited (SIRF).

Note 25 Research and development syndicates

As at 30 June 2002, all investors in the R&D Syndications have exercised their put options under the R&D Syndication agreements and the R&D Syndicate deposits held under contract were paid to the investors.

Note 26 Resources made available to CSIRO and not included in the Statement of Financial Position

	Land $'000	Buildings $'000	Plant and equipment $'000	Total $'000
At valuation or cost	6 762	44 979	31 758	83 499
Accumulated depreciation	–	(24 993)	(28 951)	(53 944)
Net value as at 30.6.2002	**6 762**	**19 986**	**2 807**	**29 555**
Net value as at 30.6.2001	**12 376**	**22 140**	**3 362**	**37 878**

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 27 Monies held in trust

	2002 $'000	2001 $'000
Monies held in trust for the benefit of CSIRO which are not included in the Statement of Financial Position. They are represented by cash at bank and the following investments:		
Investments		
M F Cash Management Fund*	538	694
Potter Warburg Cash Management Ltd**	84	49
Merlyn Asset Management Pty Ltd**	743	609
Members Australia Credit Union Ltd**	425	583
Perpetual Trustees Australia Limited***	208	–
Commonwealth Bank of Australia***	–	107
	1 998	2 042
Cash at bank	464	469
Total monies held in trust as at 30 June	**2 462**	**2 511**

* Relates to the Ken and Yasuko Myer Plant Science Research Fund

** Relates to the Elwood and Hannah Zimmerman Trust Fund

*** Relates to the Sir Ian McLennan Achievement for Industry Award

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

The Ken and Yasuko Myer Plant Science Research Fund	645	779
The Elwood and Hannah Zimmerman Trust Fund	1 252	1 241
The Australian National Wildlife Collection Foundation	353	381
Sir Ian McLennan Achievement for Industry Award	212	110
Total monies held in trust as at 30 June	**2 462**	**2 511**

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.

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

Note 27 Monies held in trust – *continued*

(b) Movements of trust funds summary

	McLennan $'000	Myer $'000	Zimmerman $'000	ANWC $'000	Total 2002 $'000
Balance at 1 July	110	779	1 241	381	2 511
Receipts during year	105	86	–	–	191
Interest and dividends	7	58	11	17	93
Expenditure	(10)	(278)	–	(45)	(333)
Balance at 30 June	**212**	**645**	**1 252**	**353**	**2 462**

Note 28 Remuneration of auditors

	2002 $	2001 $
Remuneration to the Auditor-General for auditing the financial statements for the reporting period	**162 000**	**195 000**

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

Note 29 Collections

CSIRO owns several collections used for scientific research. CSIRO's collections have been established over time and cover an extensive range of evolution and change in species. The collections are irreplaceable, bear scientific and historical value and are not reliably measurable in monetary terms. Therefore, CSIRO has not recognised them as an asset in its financial statements. The 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 Sub-Antarctic Islands. It is among Australia's most diverse ichthyological collections and contains one of the largest collections of sharks, rays and deepwater fishes in the Southern Hemisphere.
- Other Collections – These include the Australian Tree Seed Collection, CSIRO's Dadswell wood collection, CSIRO collection of living microalgae, and wood-inhabiting fungi collection.

Note 30 Remuneration of Board Members

	2002 $	2001 $
Remuneration and superannuation benefits received or due and receivable by full-time and part-time Board Members were:		
Board Members' remuneration	587 362	820 502
Payments to superannuation funds for Board Members	42 171	74 263
	629 533	**894 765**

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

$			2002 Number	2001 Number
Nil	–	10 000	6	2
10 001	–	20 000	–	1
20 001	–	30 000	5	4
30 001	–	40 000	1	1
40 001	–	50 000	1	–
50 001	–	60 000	–	1
160 001	–	170 000	–	1
430 001	–	440 000	1	–
520 001	–	530 000	–	1*

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

Note 31 Meetings of Board Members and Audit Committee

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

	Board Members' Meetings		Audit Committee Meetings	
	No. eligible to attend	No. attended	No. eligible to attend	No. attended
C B Livingstone (Chairman, appointed 6/11/2001)	6	6	2	2
D C K Allen (Chairman, term ended 5/11/2001)	2	2	1	1
G G Garrett	6	6	4	4
A J Gandel (resigned 30/6/2002)	6	4	–	–
R A Higgins (resigned 24/1/2002)	3	1	–	–
D P Mercer	6	6	4	4
D F J McDonald	6	6	–	–
M J O'Kane (term ended 27/5/2002)	5	4	–	–
A E de N Rogers (term ended 27/5/2002)	5	5	4	4
V R Sara	6	4	–	–
P Shergold (appointed 14/3/2002)	2	2	–	–
E D Tweddell (appointed 26/6/2002)	–	–	–	–
P J B Duncan (appointed 26/6/2002)	–	–	–	–
S Cory (appointed 26/6/2002)	–	–	–	–

The members of the Audit Committee are Mr D P Mercer (Chairman), Mr A E de N Rogers (term ended 27/5/2002) and Ms E Alexander (independent adviser and non Board Member). Ms E Alexander attended all Audit Committee meetings held for the year.

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

Note 32 Remuneration of Officers

	2002 $	2001 $
Remuneration received or due and receivable by Officers	**6 684 312**	**6 084 192**

The number of Officers, including officers who joined CSIRO during the year, who received or were due to receive total remuneration (including payments on termination of employment) of $100 000 or more are:

$			2002 Number	2001 Number
100 001	–	110 000	1	–
110 001	–	120 000	–	1
120 001	–	130 000	–	–
140 001	–	150 000	1	–
150 001	–	160 000	1	1
160 001	–	170 000	1	1
170 001	–	180 000	–	8
180 001	–	190 000	1	7
190 001	–	200 000	5	2
200 001	–	210 000	5	–
210 001	–	220 000	4	2
220 001	–	230 000	3	–
230 001	–	240 000	–	1
240 001	–	250 000	1	1
260 001	–	270 000	–	1
270 001	–	280 000	3	1
280 001	–	290 000	1	1
290 001	–	300 000	–	1
300 001	–	310 000	2	–
430 001	–	440 000	1	–
520 001	–	530 000	–	1

The Officers' remuneration includes the Chief Executive and members of the Executive Management Council.

Note 33 Related party disclosures

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

C B Livingstone (Chairman appointed 6/11/2001)	D C K Allen (Chairman term ended 5/11/2001)
A J Gandel (resigned 30/6/2002)	G G Garrett
M J O'Kane (term ended 27/5/2002)	R Higgins (resigned 24/1/2002)
A E de N Rogers (term ended 27/5/2002)	D P Mercer
V R Sara	D F McDonald
P Shergold (appointed 14/3/2002)	E D Tweddell (appointed 26/6/2002)
P J B Duncan (appointed 26/6/2002)	S Cory (appointed 26/6/2002)

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

Board Members' interests in contracts

Since 1 July 2001 no Board Member of CSIRO has received or become entitled to receive a benefit, other than a benefit included in the aggregate amount of remuneration received or due and receivable shown in Note 30 by reason of a contract made by CSIRO with the Board Member or with a firm of which the Board Member is a member or with a company in which the Board Member has a substantial financial interest.

Other transactions of Board Members – related entities

Ms C B Livingstone is a director of Telstra Corporation Ltd, Goodman Fielder Ltd, Rural Press Ltd, the Australian Business Foundation and the Sydney Institute. She is also a member of the Advisory Board of the Department of Accounting and Finance at the Macquarie University. All contracts and transactions between these entities and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to her.

Mr R Higgins was 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 Corporation Ltd. He is a Director of Australian Prudential Regulating Authority and Chancellor of RMIT University. Orica Ltd has commercial relationships with CSIRO and RMIT University is involved in a number of Cooperative Research Centres in which CSIRO is a participant. 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.

Other transactions of Board Members – related entities – *continued*

Professor M J O'Kane was the Vice-Chancellor of the Adelaide University until August 2001. 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 was a Director of FH Faulding & Co Limited until August 2001. All contracts and transactions between these entities and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to her.

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 and transactions between these entities and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to him.

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 Cooperative Research Centres Committee and the Coordinating Committee on Science and Technology. She is also Director, APEC R&D Leaders Network Advisory Board, a member of the Rio Tinto Foundation for a Sustainable Minerals Industry Advisory Board and Vice-Chair, OECD Global Science Forum. All contracts and transactions between these entities and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to her.

Mr P J B Duncan is a director of Orica Ltd. All contracts and transactions between Orica Ltd and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to him.

Dr P Shergold is the Chief Executive Officer and Secretary of the Department of Education, Science and Training (DEST). All contracts and transactions between DEST and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to him.

Professor S Cory is Director of The Walter and Eliza Hall Institute of Medical Research and Professor of Medical Biology of the University of Melbourne. She is also a Director of Bio21 Australia Limited. She is currently a member of the Knowledge, Innovation, Science and Engineering (KISE) Council of the Victorian Government; a member of the Strategic Health Research Investment Committee of the Victorian Government; the Board of Governors, Ian Clunies Ross Memorial Foundation; the Council of the Cancer Council Victoria; the Board of Management of the CRC for Cellular Growth Factors; the Education sub-committee of the CRC for Discovery of Genes for Common Human Diseases; the Commonwealth Government's Expert Advisory Committee on National Research Priorities; and the Council of the Australian Academy of Science. All contracts and transactions between these entities and CSIRO are based on normal commercial terms and conditions, and there is no personal benefit to her.

Note 34 Average staff levels

	2002 Number	2001 Number
The average staffing levels for CSIRO during the year	**5 835**	**5 965**

Note 35 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.
Receivables for goods and services and other receivables	8	These receivables are recognised at the nominal amounts less 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.
Investments – eg. Shares	9	These are carried at cost or recoverable amounts. No dividends have been declared or paid by the investee.	
Receivables from AMC	15 (b)	Receivables from AMC are recognised at their nominal amounts.	Refer Note 15 for details of terms and conditions.

(a) Terms, conditions and accounting policies – *continued*

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	16	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 2.7% p.a. (2001 3.3%). The lease liabilities are secured by the lease assets and disclosed in Notes 10 and 11.
Trade creditors and other creditors	19 & 20	Creditors and accruals are recognised at their nominal amounts, being the amounts at which the liabilities will be settled. Liabilities are recognised to the extent that the goods or services have been received (irrespective of having been invoiced).	Settlement is usually made net 30 days.
Research revenue received in advance	20	Revenue from contract research activities is recognised when work is performed. Revenue is deferred to the extent that CSIRO has not performed its contractual obligations as at 30 June 2002.	Research revenue received in advance is not recognised as revenue until work is performed.
Deposits – trust monies	17	Trust monies are recognised at their nominal amounts.	Being monies held in trust for third parties. They are payable on demand.
Loans	15 & 20	Loans are recognised at their principal amounts. Interest expense is disclosed as a contingent liability as it accrues in the Schedule of Contingencies.	Loans from the Commonwealth and Queensland Governments are unsecured. Refer Note 15 for details of terms and conditions.

Note 35 Financial instruments – *continued*

(b) Interest rate risk

Financial Instrument	Notes	Floating Interest Rate 2002 $'000	Floating Interest Rate 2001 $'000	Fixed Interest Rate 1 year or less 2002 $'000	Fixed Interest Rate 1 year or less 2001 $'000	Fixed Interest Rate 1 to 2 years 2002 $'000	Fixed Interest Rate 1 to 2 years 2001 $'000	Fixed Interest Rate 2 to 5 years 2002 $'000	Fixed Interest Rate 2 to 5 years 2001 $'000	Fixed Interest Rate > 5 years 2002 $'000	Fixed Interest Rate > 5 years 2001 $'000	Non Interest Bearing 2002 $'000	Non Interest Bearing 2001 $'000	Total 2002 $'000	Total 2001 $'000	Weighted Average Effective Interest Rate 2002 %	Weighted Average Effective Interest Rate 2001 %
Financial assets (recognised)																	
Cash at bank and cash on hand	7	23 429	51 804											23 429	51 804	4.4	6.0
Deposits – at call	7			124 960	57 909									124 960	57 909	4.8	6.3
Receivables for goods and services	8											51 195	43 125	51 195	43 125	n/a	n/a
Receivable from AMC	8											57 800	–	57 800	–	n/a	n/a
Receivables for property sales	8											20 250	–	20 250	–	n/a	n/a
GST receivable	8											1 461	–	1 461	–	n/a	n/a
Other receivables	8											5 234	4 322	5 234	4 322	n/a	n/a
R&D Syndicate deposits	9									–	27 008			–	27 008	n/a	9.8
Investments	9											2 409	1 781	2 409	1 781	n/a	n/a
Total financial assets (recognised)		**23 429**	**51 804**	**124 960**	**57 909**	**–**	**–**	**–**	**–**	**–**	**27 008**	**138 349**	**49 228**	**286 738**	**185 949**		
Total Assets														**1 384 809**	**1 269 153**		
Financial liabilities (recognised)																	
Loans payable	15	52 800	–									5 000	–	57 800	–	4.0	n/a
Finance lease liabilities	16			19 844	–			8 178	7 053	33 807	36 181			61 829	43 234	2.7	3.3
Trade creditors	19											29 777	23 911	29 777	23 911	n/a	n/a
Research revenue received in advance	20											39 199	39 536	39 199	39 536	n/a	n/a
R&D Syndicates – under contract	20									–	27 008			–	27 008	n/a	9.8
Trust monies	17	36 495	8 477											36 495	8 477	4.4	6.0
Other creditors	20											6 058	9 336	6 058	9 336	n/a	n/a
GST payable	20											–	7 874	–	7 874	n/a	n/a
Total financial liabilities (recognised)		**89 295**	**8 477**	**19 844**	**–**	**–**	**–**	**8 178**	**7 053**	**33 807**	**63 189**	**80 034**	**80 657**	**231 158**	**159 376**		
Total liabilities														**412 533**	**333 691**		
Legal claims & bank guarantees												205	324	205	324		
Total financial liabilities (unrecognised)												**205**	**324**	**205**	**324**		

(c) Net fair values of financial assets and liabilities

	Notes	2002 Total carrying amount $'000	2002 Aggregate net fair value $'000	2001 Total carrying amount $'000	2001 Aggregate net fair value $'000
Financial assets					
Cash at bank and on hand	7	23 429	23 429	51 804	51 804
Deposits at call	7	124 960	124 960	57 909	57 909
Receivables for goods and services	8	51 195	51 195	43 125	43 125
Receivable from AMC	8	57 800	57 800	–	–
Receivables for property sales	8	20 250	20 250	–	–
GST receivable	8	1 461	1 461	–	–
Other receivables	8	5 234	5 234	4 322	4 322
R&D Syndicate deposits – under contract	9	–	–	27 008	27 008
Investments	9	2 409	8 517	1 781	25 629
		286 738	**292 846**	**185 949**	**209 797**
Financial liabilities (recognised)					
Loans payable	15	57 800	57 800	–	–
Finance lease liabilities	16	61 829	61 829	43 234	43 234
Trade creditors	19	29 777	29 777	23 911	23 911
Research revenue received in advance	20	39 199	39 199	39 536	39 536
R&D Syndicates – under contract	20	–	–	27 008	27 008
Trust monies	17	36 495	36 495	8 477	8 477
Other creditors	20	6 058	6 058	9 336	9 336
GST payable	20	–	–	7 874	7 874
		231 158	**231 158**	**159 376**	**159 376**
Financial liabilities (unrecognised)					
Legal claims & bank guarantees	Schedule of Contingencies	**205**	**205**	**324**	**324**

(c) Net fair values of financial assets and liabilities – *continued*

Financial assets

The net fair values of cash, deposits at call, receivables from AMC, for sale of properties, goods and services and other receivables 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, other creditors and trust monies are approximated by their carrying amounts.

Hedges

CSIRO has specific forward exchange contracts to sell a total of USD 3 319 110 (2001 USD 2 658 987) at an average exchange rate of USD 0.517 and JPY 5 645 000 (2001 Nil) at an exchange rate of JPY 68.2.

In addition, CSIRO has specific forward exchange contracts to buy a total of USD 1 364 504 (2001 Nil) at an average exchange rate of USD 0.526 and GBP 11 814 (2001 Nil) at an exchange rate of GBP 0.3552.

These contracts have various maturity dates after 30 June 2002.

(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.

Appendices

Appendix 1: Sector advisory committees

The Sector Advisory Committees (SACs), with members representing CSIRO's stakeholders and customers in 22 different Sectors, were established in 1995 to ensure the continuing effectiveness of CSIRO's R&D in support of each Sector.

During 2001–02, CSIRO reflected on the many valuable contributions of the SACs over the last six years and agreed to modify the overall arrangements to enable the constructive interactions between CSIRO and the SACs to increase and to take place at a higher level.

Accordingly, following a meeting with SAC Chairs in April 2002, the SACs were disbanded in June 2002 and a smaller number of Sector Advisory Councils established to cover the seven areas of agribusiness; energy and transport; health; information, communication and services; mineral resources; manufacturing, and natural resources management and environment.

Chairs have been appointed to each of the seven Councils, most of the members have been appointed and the activities of the new Councils will commence with a meeting between CSIRO management and the Council Chairs in September 2002.

Below are listed the Chairmen and members of each of the 22 SACs which provided a valuable service to CSIRO in 2001–02. Also shown are the CSIRO sector coordinators. The occupations of SAC members listed are those that applied at 14 June 2002 when the SACs were formally disbanded.

Manufacturing, Information and Service Industries

Built Environment Sector

Chairman
Mr Alan Castleman
Chairman
Australian Unity Ltd
Tel (03) 9697 0380
Email rwallace@austunity.com.au

Members
Ms Gwen Andrews
Chief Executive
Australian Greenhouse Office

Mr Brian Bayley
Managing Director
Melbourne Water Corporation

Mr Paul Blake
Executive Director
National Transport Secretariat

Mr Stephen Cantwell
Group General Manager
Network Access, QR

Mr Russell Cooper
Managing Director
SITA Australia Pty Ltd

Mr Michael Delaney
Manager
Central Engineering Services
Leighton Contractors Pty Ltd

Mr Richard Dinham
Chief Executive Officer
DesignInc Sydney Pty Ltd

Mr Karl Fender
Director
Fender Katsalidis

Mr Paul Frewer
Deputy Director
Department for Planning and Infrastructure

Mr John Murray
National Executive Director
Master Builders Australia

Mr Mark Pascoe
Manager, Water and Sewerage
Urban Management Division
Brisbane City Council

Dr Stephen van der Mye
Managing Director
National Electricity Market Management Company

Dr Chris Whitaker
Managing Director
Melbourne Port Corporation

Mr Ross Wraight
Chief Executive
Standards Australia

Sector Coordinator
Mr Larry Little
CSIRO Manufacturing & Infrastructure Technology
Tel (03) 9252 6114
Email larry.little@csiro.au

Chemicals and Plastics Sector

Chairman
Mr Alan Seale
Consultant
Tel (03) 9429 2670
Email aerseale@netspace.com.au

Members
Ms Bronwyn Capanna
Executive Director
ACSMA

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

Mr Andy Denver
President
USF Filtration & Separation Group

Dr Geraldine Elliott
Product Development Manager
Faulding Pharmaceuticals

Mr Claude Gauchat
Executive Director
AVCARE

Dr Greg Healy
International Manager
Nufarm Ltd

Mr Leo Hyde
R&D Manager
DuPont Australia Ltd

Mr Martin Jones
Chief Executive Officer
PACIA

Professor Ian Rae
History & Philosophy of Science
University of Melbourne

Dr Alan Robertson
Baker Medical Research Institute

Mr Roy Rose
General Manager Technology
Orica Australia

Dr Greg Smith
Managing Director
The IP Factory Pty Ltd

Professor John White
Research School of Chemistry
Australian National University

Sector Coordinator
Dr Greg Simpson
CSIRO Molecular Science
Tel (03) 9545 2519
Email greg.simpson@csiro.au

Information and Communication Technologies Sector

Chairman
Mr John Kranenburg
Executive Director
Fujitsu Australia Ltd
Tel (02) 9776 4751
Email john.kranenburg@fujitsu.com.au

Members
Dr Gary Anido
Head, Melbourne School Telecommunications,
Multimedia & IT
Melbourne University Private

Dr Rod Badger
Deputy Chief Executive
National Office for the Information Economy

Dr Chris Beare
Chairman & CEO
Radiata Communications Pty Ltd

Mr James Clarke
Managing Director, Australian R&D Program
Nortel Networks

Mr Rob Durie
Executive Director
Australian Information Industry Association

Mr Steve Killelea
President, Chief Executive Officer
Integrated Research Pty Ltd

Mr Ian McRae
Vice President
Cap Gemini Ernst & Young

Professor Iain Morrison
Deputy Head, Department of Information Systems
University of Melbourne

Dr Phil Robertson
Director General Manager, Solutions
Canon Information System Research Australia

Mr Silvio Salom
Managing Director
Adacel

Sector Coordinator
Dr Rhys Francis
CSIRO Mathematical & Information Sciences
Tel (03) 8341 8231
Email rhys.francis@csiro.au

Integrated Manufactured Products Sector

Chairman
Mr Robert Trenberth
Consultant
Ernst & Young
Tel (03) 9288 8252
Email robert.trenberth@ernstyoung.com.au

Members
Mr Mark Albert
Managing Director
MTM Pty Ltd

Dr Patricia Crook AO
Managing Director
Dynek Pty Ltd

Mr Graham Dawson
Director
Dawson Management Enterprises Pty Ltd

Mr Barry Murphy
General Manager, Operations
Adacel Technologies Ltd

Mr Victor Perkin
Executive Manager, Manufacturing
Capral Aluminium Limited

Dr Stuart Romm
Chief Executive
HPM Industries Pty Ltd

Mr Cec Stubbs
Company Director

Mr Ian Vaughan
Retired

Mr Garry Wall
General Manager
Department of Industry, Tourism & Resources

Ms Nicola Watkinson
Director, Office of Manufacturing
Department of State and Regional Development, Victoria

Sector Coordinator
Dr Ian Sare
CSIRO Manufacturing & Infrastructure Technology
Tel (03) 9545 2787
Email ian.sare@csiro.au

Measurement Standards Sector

Chairman
Mr Chris J Whitworth
Alstom Power Ltd
Tel (02) 8870 6077
Email chris.whitworth@power.alstrom.com

Members
Dr Stephen Andersen
Consultant
Southern Pathology

Mr Alex Baitch
Manager, Network Capability
Integral Energy

Dr Judith Bennett
Executive Officer
National Standards Commission

Mr Paul Brady
Officer in Charge
Support Equipment Logistic Management Unit
Department of Defence

Mr Tony Craven
Executive Director
JAS-ANZ

Mr Brian Frizell
Retired

Mr James Galloway
Assistant Director, Technology & Regulations
Australian Electrical & Electronic Manufacturers

Dr Sandra Hart
General Manager
Australian Government Analytical Laboratories

Mr Anthony Russell
Chief Executive Officer
National Association of Testing Authorities Australia

Mr Ross Wraight
Chief Executive
Standards Australia

Ms Janice Wykes
General Manager, Business Environment Branch
Department of Industry, Science and Resources

Sector Coordinator
Dr Barry Inglis
CSIRO Telecommunications & Industrial Physics
Tel (02) 9413 7460
Email barry.inglis@csiro.au

Pharmaceuticals and Human Health Sector

Chairman
Dr Ian Pitman
Scientific Director
FH Faulding & Co Limited
Tel (08) 8209 2675
Email ian.pitman@faulding.com.au

Member
Dr Julian Clark
Julian Clark Consulting

Sector Coordinator
Professor Richard Head
CSIRO Health Sciences & Nutrition
Tel (08) 8303 8865
Email richard.head@csiro.au

Radio Astronomy Sector

Chairman
Dr Brian Boyle
Director
Anglo-Australian Observatory
Tel (02) 9372 4812
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Appendix 2: Our research through Cooperative Research Centres (CRCs)

The Commonwealth Government sponsored Cooperative Research Centres (CRCs) Program supports collaborative research between industry, Commonwealth and State Government agencies, universities and other research providers including CSIRO.

At 30 June 2002 CSIRO was a core participant in 46 CRCs. The Organisation makes a major contribution to the Program through its experience in collaborating with industry and in applying its research management skills.

During 2001–02, CSIRO's total in-kind and cash contribution to CRCs from its own resources was $44.8 million. When combined with funding from the Commonwealth Government and external sources provided specifically for CRCs, the total expended during the financial year was $72 million.

Working in CRCs has enabled CSIRO to contribute to a range of exciting advances in research and development. Among those announced during 2001–02 were:

- commercial production and distribution of a virus test kit for Gill Associated Virus and Yellow Head Virus;
- the release of a foliage-eating beetle in Western Australia against the destructive weed bridal creeper;
- determination of the structure of an important human immune system regulator. A drug designed to inhibit this system could provide a therapeutic against rheumatoid arthritis and other inflammatory diseases; and
- development of an education software package called VineLOGIC, which centres around a simulation model of grapevine growth and development and enables the user to test a wide range of scenarios relating to vineyard management.

Full details of CRC activities are available through their annual reports and publications and from the Internet on http://www.crc.gov.au/

Cooperative Research Centres in which CSIRO was a participant at 30 June 2002

Manufacturing Technology

Bioproducts (http://www.botany.unimelb.edu.au/botanyunimelb/1pages/research/labs/crc/CRC.html)

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

Construction Innovation (http://www.construction-innovation.info)

Functional Communication Surfaces (http://crc-fcs.com)

Innovative Wood Manufacturing (http://www.crcwood.unimelb.edu.au/)

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

International Food Manufacture and Packaging Science (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

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

Coal in Sustainable Development (http://www.ccsd.biz)

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

Landscape Environments and Mineral Exploration (http://leme.anu.edu.au/)

Predictive Mineral Discovery (http://www.pmdcrc.com.au/)

Agriculture and Rural Based Manufacturing

Australian Sheep Industry (http://www.sheep.crc.org.au/)

Australian Cotton CRC (http://www.cotton.crc.org.au)

Cattle and Beef Quality (http://www.beef.crc.org.au)

Innovative Dairy Products (http://www.dairycrc.com)

Sustainable Aquaculture of Finfish

Sustainable Rice Production (http://www.ricecrc.org)

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)

Australian Weed Management (http://www.waite.adelaide.edu.au/CRCWMS/)

Biological Control of Pest Animals (http://www.pestanimal.crc.org.au)

Catchment Hydrology (http://www.catchment.crc.org.au)

Coastal Zone, Estuary and Waterway Management (http://www.coastal.crc.org.au)

Greenhouse Accounting (http://www.greenhouse.crc.org.au/)

Freshwater Ecology (http://enterprise.canberra.edu.au/WWW/www-crcfe.nsf)

Plant-Based Management of Dryland Salinity (http://www.crcsalinity.com)

Tropical Savannas Management (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/)

Medical Science and Technology

Cellular Growth Factors (http://www.ludwig.edu.au/crc-cgf)

Diagnostics (http://diagnosticscrc.org)

Eye Research and Technology (http://www.crcert.org)

Tissue Growth and Repair Vaccine Technology (http://www.crc-vt.qimr.edu.au)

Smart solutions | for clearer vision

Australian scientists have developed a permanent contact lens to improve poor vision.

The synthetic lens can be surgically implanted to provide permanent, but reversible, correction of refractive error.

The CRC for Eye Research and Technology, believes the new lens will enable some people to do away with the need to wear glasses.

The synthetic material used in the design of this lens has been developed by CSIRO Molecular Science, a participant in the CRC for Eye Research and Technology. The novel material is highly porous and has been especially designed to be implanted within the delicate tissue of the eye.

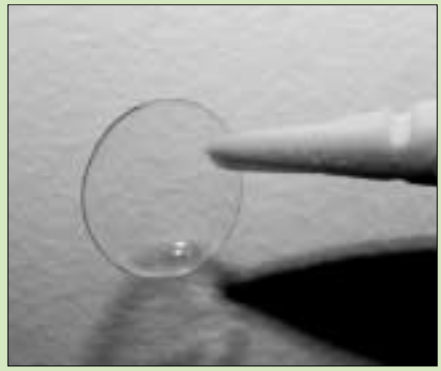

Photo: CRC for Eye Research and Technology

With almost two thirds of the world's population requiring some form of vision correction, this research goes some way to providing an affordable, permanent solution to refractive eye disorders.

The CRC for Eye Research and Technology is hoping to attract funding to start human trials in the near future.

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