



CSIRO

CSIRO Operational Plan

1999–2000



CSIRO OPERATIONAL PLAN

1999–2000

**The Commonwealth Scientific and
Industrial Research Organisation (CSIRO)
is an independent statutory authority constituted
and operating under the provisions of the
*Science and Industry Research Act 1949.***

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Foreword

In recent months the CSIRO Executive has engaged in a highly productive series of discussions with the Sector Advisory Committees (SACs) and CSIRO staff as part of the process of setting strategic directions for our research in the early years of the new millennium. These discussions have revealed:

- the immense value for CSIRO in having access to the diverse expertise of SAC members to enrich our priority setting process;
- the great maturing in the relationship between CSIRO and the SACs since they were established three years ago;
- the very considerable progress which has already been made in refocussing of effort within a number of Sector portfolios and the work which remains to be done in some;
- the extent to which exciting demand-driven opportunities for CSIRO's research expertise swamp our capacity to deliver given our current level of resources; and
- an increasing diversity of clients and research collaborators, stretching our business development skills as we work with them to develop mutually beneficial long-term relationships.

Despite CSIRO's long record of excellence and achievement—which has led to extremely high levels of public recognition and support—we cannot afford to be complacent. We can justly claim to be Australia's premier science and technology organisation—but we risk being taken for granted if we do not continue to devote all our energies to identifying, developing, delivering and communicating the economic, social and environmental benefits that our R&D brings for Australia.

This Operational Plan presents an overview of the way in which CSIRO's Divisions and Corporate units are working towards that end. It provides a picture of the diverse activities and achievements to be pursued in 1999–2000, which is the final year of the current funding triennium.



Malcolm McIntosh
Chief Executive
June 1999

Organisational Chart*

iv

CSIRO BOARD				
Mr D Charles K Allen (Chairman)				
Dr MK McIntosh Mr J Gandel Prof VR Sara	Mr DP Mercer Mr RA Higgins Mr DFJ McDonald	Mr AE de N Rogers Prof MJ O'Kane		
CSIRO EXECUTIVE				
Dr Malcolm McIntosh Chief Executive	Dr Colin Adam Deputy Chief Executive	Dr Ron Sandland Deputy Chief Executive	Dr Chris Mallett Deputy Chief Executive	Dr Paul Wellings Deputy Chief Executive
CSIRO DIVISIONS AND CORPORATE UNITS				
Corporate Executive Office <i>Corporate Secretary:</i> <i>Dr Ted Cain</i>	Building Construction and Engineering <i>Chief: Mr Larry Little</i> Energy Technology <i>Chief: Dr John Wright</i> Exploration and Mining <i>Chief: Dr Bruce Hobbs</i> Minerals <i>Chief: Dr Rod Hill</i> Petroleum Resources <i>Chief: Dr Adrian Williams</i>	Australia Telescope National Facility <i>Director: Prof Ron Ekers</i> Health Sciences and Nutrition <i>Chief: Prof Richard Head</i> Manufacturing Science and Technology <i>Chief: Dr Ian Sare</i> Mathematical and Information Sciences <i>A/Chief: Dr Murray Cameron</i> Molecular Science <i>Chief: Dr Annabelle Duncan</i> Telecommunications and Industrial Physics <i>Chief: Dr Dennis Cooper</i>	Animal Health <i>Chief: Dr Mike Rickard</i> Animal Production <i>Chief: Dr Oliver Mayo</i> Food Science Australia <i>Chief Executive: Dr Michael Eyles</i> Plant Industry <i>Chief: Dr Jim Peacock</i> Tropical Agriculture <i>Chief: Dr Elizabeth Heij</i> Textile and Fibre Technology <i>Chief: Dr Brett Bateup</i>	Atmospheric Research <i>Chief: Dr Graeme Pearman</i> Entomology <i>Chief: Dr Jim Cullen</i> Forestry and Forest Products <i>Chief: Dr Glen Kile</i> Land and Water <i>Chief: Dr Graham Harris</i> Marine Research <i>Chief: Dr Nan Bray</i> Wildlife and Ecology <i>Chief: Dr Brian Walker</i>
Alliance responsibility:	Minerals and Energy	Information, Manufacturing and Service Industries	Agribusiness	Environment and Natural Resources
Corporate responsibility:	CSIRO Publishing <i>General Manager: Mr Paul Reekie</i> Legal and Commercial Networks <i>Chair: Dr Colin Adam</i>	Information Technology Services <i>General Manager: Mr Jonathan Potter</i> Corporate Property <i>General Manager: Mr George Harley</i>	Corporate Human Resources <i>General Manager: Mr Peter O'Keefe</i> Leadership, Career and Team Development <i>General Manager: Mr Bob Marshall</i>	Corporate Finance <i>General Manager: Mr Bob Garrett</i> Strategic Planning and Evaluation <i>General Manager: Dr Andrew Pik</i>

*as at 16 July 1999. Divisions and Corporate Units are shown below the Executive member responsible for oversight of their performance

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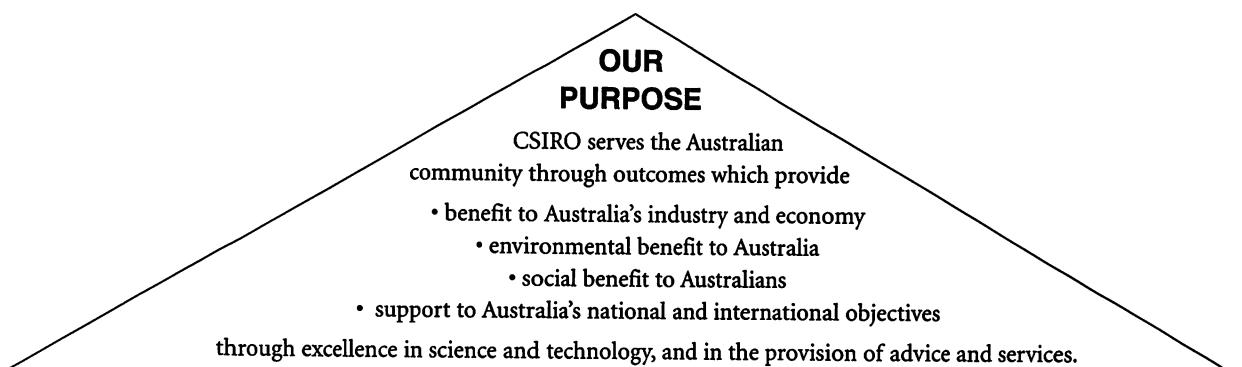
On 5 July 1999, the Chief Executive, Dr Malcolm McIntosh, announced a restructuring of CSIRO's activities in molecular biology and human health:

- Dr Annabelle Duncan as Chief of a modified Division of Molecular Science comprising the Clayton and North Ryde sites of Molecular Science
- Dr Richard Head as Chief of a new Division of Health Sciences and Nutrition bringing together the Parkville site of Molecular Science and the Division of Human Nutrition.

The Operational Plan entries for Human Nutrition and Molecular Science reflect the situation prior to these changes.

Corporate Overview

PURPOSE, VISION, VALUES AND OPERATING PRINCIPLES



Satisfied customers and supportive stakeholders through application of our research	CSIRO—Unity of purpose, diversity of means	Top people, top performance, integrity, trust and respect	First class science—because it helps Australia
OPERATING PRINCIPLES			
<ul style="list-style-type: none">• We determine our research and commercialisation priorities by assessing the needs of, and potential benefit to, our customers, based on an understanding of their business and the world markets in which they operate.• We contribute our expertise to the development of science and technology policy and priorities in Australia.• We commit ourselves to excellence in technology transfer to ensure timely exploitation of research results.• We provide quality advice and service.• We deliver our research and services on time, within budget and in accordance with legal contractual and ethical obligations.	<ul style="list-style-type: none">• We determine priorities and implementation strategies at all levels of the corporation by a systematic process.• We apply the highest standards of management practice in all our operations. We pay particular attention to excellence in project management. We foster a culture of teamwork.• We evaluate all of our activities, working towards the world's best practice in quality and productivity.• We accept accountability for our decisions on the use of CSIRO's resources and take pride in our achievements for Australia.• We use lessons from our own and others' practices and experience to improve our performance continually.	<p>We work together to create an organisation that:</p> <ul style="list-style-type: none">• Seeks to recruit the best and the brightest, provides a stimulating environment to encourage individuals to develop their full potential and provides career opportunities which make CSIRO an attractive development base for future industry leaders.• Fosters adaptability and recognises exceptional performance with appropriate rewards.• Cares for the safety and well being of all employees with employment policies to support corporate goals.• Fosters creativity which underpins our performance and delivery.• Draws upon the breadth and depth of our skills to assemble excellent teams to tackle major challenges, and uses networks of special skills inside and outside CSIRO.• Respects the unique skills, professionalism and knowledge of all our employees, and recognises that we are responsible for creating and maintaining our reputation.	<ul style="list-style-type: none">• We maintain a world standard of scientific and engineering excellence in order to deliver agreed outcomes to our customers in industry, government and the community, on time and within budget.• The quality of our scientific research enhances Australia's international standing.• We work with Australia's education and training organisations to increase awareness of science and technology, and to enhance the supply of excellent graduates into the scientific and technical workforce.

Corporate Overview

STRATEGIES

CSIRO conducts scientific research to assist Australian industry, further the interests of the Australian community and contribute to the achievement of Australian national objectives. Related primary functions are to encourage or facilitate the utilisation of research results, and to provide services and facilities in relation to science.

As the framework for planning and marketing its research, services and facilities, CSIRO has identified 22 Sectors representative of industries, natural resources and markets of national significance. The conduct and delivery of research is undertaken by CSIRO's Divisions in accordance with Sector Plans which are developed with the assistance of external Sector Advisory Committees. These Committees play an important role in helping CSIRO to identify those points at which CSIRO research can make the greatest contribution to the Sectors. Planning in this way emphasises our focus on identifying and serving the needs of the Australian community. Individual plans for each Sector form the basis of the CSIRO Strategic Research Plan for the current triennium: 1997–98 to 1999–2000.

CSIRO's Divisions are the focus of the Organisation's disciplinary skills base and the key business or operating units of CSIRO through which the Strategic Plan is put into effect. For this reason the CSIRO Operational Plan is presented on a Divisional basis.

CSIRO's strategies for the triennium are reflected in seven themes summarised below. Each of these is discussed in more detail in the CSIRO Strategic Research Plan 1997–98 to 1999–2000.

[1] Focus on real needs and realistic commitments

In planning for the triennium, a review of CSIRO's activities and opportunities highlighted CSIRO's impressive array of scientific achievements and diverse contributions to the nation, but raised the concern that resources in some areas may have been spread too thinly. Hence, a primary strategy for CSIRO is to focus increasingly on those research opportunities that are relevant to real economic, social or environmental needs, where CSIRO has an appropriate role and capability, and where there are firm signals of external support for CSIRO's involvement.

[2] Working with customers

To be truly successful in assisting industry and furthering community interests, CSIRO's efforts must not only focus on relevant research issues, they must also be grounded in a capacity to listen to, and work with, the stakeholders and customers for whom research is being conducted. To foster the efficient delivery and effective application of new knowledge and improved technologies, CSIRO will continue to upgrade its commercial and technology transfer practices, and will adopt flexible and responsive modes of working with customers.

[3] Encouraging teamwork and collaboration

CSIRO's core strength, which sets it apart from other research agencies, is the capacity to assemble and manage teams of highly skilled professionals from a very wide range of disciplines. The move to Sector-based operations and recent Divisional amalgamations opens the door to fresh opportunities for interdisciplinary collaboration. Where there are complementary roles and expertise, CSIRO will also seek to expand collaboration with other research performers and technology transfer services in both the public and private sectors.

[4] Achieving a balanced research portfolio

CSIRO requires a balanced portfolio of research based on short, medium and longer term needs. Research timescales oblige us to look beyond the lifetime of individual governments and the investment cycle of many businesses. To remain vital and relevant to emerging challenges, our interactions with customers and stakeholders must raise mutual awareness of what strategic research is needed to underpin future advances and what is needed to address immediate concerns.

[5] The pursuit of excellence: quality people—quality processes—quality outcomes

CSIRO has a reputation for excellence in research and development. This commitment to excellence will be applied in every aspect of our endeavours including staff training and development, research management, administrative support, customer relations, marketing and commercialisation. The Sector Plans reinforce this strategy by explicitly addressing these aspects as well as specific research objectives.

[6] Enhancing communication

Effective internal communication is essential if the positive benefits of change within CSIRO are to be maximised. Line managers will be assisted to develop the necessary skills and held accountable accordingly. Effective external communication is also essential in building and maintaining CSIRO's profile and reputation amongst our stakeholders and customers—particularly potential future customers. CSIRO's National Awareness Program will complement the continuing efforts of staff at all levels to promote awareness of the importance of science, and of CSIRO's contribution to the nation.

[7] Fiscal responsibility

A very high priority is being placed on securing and maintaining the financial health of all Divisions, and on the maintenance of high standards of fiscal management and accountability.

OUTLOOK FOR 1999–2000

Having successfully established the operation of Sector Advisory Committees and the newly merged Divisions in the first two years of the current triennium, the CSIRO Executive anticipates a highly productive year of achievement in 1999–2000. In addition to the Division-based information on planned achievements recorded in this Operational Plan, the May 1999 Portfolio Budget Statement for the Industry, Science and Resources Portfolio contains a selection of anticipated CSIRO research outputs for 1999–2000—and the outcomes to which they will contribute—classified by Sector.

During the past year, the Sector Advisory Committees have been actively involved with CSIRO in contributing to a mid-triennium review of performance and the identification of research priorities for the following triennium. Government Departments also provided advice on major policy trends and needs at a workshop in December 1998. Determination of Divisional responses to Sector priorities, including the preparation of new Sector Plans and a new CSIRO Strategic Research Plan, will be major activities during 1999–2000. A follow-up workshop with Government Departments will be held when the plan is close to completion in early 2000.

The eight 'Executive's Special Projects' selected late in 1997 are now well established and expected to make significant progress during the year. A number of new projects, addressing issues of national importance identified during the recent priority setting process, may be initiated prior to commencement of the next triennium. The current projects are:

- Towards sustainable energy;
- Low emission transportation technologies;
- Advanced mm-wave integrated circuits for radio astronomy and telecommunications;
- Sustainable urban water systems;
- Novel technologies for feral animal control;
- Genomics and gene discovery;
- Bioinformatics initiative;
- Bioactive molecules initiative.

The Government has foreshadowed an 'innovation summit and statement' in early 2000. CSIRO will play an active role in the organisation of the summit and in preparation of the statement.

CSIRO will also contribute to a number of parliamentary and government initiated inquiries, including the Wool Industry Task Force Review and the House of Representatives Committee Inquiry into Increasing Value-Adding to Australia's Raw Materials.

Three particular issues which CSIRO anticipates to be at the forefront of national debate in the coming year—and to which CSIRO expects to make a major science-based contribution are:

- gene technology / biotechnology and related consumer issues and ecological safety;
- sustainability and remediation of land and water resources;
- understanding and management of Australia's extensive marine resources.

During the year, CSIRO will monitor changes in economic conditions and in government policies and programs in support of R&D. The response by the business sector to such changes can have a significant impact on CSIRO's external earnings performance either across-the-board or in particular Sectors. The Government expects CSIRO to earn 30 per cent of its total revenue externally.

Efforts to continue upgrading CSIRO's commercial and business development skills will continue, including ongoing revision of the CSIRO Commercial Practice Manual.

The new CSIRO Enterprise Agreement (1998) entails certain commitments which will be pursued during the year, in particular a major review of salary and classification and performance management systems.

Further strengthening of national research infrastructure will arise from further substantial progress toward:

- completing the successful development of the Riverside Corporate Park at North Ryde in Sydney;
- rationalisation and co-location of CSIRO, Queensland Government and Queensland University animal and plant research facilities in southern Queensland;
- development in Perth of a centre of excellence for research for the petroleum and minerals industries in cooperation with the Government of Western Australia and local universities.

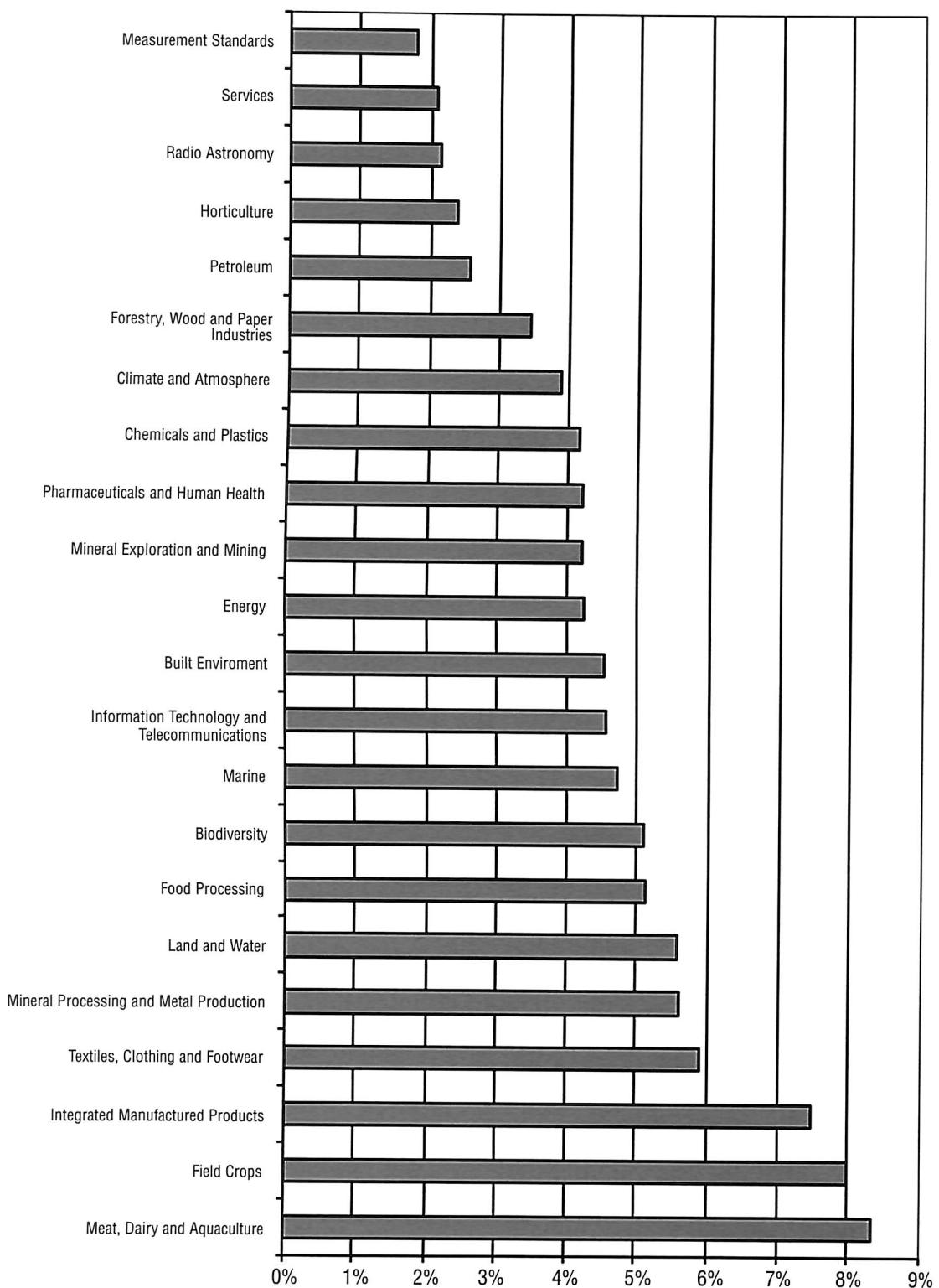
Corporate Overview

FINANCIAL RESOURCES (\$m) and STAFF NUMBERS (FTEs) by DIVISION*

DIVISION	Revenue					Operating Result	Cash Balance ²	Capital Expenditure	Research Staff ³	Total Staff ⁴
	Total	Direct Approp	Research & Services ¹	Other						
Animal Health ⁵	21.816	11.916	9.400	0.500		0.017	0.361	0.700	120	223
Animal Production	20.847	15.480	5.080	0.287		0.245	-2.271	0.900	150	203
Atmospheric Research	14.245	9.716	4.517	0.012		-0.566	0.690	0.566	92	125
Australia Telescope National Facility ⁶	14.792	12.075	2.297	0.420		-0.265	3.657	2.602	65	133
Building Construction and Engineering	29.184	19.984	9.200	0.000		0.272	0.645	2.200	172	240
Energy Technology	22.046	14.771	7.200	0.075		0.119	0.504	1.690	111	167
Entomology	30.425	16.220	14.029	0.176		-0.223	0.049	1.167	227	296
Exploration and Mining	31.419	17.513	13.905	0.000		-0.335	0.077	1.662	168	264
Food Science Australia ⁷	29.629	14.329	15.300	0.000		0.000	2.434	0.000	142	206
Forestry and Forest Products	27.915	18.237	9.677	0.000		0.175	2.775	1.200	188	256
Human Nutrition	9.500	6.540	2.905	0.055		0.075	1.535	0.300	70	89
Land and Water	45.594	30.074	15.100	0.420		0.308	4.830	2.600	305	451
Manufacturing Science and Technology	45.958	27.916	18.045	-0.003		-0.940	-0.143	2.675	248	329
Marine Research	33.608	22.029	11.479	0.100		-1.206	1.978	1.158	206	301
Mathematical and Information Sciences	32.178	22.801	9.128	0.250		-1.438	4.170	4.510	193	264
Minerals	31.795	20.795	10.775	0.225		-1.205	-0.365	2.200	201	290
Molecular Science	40.887	27.711	11.776	1.400		-1.706	1.438	0.870	277	354
Petroleum Resources	15.772	8.736	6.636	0.400		-0.081	-0.233	0.700	50	68
Plant Industry	56.268	31.586	23.862	0.820		-1.679	5.394	2.015	442	568
Research Vessel Franklin ⁶	4.643	4.463	0.150	0.030		-0.681	0.364	0.325	0	8
Telecommunications and Industrial Physics ⁸	55.750	39.750	15.700	0.300		0.149	10.373	3.500	342	465
Textile and Fibre Technology	21.823	12.523	8.900	0.400		-0.454	5.933	1.200	129	222
Tropical Agriculture	33.262	21.853	10.283	1.126		0.205	2.779	2.300	202	293
Wildlife and Ecology	22.890	15.977	6.521	0.391		0.187	3.818	0.780	129	204
Centre for Mediterranean Agric Research ⁹	0.702	0.687	0.011	0.004		-0.078	0.284	0.000	2	8
Divisional Total	692.944	443.681	241.876	7.387		-9.108	51.073	37.820	4,231	6,027
Corporate Activities¹⁰	47.819	37.517	7.927	2.375		-0.208	3.597	0.252	12	300
Discovery Centre	0.738	0.000	0.000	0.738		0.285	0.027	1.300		
Corporate Funds	10.524	9.624	0.000	0.900		10.247	-38.547	0.000		
Capital Program	-0.895	-2.321	0.000	1.427		0.400	0.000	45.800		
Capital Use Revenue ¹¹	109.039	109.039				109.039				
Operational Total	860.169	597.540	249.803	12.826		110.656	16.150	85.172	4,243	6,327

- * The footnotes to this table should also be read in conjunction with the resources summary at the end of each Divisional entry.
- Financial estimates are from 1999–2000 as at 9 June 1999. Staff numbers are as at 30 June 1999 and include indefinite and term CSIRO Officers only.
- 1. Revenue for Research and Services as defined for CSIRO's external earnings performance indicator (PI). After adjusting for the Capital Use Charge (*see note 11*), CSIRO's estimated external earnings PI ratio for 1999–2000 is 33.8%. The PI definition excludes 'Other' revenue from both numerator and denominator.
- 2. Estimated 30 June 2000 cash balance.
- 3. Includes Research Scientist/Engineer, Research Projects and Research Management functional classifications.
- 4. Includes Research Staff plus Technical Services, Communications and Information, Administrative Services, General Services, Corporate Management and Senior Specialist functional classifications.
- 5. Includes the Australian Animal Health Laboratory—a National Facility managed by CSIRO on behalf of the government.
- 6. A National Facility managed by CSIRO on behalf of the government.
- 7. Through the Division of Food Science and Technology, CSIRO has entered a joint venture (Food Science Australia) with the Australian Food Industry Science Centre (Afisc). CSIRO's direct contribution to the joint venture is \$14.3m for 1999–2000. The joint venture has planned total revenues of \$35.596m an operating result of -\$865K and closing cash balance of \$6.116m. Figures in this table represent an estimate of CSIRO's operational activities in the joint venture which differ from the legal interest.
- 8. Includes the Australian National Measurement Laboratory—a National Facility managed by CSIRO on behalf of the government.
- 9. Six CSIRO Divisions support the Centre for Mediterranean Agricultural Research.
- 10. Corporate Activities includes all the Corporate Units, CSIRO Publishing, CSIRO Executive, the LIPI Project and the Magnesium Project.
- 11. A Capital Use Charge (CUC) is part of the Government's new accrual framework. It is funded by increasing the Organisation's appropriation by 12% of the opening net asset position. This is received as part of the Organisation's appropriation during the year, and paid to the Commonwealth as a dividend in June. This causes the Organisation's operating result to appear inflated by the amount of the CUC.

PLANNED INVESTMENT PROFILE BY SECTOR



This chart shows the proportion of total CSIRO investment being directed to each of the 22 Sectors in 1999–2000. It is derived from the anticipated revenues and planned investment profiles shown in the entries for individual Divisions. These profiles reflect Divisional responses to decisions on Sector priorities made through CSIRO's strategic research planning process.

Corporate Overview

CSIRO OPERATIONS AND REPORTING



Deputy Chief Executives

DIVISIONS

DR CHRIS MALLETT

	Field Crops	Food Processing	Forestry, Wood & Paper Industries	Horticulture	Meat, Dairy & Aquaculture	Textiles, Clothing and Footwear	Biodiversity	Climate & Atmosphere	Land & Water	Marine	Built Environment	Chemicals and Plastics	Information Technology & Telecommunications	Integrated Manufactured Products	Measurement Standards	Pharmaceuticals & Human Health	Radio Astronomy	Services	Energy	Mineral Exploration and Mining	Mineral Processing & Metal Production	Petroleum	
Animal Health	●				●	●	○																
Animal Production					●	●		●		○													
Food Science Australia	●	●		●	●							●		●									
Plant Industry	●	●		●	●	●	●	●	●		○												
Textile & Fibre Technology						●																	
Tropical Agriculture	●				●		●	●	●	●	●												

DR PAUL WELLINGS

Atmospheric Research								●											○				
Entomology	●		●	●	●	●		●	○	●	●	●	●	●	●			●					
Forestry & Forest Products		●						●	●	●	●	●	●	●	●								
Land & Water	●		●	●	●			●	●	●	●	●	●	●	●				●	●	●	○	●
Marine Research					●			●	●		●												●
Wildlife & Ecology	●		●		●	●	●	●	●	●	●							○	○	●			

DR RON SANDLAND

Australia Telescope National Facility																		●					
Health Sciences and Nutrition	●	●			●													●					
Manufacturing Science & Technology												●	●	●	●		○	●	●	●	●	●	
Mathematical & Information Sciences	○	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	○
Molecular Science												●	●	●	●	●	●						○
Telecommunications & Industrial Physics						○		●		●	●	●	●	●	●	●	●	●	●	●	●	●	○

DR COLIN ADAM

Building Construction & Engineering												●	●	●									●
Energy Technology								●	●	●								●	○	●	●		
Exploration & Mining																		●	●	●			●
Minerals																		●			●	●	○
Petroleum Resources																		●					●

● and ○ indicate Sectors to which a Division plans to contribute in 1999–2000. An open circle indicates a contribution of less than \$300,000. Deputy Chief Executives' responsibilities reflect changes announced 16 July 1999.

CSIRO PARTICIPATION IN COOPERATIVE RESEARCH CENTRES

Cooperative Research Centres (CRCs) bring together researchers and research groups from universities, State government agencies, business enterprises and Commonwealth research organisations such as CSIRO.

CRCs undertake collaborative research and education programs in the fields of natural sciences and engineering, with a strong focus on commercial and other applications. The Commonwealth Government provides up to fifty per cent of the cost of establishing and operating a Centre. The participating organisations contribute the balance of required resources in cash or kind. CSIRO accounts for approximately 20 per cent of resources committed to Centres by participating organisations over the contract period.

The CRC Program was launched in May 1990 and successful applicants in the sixth round of funding were announced in April 1999. From 1 July 1999 the Program will comprise 65 Centres across six broad fields of research. CSIRO will be a core participant in the 51 Centres listed below.

Further information on the CRC Program and individual Centres can be found at the following internet address: www.disr.gov.au/crc.

Manufacturing Technology

- CRC for Bioproducts
- CRC for CAST Metals Manufacturing
- CRC for Intelligent Manufacturing Systems and Technologies
- CRC for International Food Manufacture and Packaging Science
- CRC for Microtechnology
- CRC for Molecular Engineering and Technology: Sensing and Diagnostic Technologies
- CRC for Polymers
- CRC for Welded Structures

Information and Communication Technology

- CRC for Advanced Computational Systems
- CRC for Enterprise Distributed Systems Technology
- CRC for Satellite Systems Applications
- Australian Telecommunications CRC

Mining and Energy

- A J Parker CRC for Hydrometallurgy
- Australian Geodynamics CRC
- CRC for Australian Mineral Exploration Technologies

- Australian Petroleum CRC
- CRC for Black Coal Utilisation
- CRC for Clean Production from Lignite
- G K Williams CRC for Extractive Metallurgy
- CRC for Landscape Evolution and Mineral Exploration
- CRC for Mining Technology and Equipment

Agriculture and Rural Based Manufacturing

- CRC for Aquaculture
- CRC for Australian Cotton
- CRC for Cattle and Beef Quality
- CRC for Food Industry Innovation
- CRC for Hardwood Fibre and Paper Science
- CRC for Legumes in Mediterranean Agriculture
- CRC for Premium Quality Wool
- CRC for Quality Wheat Products and Processes
- CRC for Sustainable Production Forestry
- CRC for Sustainable Rice Production
- CRC for Sustainable Sugar Production
- CRC for Tropical Plant Protection
- CRC for Viticulture

Environment

- CRC for Antarctica and the Southern Ocean
- CRC for Biological Control of Pest Animals
- CRC for Catchment Hydrology
- CRC for Coastal Zone, Estuary and Waterway Management
- CRC for Freshwater Ecology
- CRC for Southern Hemisphere Meteorology
- CRC for Sustainable Development of Tropical Savannas
- CRC for Terrestrial Carbon Accounting
- CRC for Tropical Rainforest Ecology and Management
- CRC for Waste Management and Pollution Control
- CRC for Water Quality and Treatment
- CRC for Weed Management Systems

Medical Science and Technology

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

Chief: Dr Mike Rickard

FOCUS

CSIRO Animal Health is a national centre of excellence in disease diagnosis, research and policy advice in animal health. The Division has a high level of expertise in disease diagnosis and the development of diagnostic tests; virology; development of vaccines; veterinary skills; immunology; molecular biology; bacteriology and organic chemistry, particularly as it relates to natural toxins. It is this combination of special skills in the diseases of livestock that gives the Division its national stature in providing advice to the Commonwealth and States and in research on effective products for disease treatment and prevention. The Australian Animal Health Laboratory (AAHL) facility is recognised internationally as one of the best biocontainment facilities in the world for the safe handling and containment of micro-organisms and for contained experimentation in animals.

Outlook and Strategies

As global free trade increases, the OIE (Office International des Epizooties) is developing new international standards for disease surveillance leading to an increased requirement for import and export disease testing and certification.

It is anticipated that AAHL will play a key role in the development and implementation of a national strategy by the National Office of Animal and Plant Health for the coordinated and strategic delivery of terrestrial and aquatic animal health programs in the region.

With the support of commercial partners and Australian and international collaborators, CSIRO Animal Health will continue to deliver excellent outcomes in disease diagnosis and the development of vaccines and therapeutics.

Planned Activities and Achievements

Meat, Dairy and Aquaculture

- Swift diagnosis and investigation of exotic diseases and efficient and rapid participation in the management of animal and fish disease outbreaks of national significance.
- License prototype vaccines for cattle and pigs to manufacturing partners for evaluation.
- Negotiate new research contracts for vaccine and therapeutic development for the benefit of the intensive livestock industries.
- Complete specificity trials of a Johne's Disease diagnostic assay enabling commencement of a control program.
- Demonstrate positive responses to recombinant antigens from *Mycobacterium paratuberculosis* to provide a more specific test for Johne's Disease.
- Demonstrate a therapeutic effect of recombinant antibodies with the aim of reducing chemical and antibiotic usage in disease control.
- Evaluate candidate vaccine antigens for the control of liver fluke in sheep and cattle.

Textiles, Clothing and Footwear

- Development of more satisfactory tests for Capripox and Foot and Mouth disease.
- Trial a prototype on-farm lice detection assay and introduce its use to reduce insecticide residues in wool.

Food Processing

- Demonstrate that dietary changes can reduce the incidence of *E Coli* in cattle, thereby reducing the chances of *E Coli* poisoning through contaminated meat products.
- Validate an ELISA assay for the detection of Corynetoxin enabling the monitoring of plant toxin levels in agricultural products.

Research Support

- In order to broaden the sources of external funding and to develop longer-term co-investment in our research, the Division will seek access to venture capital through the licensing of a package of selected technology to a research development company.

Planned Investment Profile by Sector	(%)
Meat Dairy & Aquaculture	86.8
Textiles, Clothing & Footwear	10.3
Food Processing	2.8
Biodiversity	0.1

Resource Summary 1999–2000

Total Revenue (\$'000)	21,816
—Direct Appropriation (\$'000)	11,916
—Research & Services (\$'000)	9,400
—Other (\$'000)	500
Earnings Performance Indicator (%)	44.1
Operating Result (\$'000)	17
End of Year Cash Balance (\$'000)	361
Research Staff (EFT)	120
Total Staff (EFT)	223

FOCUS

CSIRO Animal Production supports the sustainability and international competitiveness of Australia's livestock industries in the temperate climate zones. The major contribution is to the Textiles, Clothing and Footwear Sector, with a large contribution to Meat, Dairy and Aquaculture and a growing contribution to Climate and Atmosphere, with a small but potentially significant contribution to Marine.

Outlook and Strategies

A major challenge for the Division is to implement the decisions on the new CRCs. While transition years have been planned, termination years are much harder to manage.

In order both to continue to decrease the Division's dependence on the wool industry and to assist livestock producers with alternative enterprises, the Division has initiated or is initiating work on alpacas, cashmere goats, earthworms, rabbits and yabbies. While this change in direction allows the Division to use existing expertise on novel production systems, we must do it in such a way that our disciplinary strengths are maintained and our delivery of outcomes to the major industries is uninterrupted.

Having identified biotechnology as the major single class of enabling technologies for the livestock industries for the foreseeable future, the Division now has the difficult task of resourcing this area at a time when the traditional livestock industries mainly wish to support short term survival research.

Planned Activities and Achievements***Textiles, Clothing and Footwear***

- Develop expression arrays for genes expressed in the wool follicle.
- Establish breeding program for ultra-fine Merino breeding flock.
- Validate flow cytometry as a technology for counting sheep nematode eggs.
- Finalise guidelines for management of macrocyclic lactone resistance in sheep nematodes.
- Initiate commercialisation of genomics.
- Establish a commercial service for DNA pedigreeing [*also Meat, Dairy & Aquaculture*].
- Evaluate novel formulation approach utilising protected anthelmintic technology [*also Meat, Dairy & Aquaculture*].
- Identify role of three putative genes in avermectin resistance in sheep nematodes [*also Meat, Dairy & Aquaculture*].
- Establish commercial system for producing spores of fungi to control worms [*also Meat, Dairy & Aquaculture*].

Meat, Dairy and Aquaculture

- Identify feed components that influence the composition of compost worms, especially in relation to protein and lipid.

- Identify the potential for manipulating the composition of compost worms by managing the feeding regime.
- Initiate research on yabby production systems.
- Initiate breeding research on meat rabbits.
- Appraise electronic method for indicating temperament in feedlot cattle.
- Establish gene-based test for stress in pigs.
- Improved high performance prawn diets in use commercially.
- Establish sheep cloning by nuclear transfer [*also Textiles, Clothing & Footwear*].
- Complete QTL analysis for productivity and quality traits in sheep [*also Textiles, Clothing & Footwear*].
- Commercial partnerships for novel delivery systems for porcine growth hormone, and helminth vaccines [*also Textiles, Clothing & Footwear*].

Climate and Atmosphere

- Identify a potential immune correlate for the vaccine against methanogenic organisms currently under development [*also Meat, Dairy & Aquaculture*].
- Identify the appropriate composition of the antigen component of the vaccine against methanogenic organisms [*also Meat, Dairy & Aquaculture*].

Marine

- Technology to produce Omega3 milk established.

Planned Investment Profile by Sector (%)	
Textiles, Clothing & Footwear	55.4
Meat, Dairy & Aquaculture	40.9
Climate & Atmosphere	2.6
Marine	1.1

Resource Summary 1999–2000

Total Revenue (\$'000)	20,847
—Direct Appropriation (\$'000)	15,480
—Research & Services (\$'000)	5,080
—Other (\$'000)	287
Earnings Performance Indicator (%)	24.7
Operating Result (\$'000)	245
End of Year Cash Balance (\$'000)	-2,271
Research Staff (EFT)	150
Total Staff (EFT)	203

Chief: Dr Graeme Pearman

FOCUS

CSIRO Atmospheric Research conducts world-class research into our atmospheric environment and provides advice and applications for the benefit of Australia. Specifically, the Division addresses issues such as urban and regional air pollution, acid deposition, the enhanced greenhouse effect, ozone depletion, climatic variability and severe weather. Research tools include computer-based climate and atmosphere models as well as remote sensing and other atmospheric monitoring instruments. Key stakeholders include Commonwealth and State Environment Departments, and energy and mineral resource companies.

Outlook and Strategies

There is a strong demand from government, industry and the community for information about changes to the atmospheric environment and for solutions to related environmental issues and problems. Australia faces increasing commitments associated with international protocols and agreements on topics such as climate change and ozone depletion.

Research advances continue to be underpinned by the rapid growth in computing and information technology. This promises the development and application of climatic and air quality models of increasing realism, allowing for better accuracy and greater detail of predictions, as well as development of new, integrated earth-system models.

The Division's Atmospheric Processes Program (radiation interactions with the atmosphere and land, and applications of remote sensing tools) will be incorporated into the other Divisional Programs which utilise that work. Further restructuring of the Division's scientific programs is under way.

The Division will establish a new greenhouse gas modelling team to conduct three-dimensional carbon transport modelling for the atmosphere and oceans, global and regional inverse modelling and multi-decadal modelling. The work will be of relevance to policy advice on issues relating to the Kyoto Protocol (negotiated under the Framework Convention on Climate Change), to the Australian National Greenhouse Inventory, to interpretation of data on changing global greenhouse gas concentrations, and to design of measurement strategies.

The Division's activities in the CSIRO Climate and Atmosphere Sector represent about half of the total Sector effort. The Division is a partner in the Cooperative Research Centre for Southern Hemisphere Meteorology, and is a major user of the joint supercomputing facility, shared by CSIRO and the Bureau of Meteorology. The facility supports the Division's climatic and air quality modelling.

The Division receives significant external support from the National Greenhouse Research Program of Environment Australia. Environment Australia is the Division's foremost external funding agency, but there is increasing support from resource industries.

Planned Activities and Achievements

Climate and Atmosphere

- Significant interactions with Commonwealth and State environment agencies on air quality characterisation, modelling and health risk assessment.

- National and overseas consultancy studies including a project to characterise haze in Malaysia. Projects typically involve Australian and overseas partners and contribute to scientific advances in environmental management.
- Contributions to an assessment of the impact of hybrid car technology on air quality and greenhouse gas emissions. (Chief Executive's Special Project)
- Research on the changing composition of our atmosphere using the Cape Grim Baseline Air Pollution Station, in Tasmania. The Bureau of Meteorology and CSIRO jointly manage the station. The Division's GASLAB and other laboratory facilities have close linkages with the Station.
- A number of major, ongoing field experiments will be conducted to provide Australia-wide validation of satellite-based measurements of atmospheric radiation and aerosol.
- Continued development and use of sophisticated climate models to assess likely future regional changes to climate, and testing of model-based multi-seasonal predictions. The advances resulting from this work will be supplied to agencies such as the Bureau of Meteorology and the Queensland Department of Natural Resources, and international institutions.
- Assessment of likely regional impacts of climate change for the Queensland, NSW, and Victorian governments, and for the Rural Industries Research and Development Corporation. In a collaborative project for the Western Australian government, the Division is examining rainfall fluctuations in the south-west of the state.

Planned Investment Profile by Sector (%)

Climate & Atmosphere	99
Energy	1

Resource Summary 1999–2000

Total Revenue (\$'000)	14,245
—Direct Appropriation (\$'000)	9,716
—Research & Services (\$'000)	4,517
—Other (\$'000)	12
Earnings Performance Indicator (%)	31.7
Operating Result (\$'000)	-566
End of Year Cash Balance (\$'000)	690
Research Staff (EFT)	92
Total Staff (EFT)	125

FOCUS

Australia is ranked among the top five countries in ground-based optical and radio astronomy, and the CSIRO's Australia Telescope National Facility (ATNF) is Australia's pre-eminent radio astronomy institution. It is the only facility in the world which can make high-resolution images of the southern sky at radio wavelengths. The current major focus is on upgrading observing facilities to maintain ATNF's operation as a prestigious world-class national research facility dedicated to the advancement of knowledge and providing a showpiece for Australian technology.

Outlook and Strategies

The critical overall objective of the ATNF is to remain at the forefront of world radio astronomy into the next millennium. As a National Research Facility, the ATNF currently provides facilities which enable its users to carry out leading edge radio astronomy.

The ATNF has begun a major upgrade of ATNF observing facilities; this is supported by Major National Research Facility program and CSIRO Capital Investment funds.

The ATNF and CSIRO Telecommunications and Industrial Physics (CTIP) have jointly commenced a project on *Advanced Millimetre-Wave Integrated Circuits for Radio Astronomy and Telecommunications* with the support of the CSIRO Executive's Special Projects Fund.

The ATNF will continue to participate in planning future international research facilities.

In particular Australia is well positioned to play a key role in the development of the Square Kilometre Array (SKA). Strong participation in the project will increase the possibility of Australia hosting the instrument.

Planned Activities

- Operate the Parkes, Narrabri and Mopra Observatories, and the Long Baseline Array (LBA) network, and the Marsfield facilities, as National Research Facilities.
- Modify panels on the Narrabri and Mopra antennas so that the full 22-m diameter reflecting surface can be used for mm-wave operation.
- Develop and construct new 12-mm/3-mm receiving systems for the Compact Array at Narrabri.
- Upgrade the Compact Array local oscillator distribution system using fibre optics.
- Evaluate and refine the additional MMIC foundry runs for the electronic devices being developed through the joint ATNF/CTIP project.
- Support the MOU between ATNF and Onsala Space Observatory which will allow Australian astronomers access to 5% of the observing time on the Swedish-ESO Submillimetre Telescope (SEST).
- Participate in planning the SKA and the Atacama Large Millimetre Array (ALMA).
- Participate in national and international activities related to radio-spectrum management.
- Promote CSIRO and ATNF activities through information and educational resources.

Planned Achievements

- Provision of access to ATNF's facilities that satisfies the Australian and overseas community of users.
- Provision of at least 70% of the available time for astronomy on the Compact Array and Parkes radio telescope, keeping time lost during scheduled observing periods to below 5%.
- Demonstration of capabilities of a real time data processing system for the Compact Array.
- Installation of the first two new 12-mm receiver systems, and testing the Compact Array at 12-mm wavelength.
- Completion of the final design of electronic devices funded under an Executive Special Project.
- Coverage of the Magellanic clouds and the 'Zone of Avoidance' (the optically obscured region along the centre of the Milky Way), in the continuing multi-beam survey of atomic hydrogen gas in the local universe.
- Completion of the multi-beam survey to detect new southern millisecond pulsars.
- Support for the Japanese VSOP Space-VLBI mission by allocation of observing times of up to 5% at Narrabri and Parkes, and up to 25% on the Mopra antenna.
- Participation in OECD and ITU meetings on spectrum planning for radio astronomy, and in the formation of an Asia-Pacific group for regional planning discussions.
- Participation in the commissioning of the new Astronomical Image Processing System (AIPS++).
- At least 50 scientific papers published in refereed journals.

Planned Investment Profile by Sector (%)

Radio Astronomy	100
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Resource Summary 1999–2000

Total Revenue (\$'000)	14,792
—Direct Appropriation (\$'000)	12,075
—Research & Services (\$'000)	2,297
—Other (\$'000)	420
Earnings Performance Indicator (%)	16.0
Operating Result (\$'000)	-265
End of Year Cash Balance (\$'000)	3,657
Research Staff (EFT)	65
Total Staff (EFT)	133

CSIRO Building, Construction and Engineering

Chief: Mr Larry Little

FOCUS

CSIRO Building, Construction and Engineering operates to support, advance and improve the operation of industries relating to the Built Environment and other related Sectors. Strategic research is focused in life cycle performance; intelligent construction systems; information and communication in construction, new materials production and process design and optimisation. These key areas will provide substantial advantage to Australia in the next century. Our research capabilities include thermal and fluids engineering, design science/knowledge-based systems, construction process re-engineering, sustainable materials engineering and network optimisation in transport and utilities.

Outlook and Strategies

The Division is responding to several issues identified by industry and government as priorities for R&D: development of new industry processes and new design technologies to reduce energy consumption and greenhouse gas emissions; application of IT in construction; research to underpin intelligent transport systems; developing technologies and systems to reduce the economic and environmental cost of managing urban water, wastewater and stormwater and improve the quality of water services; new material products and processes for Australian companies in a global market.

A new management structure will be implemented, based around the Division's three core science capabilities (Thermal and Fluids Engineering, Sustainable Materials Engineering and Complex Engineered Systems/Intelligent Infrastructure Systems/Complex Systems Engineering). Business development activities will be aligned to the marketing of each of the three core capabilities across the full spectrum of Built Environment applications.

Facilities in Sydney will be upgraded and expanded with construction of a new Fire Laboratory and offices. Staff presence in Brisbane will increase via a joint venture or partnership with QUT and a MOU with Lend Lease. The Structural Laboratory in Melbourne is being extended to enable testing and research on large structures linked to development and validation of whole building models subject to a range of environmental loads.

Planned Activities and Achievements

Built Environment

- New energy appraisal models linked to emerging national energy codes and standards for the design of dwellings, commercial and industrial buildings.
- CFD models to support design of hybrid ventilation systems in buildings.
- A key role in the Inquiry into Urban Air Quality in Australia and State of Environment Reporting on Human Settlements for Environment Australia using its urban modelling capability.
- A new Chief Executive's Special Project on Urban Water combines expertise from several Divisions to respond to national priorities identified by WSAA.
- Continued leadership in the development of a performance-based Fire Code for the Building Code of Australia, including significant new research on materials flammability and fire spread modeling.
- Research on low energy accelerated processing is advancing with development of microwave curing of cementitious composites, new kiln technologies and new technologies for waste re-processing.

- Provision of national technical leadership in the International Alliance for Interoperability. Several prototype systems for automated code checking and on-line product databases are under development with industry partnerships.
- The Division has a major role in APEC harmonisation, is a designated testing centre for export of timber building products to Japan, and has won several contracts to undertake a range of materials durability studies in South East Asia.
- Several new optimisation and scheduling projects have commenced for individual firms in transport, energy and communication.

Mineral Processing and Metal Production

- Research on optimisation of the mixing process continues with new swirling flow technologies for application initially in the alumina refining industry. Studies on multi-phase flows in pipelines and pumps are being applied to hoisting, transport, crushing and pumping activities. Behaviour of dry granular materials is being modelled with particular application to bulk handling in rotary kilns.

Chemicals and Plastics

- Commercialisation of the patented SICOR process is continuing with automotive building products industries; plastic nails and rubber based products.

Integrated Manufactured Products

- Research is centred on developing innovative treatments to protect metallic surfaces (aluminium and magnesium) in transport and aerospace. Research on smart coatings is linked to a body of knowledge in CSIRO on material degradation processes and life prediction modeling.

Planned Investment Profile by Sector (%)

Built Environment	76.0
Mineral Processing & Metal Production	13.1
Chemicals & Plastics	7.2
Integrated Manufactured Products	3.7

Resource Summary 1999–2000

Total Revenue (\$'000)	29,184
—Direct Appropriation (\$'000)	19,984
—Research & Services (\$'000)	9,200
—Other (\$'000)	0
Earnings Performance Indicator (%)	31.5
Operating Result (\$'000)	272
End of Year Cash Balance (\$'000)	645
Research Staff (EFT)	172
Total Staff (EFT)	240

FOCUS

CSIRO Energy Technology provides R&D contributing to the sustainability of Australia's energy industry—including its energy exports. The main areas of endeavour are coal preparation, advanced power generation including both central and distributed systems, aspects of renewable energy and energy storage and the mitigation of the environmental impacts of energy, particularly those associated with greenhouse gas emissions. The Division also contributes to CSIRO's broader environmental capability through its expertise in advanced analytical and environmental chemistry applied to air and water quality.

Outlook and Strategies

A major activity will be managing the move of the Division's headquarters to a state-of-the-art energy efficient building in Newcastle. Our commitment is to have 100 staff in Newcastle two years after the completion of the building, scheduled for 2003.

Re-alignment of the Division's research, begun in 1997–98 to address the research needs of a sustainable energy sector, will continue. In 1997 the Australian Government signed an international agreement that by 2010 Australian greenhouse gas emissions will be no more than 8% above those of 1990. Support for government initiatives to achieve that target, plus a need to respond to the restructuring and technological changes within the energy industry, are the main drivers of the shift of resources within the Division. As part of the shift of resources, the Division will:

- Seek new ways to demonstrate the value and relevance of CSIRO research to government—in particular through input to technology aspects of policy development for achieving future goals.
- Strengthen research in small gas-fired power (including cogeneration) and in gas technology for residential, commercial and industrial applications.
- Strengthen expertise/capability to address energy generation from renewable energy resources, in particular biomass and solar.

Planned Activities and Achievements**Energy**

- Commissioning of a facility to demonstrate the viability of a process to use solar-thermal energy to enhance the value of gas derived from fossil fuels (\$4.8 million funding over 3 years). The solar dish and associated process units will be in place in the second half of 1999 and will be followed by the commissioning and operation of the solar-gas reforming unit and hydrogen/carbon dioxide separation systems prior to bringing fuel cells and a microturbine on-line during 2000.
- Provision of coal performance data related to the use of Australian coals in advanced power generation technologies from the new coal gasification facility at Pinjarra Hills. (CRC for Black Coal Utilisation)
- Development of commercial-scale (600 m³/h) turboflotation unit with CMI/Ludowici and complete investigation of its performance. (The Australian Coal Association and AusIndustry support this project through the START scheme)
- Completion of a coherent comparative study on

leaching of fly ash derived from pulverised coal combustion, including a database to allow prediction of possible release of toxic trace elements as a function of coal/ash type and process conditions.

Land and Water

- Development of a multi-roll unit for the horizontal belt-press filter used for electro-dewatering of sewage sludge, with parallel optimisation studies of power consumption. (CRC for Waste Management and Pollution Control)
- Development and application of environmentally-relevant sediment bioassays for use in the ecological risk assessment.
- Development and validation of predictive biogeochemical models of copper behaviour in rivers receiving mine wastes.

Climate and Atmosphere

- Assessment of the potential for the plumes from the NSW power stations, located outside the Sydney metropolitan region, to be transported into the Sydney airshed, and their possible impact on the levels of photochemical smog pollution in Sydney.

Research Support

- Activities associated with the relocation of Divisional headquarters will include: letting of tenders for the building and site preparation; increased effort on marketing activities to secure industry participation in the construction of the building and in subsequent research; and initiating processes to manage associated HR issues.

Planned Investment Profile by Sector (%)	
Energy	75.5
Land & Water	11.5
Climate & Atmosphere	5.6
Marine	3.8
Mineral Processing & Metal Production	3.4
Mineral Exploration & Mining	0.2

Resource Summary 1999–2000

Total Revenue (\$'000)	22,046
—Direct Appropriation (\$'000)	14,771
—Research & Services (\$'000)	7,200
—Other (\$'000)	75
Earnings Performance Indicator (%)	32.8
Operating Result (\$'000)	119
End of Year Cash Balance (\$'000)	504
Research Staff (EFT)	111
Total Staff (EFT)	167

Chief: Dr Jim Cullen

FOCUS

CSIRO Entomology is focused on three key areas: supporting Australian rural industries, working with manufacturing industry to develop innovative chemical and pharmaceutical products, and managing environmental issues.

Outlook and Strategies

Rural: management and ecology of pests and weeds in field crops and pastures, reducing high dependence on harmful synthetic insecticides, and developing and improving technologies for the storage, handling and transport of grains.

Chemicals and pharmaceuticals: using insect pathogens (bacteria, fungi, nematodes and viruses) as environmentally safe and specific new pesticides, and using insects as a source of new chemicals for cleaning up pesticide residues and for novel pharmaceuticals.

Environment: developing the knowledge essential for the preservation and management of Australia's biodiversity, the preparation of conservation plans, weed control and sustaining agricultural practice.

Planned Activities and Achievements**Field Crops**

- Characterisation of two Bt resistant strains of *H. armigera* for resistance mechanisms and cross resistance patterns.
- Commencement of first trials of in-situ heat disinfection of bulk grain.
- Completion of a survey of psocids in grain storage and development of a system for psocid control.
- Conduct of field trials of a new adaptive discounting control procedure for aeration-cooling.
- Conduct of a survey of potential natural enemies of redlegged earth mite in Australia and South Africa.
- Release of an exotic parasitoid for the control of the white and conical snails in grains crops.
- Development of methods to augment and maintain populations of key parasitoids of *Helicoverpa* as an aid to integrated pest management in cotton.
- Conduct of an impact assessment study in the field of a genetically engineered *Helicoverpa* baculovirus expressing an insect-selective neurotoxin.

Biodiversity

- Completion of development of basic specimen and taxon information management tools (BioLink).
- Submission of *Australian Tettigoniidae 3, Australian Weevils 4, Butterflies of Australia, Oecophorine Genera of Australia III, Olethreutine Genera of Australia and Australian Heliothinae*.
- Finalisation of *Checklist of Australian Coleoptera*.
- Continuation of the importing and testing of natural enemies of mimosa.

Chemicals and Plastics

- Isolation of at least one novel target for developing new nematicides.
- Testing of biological activity of a cloned dipteran juvenile hormone esterase gene/enzyme system.
- Completion of barley and oats trials for registration of carbonyl sulphide.
- Start of field trials on new uses for ethyl formate.
- Completion of improved bait delivery for termites.

Meat, Dairy and Aquaculture

- Completion of the mass-rearing facility based in the Institut Haiwan, Johor, Malaysia.
- Identification of nematode pathogens of white clover in dairy pastures.
- Establishment of new biological control projects against serrated tussock and blue heliotrope.
- Establishment of two insects to control *Prosopis* (mesquite) species across tropical rangelands.

Horticulture

- Integration of the use of the whitefly parasitoid, *Eretmocerus nr mundus* into vegetable production.
- Determination of Asian whitefly, *Bemisia tabaci*, biotypes and identification of parasitoids.
- Investigation of the ecology and management of the borer, *Agriancome spinicolis* in pecans.
- Completion of the baseline survey of soil fauna of Riverland citrus.

Other Sectors

- Screening of at least 800 insect extracts against major human cancer cell lines. [Pharmaceuticals and Human Health]
- Generic revision of Australian Cerambycidae and establishment of field trials to assess genetic and silvicultural methods of control of the shoot borer, *Hypsipyla robusta*. [Forestry, Wood and Paper]
- Redesign of the LucID interactive CD-ROM key to freshwater macroinvertebrates. [Land and Water]
- Production of a prototype version that integrates the two software packages, CLIMEX and DYMEX. [Climate and Atmosphere]
- Development of new termite prevention and control systems. [Built Environment]

Planned Investment Profile by Sector	(%)
Field Crops	28.0
Biodiversity	25.3
Chemicals & Plastics	18.6
Meat, Dairy & Aquaculture	9.8
Horticulture	6.5
Others	11.8

Resource Summary 1999–2000

Total Revenue (\$'000)	30,425
—Direct Appropriation (\$'000)	16,220
—Research & Services (\$'000)	14,029
—Other (\$'000)	176
Earnings Performance Indicator (%)	46.4
Operating Result (\$'000)	-223
End of Year Cash Balance (\$'000)	49
Research Staff (EFT)	227
Total Staff (EFT)	296

FOCUS

CSIRO Exploration and Mining's research supports the Australian mining industry's need to maintain its international position among the lowest cost mineral suppliers, simultaneously combining safe production with high community acceptability. The Division spans the full spectrum of mining activities from primary exploration through to mine safety and site rehabilitation. Core science areas include: processes governing mineralisation, rock alteration and landscape evolution; advanced instrumentation systems and interpretation of data for exploration, mining and environmental engineering; mechanics of geological excavation, extraction and materials handling processes, and control and optimisation of mining equipment and its interaction with the mining process.

Outlook and Strategies

The industry is now entering the third year of an unusually deep cyclical low in minerals prices but there are now some emerging indications of an upturn in the market.

The industry continues to be a strong user of technology, but some of the major companies have decided to outsource R&D, offering an opportunity for CSIRO. There is uncompromising pressure on output and costs and increasingly, R&D providers must provide packaged or turn-key solutions to ensure technology uptake.

Extensive strategic analysis, based on the industry outlook, has resulted in the "Glass Earth" concept: to make the top one kilometre of the Australian continent and the processes operating within it, transparent, with the aim of discovering the next generation of giant ore deposits. The "Accessible Earth" concept follows: to make new types of mineral deposits and currently sub-economic deposits totally accessible, with the aim of maximising the return to Australia by optimising the efficiency, safety and cost effectiveness of mining systems.

Participation in four Cooperative Research Centres will continue:

- CRC for Australian Mineral Exploration Technologies,
- CRC for Australian Geodynamics,
- CRC for Landscape Evolution, and
- CRC for Mining Technology and Equipment.

Planned Activities and Achievements**Mineral Exploration and Mining**

- Develop a science prospectus for the Ocean Drilling Project Leg 192 and undertake a shallow drilling project of seafloor sulfide deposits in the Manus Basin.
- Complete metallogenic studies of base metal mineralisation in the northern Australian Proterozoic Basins.
- Continue to support the Australian Nickel mining industry through the development of area selection criteria for new deposits based on further regional and deposit studies and on understanding magmatic processes in modern, active environments.
- Continue development of fully coupled mechanical-fluid-thermal-chemical numerical models and integrate chemical modelling capability for sediment-hosted and lode Gold systems, porphyry Copper/Gold systems and Proterozoic base metal sulfides.
- Undertake projects aimed at demonstrating to industry the capabilities of the new AUSTRALIS isotope micro-

analytical facility and proton microprobe.

- Through the Cerberus project, deliver a short wave infrared profiling system to World Geoscience Corporation.
- Undertake ARIES simulations in Australia using HYMAP airborne data.
- Complete laboratory proof of concept for an airborne gravity gradiometry system and in collaboration with CSIRO Telecommunications & Industrial Physics, commence development of a tensor magnetic gradiometer.
- Publish a manual on the regolith geology of the Yilgarn and an atlas of ferruginous materials.
- Develop geophysical interpretation and geomechanical modelling tools using a 3D projection table.
- Undertake prototyping of a 3D predictive numerical simulator for in-situ leaching operations.
- Finalise development of a decision support system for dust management in open cut mines.
- Develop a prototype automation system for underground mining vehicles.

Energy

- Implement advanced techniques for interactive interpretation of geological, geophysical and geotechnical data for accurate prediction and control of ground conditions and production in coal mines.
- Undertake design work for an automatic bolting/bridge conveyor system to support coal mining and haulage operations.
- Develop new communications network technology for underground mining operations.

Planned Investment Profile by Sector (%)

Mineral Exploration & Mining	77.5
Energy	21.2
Petroleum	1.3

Resource Summary 1999–2000

Total Revenue (\$'000)	31,419
—Direct Appropriation (\$'000)	17,513
—Research & Services (\$'000)	13,905
—Other (\$'000)	0
Earnings Performance Indicator (%)	44.3
Operating Result (\$'000)	-335
End of Year Cash Balance (\$'000)	77
Research Staff (EFT)	168
Total Staff (EFT)	264

Chief Executive: Dr Michael Eyles

FOCUS

Food Science Australia (FSA) is an unincorporated joint venture between CSIRO and the Australian Food Industry Science Centre (Afisc). FSA's multidisciplinary skill base and knowledge of the latest developments in food processing technologies are unique in Australia. It works closely with a wide range of industries, including the dairy, meat, milling, baking, snack and fruit and vegetable processing industries, as well as with service providers to those industries, such as packaging, transport and storage companies. In association with CSIRO Divisions in the Food Processing Sector, FSA offers research and technical services which solve problems for the food industry at every stage of the processed food business system, from analysing consumer needs to product design, through production optimisation, transport and storage, to marketing and retail support. FSA also contributes to other Sectors, particularly Meat, Dairy and Aquaculture, Chemicals and Plastics, Field Crops and Horticulture.

Outlook and Strategies

The establishment and consolidation phases for the joint venture have been substantially completed. The Food Science Australia brand name is becoming accepted both locally and overseas. The Joint Venture is now well positioned to take advantage of the R&D opportunities that exist in the sectors it services.

Research and development efforts will be focused in four strategic areas; food safety, molecular basis for food functionality, advanced product manufacture and delivery systems, and market understanding. There will be a shift in effort towards larger projects that involve a high degree of research intensity and for which customers can obtain a sustained competitive advantage from commercialisation of research outcomes.

Research collaborations with the private sector will be expanded. The business development function will be given greater prominence with the recent appointment of a Business Development leader.

Planned Activities and Achievements

Food Processing

- Continued development of polymeric oxygen scavengers in conjunction with the licensee, Southcorp Ltd—in particular the application to food manufacturing.
- Verification of the mathematical simulation model for prediction of cold chain performance for domestic and export applications.
- Development of a new process for tenderising and texturising low value meat cuts using extrusion cooking.
- Commercialisation of vegetable based texturised meat analogues using extrusion cooking.
- Implementation of advanced process control strategies in food manufacturing facilities.
- Development of improved methodology for isolating and detecting virulence of emerging pathogens including enterohaemorrhagic *E. coli*.
- Commercialisation of specialised dairy powders, including high fat powders and cream powders.
- Commercialisation of casein peptide extract as a functional food ingredient.
- Application of whey protein ingredients to sports and health food markets.
- Further understanding of the mechanisms and determinants in supramolecular structure formation and subsequent aggregate induction processes leading to greater ability to select ingredients and process steps for the design and formulation of new food types.
- Application of new knowledge and capability in

hydrocolloids to the extraction and formulation of gums and other food ingredients.

Meat, Dairy and Aquaculture

- Development of more efficient carcass processing technologies to optimise temperature / pH decline, including electrical stimulation and control of chiller conditions during cooling.
- Commercialisation of automated rib deboning and anal sealing equipment.
- Completion of a risk management manual for operations, food safety and worker safety in boning rooms and packing plants.

Horticulture

- Development of improved prototype container systems and conduct of trial shipments as part of post harvest non-chemical disease control strategies.
- Long term monitoring of distribution centres, distribution vehicles and supermarket display cabinets to identify operational improvements and energy saving opportunities.

Research Support

- Introduction of the Platinum Business Information System to enhance management and administration.
- Development of HR strategies in preparation for possible resource shifts associated with the CSIRO 2000–2003 triennium strategic plan.
- Completion of Year 2000 IT compliance requirements and of the move of staff from the Highett site to the Werribee site.

Planned Investment Profile by Sector	(%)
Food Processing	78.0
Meat, Dairy & Aquaculture	12.5
Chemicals & Plastics	4.7
Horticulture	1.9
Integrated Manufactured Products	1.7
Field Crops	1.2

Resource Summary 1999–2000

Total Revenue (\$'000)	35,596
Operating Result (\$'000)	-865
End of Year Cash Balance (\$'000)	6,116

Note: These are estimates for the Joint Venture rather than estimates of CSIRO's operational or legal interest in it. Total Revenue includes CSIRO's contribution of \$14.329 million from Direct Appropriation Income.

FOCUS

CSIRO Forestry and Forest Product's mission is to increase economic and environmental benefit to Australia by improving the management and productivity of the nation's forests, and the quality and value of forest products. The Division delivers research outcomes across the industry value chain from forest growers to wood and paper product manufacturers, and advises and assists policy makers, development assistance agencies, and the community. Research also addresses environmental aspects of forestry and forest products, waste management and utilisation, amelioration of degraded land, conservation of biological diversity, and carbon sequestration. A diverse range of skills encompasses genetics, silviculture, ecophysiology, soil science, physical and biological modeling, wood and other materials sciences, and chemical and process engineering.

Outlook and Strategies

Key drivers of the Australian forestry and forest products industry include:

- increasing plantation areas, especially eucalypts, under the influence of the Plantations for Australia: the 2020 Vision, projected growth in demand in Asian markets, and global environmental issues as expressed in instruments such as the Kyoto Protocol
- increasing importance of sustainable forest management and its potential role in determining future access to particular export markets
- industry globalisation and rationalisation, changing ownership of forest resources, role of plantation investment companies
- increasing supply of plantation timbers and forest residues, and the demand for profitable utilisation of wood residues in high value products
- completion of the Regional Forest Agreement (RFA) process and consequences for native forest access and plantation investment
- increasing application of genetic technologies to achieve desired wood properties and improved tree performance in harsh conditions
- prospects for carbon emissions trading
- finalisation and implementation of an Action Agenda by the Minister for Forestry and Conservation.

Key internal issues include:

- review of wood products and processing research to strengthen interactions with industry, capture emerging opportunities and increase external funding
- implementation of the business development plan to target specific enterprises in accordance with R&D priorities.

Planned Activities and Achievements

Forestry, Wood and Paper Industries

Molecular biology techniques incorporated into conventional tree breeding strategies to improve wood and fibre properties and environmental adaptability:

- characterisation of genes controlling cellulose biosynthesis in eucalypts.
- confirmation of trait loci (QTL) for resistance to *Dothistroma* in radiata pine. [also Biodiversity]

Silvicultural strategies for farm forestry:

- optimum irrigation strategies for eucalypt plantations in salinity affected areas in the Deniliquin region. [also Land & Water]
- on-farm experimental program to explore potential for sawlog production in the Green Triangle.

Remote sensing and spatial analysis tools for use in forest planning and the assessment of forest productivity, structure and health:

- GPS system to evaluate impacts of forest harvesting and logging operations. [also Land & Water]
- tools for spatial prediction and assessment of soil sustainability. [also Land and Water]
- use of remote sensing of crown condition as an indicator of forest health.

Novel high value products from juvenile wood and wood residues:

- charcoal and renewable energy from wood biomass. [also Energy]

Technologies to link wood properties to product properties and performance:

- automation of SilviScan-2 for wood analysis and assessment.
- operational trials for radio-frequency drying.

Environmentally acceptable wood preservatives and adhesives:

- renewable resource based tannin adhesives.
- development of new diffusion treatments for unseasoned timber. [also Built Environment]

Paper and paperboard suitable for advanced printing technologies and durable packaging:

- manufacturing process for new coatings for special-purpose papers.
- assessment of fibre quality for packaging materials used in humid conditions.

Planned Investment Profile by Sector (%)	
Forestry, Wood & Paper Industries	75.1
Biodiversity	7.1
Built Environment	5.9
Chemicals & Plastics	5.5
Climate & Atmosphere	4.0
Land & Water	2.4

Resource Summary 1999–2000

Total Revenue (\$'000)	27,915
—Direct Appropriation (\$'000)	18,237
—Research & Services (\$'000)	9,677
—Other (\$'000)	0
Earnings Performance Indicator (%)	34.7
Operating Result (\$'000)	175
End of Year Cash Balance (\$'000)	2,775
Research Staff (EFT)	188
Total Staff (EFT)	256

Chief: Dr Richard Head

FOCUS

CSIRO Human Nutrition is one of the largest nutrition and training centres in Australia. The Division's goal is to improve human well-being and community health, and reduce the incidence of diet related disease in Australia, by nutritional and other means including influencing the production and consumption of appropriate foods. To achieve these goals the Division works closely with the food and food related industries in characterising the health potential of foods. The Division offers both clinical and laboratory based research facilities including a sensory evaluation facility and multi-disciplinary research skills in nutrition, psychology, biotechnology, biochemistry, pharmacology and physiology. There is a growing number of national and international research collaborations and strong industry links across four CSIRO Sectors: Food Processing, Pharmaceuticals and Human Health, Field Crops and Meat, Dairy and Aquaculture.

Outlook and Strategies

The major drivers of nutrition-related R&D include the globalisation of markets, urbanisation, the changing health priorities of an aging population, trends in national and international regulation/deregulation and the domination of new technologies and technology transfer. A further factor is the growing interest from an increasingly well informed community about issues of health and nutrition.

These translate into several imperatives for the Division, including the need to increase the breadth of research into consumer issues, the need to strengthen research focus on the theme of "functional" foods which offer health protection and to ensure that facilities and equipment are appropriate for the provision of state of the art R&D services to Australian industry.

Strategies to address these imperatives include:

- Maintenance of a strong research focus on nutrition-linked diseases such as cardiovascular disease and cancer, more important than ever in the context of an aging population.
- Commissioning of a new sensory evaluation facility.
- Conduct of the first research projects by new research teams in the areas of nutrition and cognition, and sensory determinants of food choice.
- Completion of the final phase of a major site refurbishment project, concentrating on laboratories for functional food research.
- Review of laboratory and computing equipment.
- Organisation of a national conference for the food processing industry with the theme of taking nutrition research to the marketplace.

The Division will continue active involvement with the CRC for Tissue Growth and Repair and with its commercial arm, GroPep Pty. Ltd. Twenty CSIRO staff from the Functional Foods and Nutrition-linked Cancers Programs are directly involved with this CRC research.

Planned Activities and Achievements**Food Processing**

- Commercial development of the short-chain fatty acid delivery system Starplus™. CSIRO's intellectual property investment in this project will be enhanced by the development of satellite patents.
- Development of a convenience rice porridge baby food with desirable nutritional attributes with a major food industry partner (HJ Heinz). This product will be first to market. It is intended that the formulations will be acceptable to consumers in target export markets as

well as domestically, provide balanced nutrient intakes, and promote gut health and development in infants.

- Goodman Fielder Milling and Baking has developed *Nature's Gold*, a new wheat aleurone product. CSIRO Human Nutrition is conducting a comprehensive evaluation of the product both as an ingredient and in processed foods aimed at export markets. It has been shown already that *Nature's Gold* is a good source of bioavailable folate and current studies indicate that it has additional nutritional benefits which will enhance human health and yield new product opportunities.
- A novel program has been established to assess effects of nutrients and foods on cognition. Initial studies will focus on vitamin B₁₂, of particular relevance to the meat and cereal industries.

Pharmaceuticals and Human Health

- Development of an intellectual property (IP) position on pharmacological screening technology. This involves screening for compounds which offer protection against cardiovascular disease, cancer or gastrointestinal motility. The establishment of an IP position is expected to lead to further industry interaction with potential for product development.

Meat, Dairy and Aquaculture

- Studies of consumer attitudes towards biotechnology will be broadened to encompass perceptions of risk and communication strategies.

Planned Investment Profile by Sector (%)

Food Processing	44
Pharmaceuticals & Human Health	42
Meat, Dairy & Aquaculture	9
Field Crops	5

Resource Summary 1999–2000

Total Revenue (\$'000)	9,500
—Direct Appropriation (\$'000)	6,540
—Research & Services (\$'000)	2,905
—Other (\$'000)	55
Earnings Performance Indicator (%)	30.8
Operating Result (\$'000)	75
End of Year Cash Balance (\$'000)	1,535
Research Staff (EFT)	70
Total Staff (EFT)	89

FOCUS

CSIRO Land and Water research is focused on the ecological, economic and social issues that underpin sustainable regional development and long-term management of the Australian landscape. A unique interdisciplinary science capability that addresses key national land and water management issues makes the Division a key provider of strategic science and innovation. CSIRO Land and Water has positioned itself to provide integration across disciplines and systems understanding. To ensure adoption, the Division has developed strategic links to environmental policy bodies, local, State and Commonwealth governments, agribusiness, mining and manufacturing industries, and community-based land management groups.

Outlook and Strategies

CSIRO Land and Water is funding a number of new research positions and acquiring additional skills in areas such as aquatic ecology and process modelling, socio-psychology, irrigation science, micrometeorology, biogeochemistry and resource economics.

The Division is a key partner in two new Cooperative Research Centres announced in April 1999—the CRC for Terrestrial Carbon Accounting and the CRC for Coastal Zone Estuary and Waterway Management. Partnership continues in the CRCs for Freshwater Ecology, Catchment Hydrology, Cotton, Tropical Rainforest Ecology, Viticulture, Sustainable Sugar Production, Sustainable Rice Production, Sustainable Development of Tropical Savannas, and Landscape Evolution and Mineral Exploration.

CSIRO involvement in the Murray-Darling Freshwater Research centre in Albury will be strengthened through new operational arrangements being put in place by the Murray Darling Basin Commission, CSIRO and the board of the Murray-Darling Freshwater Centre. Through this centre CSIRO Land & Water will continue as a major partner in the CRC for Freshwater Ecology.

A strategic investment of \$1.5M in information technology infrastructure will take place over three years, commencing in 1999–2000, to ensure state-of-the-art facilities in the Division. Investment of \$1.9M in scientific capital equipment is also planned in 1999–2000, primarily to support strategic science initiatives.

The Division will focus on the development of commercialisation strategies and new partnerships with the commercial environmental management sector.

Planned Activities and Achievements

- Large-scale investment in the installation of open air laboratories and flux stations is planned to measure environmental status (Chief Executive's Special Project on Sustainable Land Management in the Murray-Darling Basin). Delivery of soil-landform mapping techniques will aid the design and implementation of land use change. *[Land and Water; Biodiversity; Forestry, Wood and Paper]*
- The 'Redesign of Australian Plant Production Systems' program Phase II will be developed in conjunction with LWRRDC. The objective is to deliver capacity to analyse and design production systems which are benign to the environment, yet produce high-quality products and maintain farm incomes. *[Field Crops; Land and Water]*
- Establishment (in association with the Divisions of Tropical Agriculture and Marine Research) of an

external consortium for an initiative to develop strategies to underpin future sustainable regional development in northern Australia. Initial focus will be in the Kimberley and Ord regions. *[Land and Water; Marine]*

- Pursuit of commercial development of a clay-like compound that can prevent algal blooms by reducing phosphorus bioavailability and lower the risk of contaminants entering the water supply and environment. *[Land and Water]*
- Delivery of outputs to four of the seven National Land and Water Resources Audit themes (dryland salinity; land use productivity and sustainability; costs of land and water degradation; capacity for change in land use and river, estuarine, and catchment health). *[Land and Water]*
- Participation, as a lead player, in a multi-agency ACIAR funded study of contaminated groundwater in Bangladesh and N.E. India. The project will identify sources of low arsenic groundwater and provide simple technologies for the removal of arsenic from drinking water. *[Land and Water]*
- Establishment of a Centre for Landscape Renewal, which will lead and develop the fundamental scientific debate in landscape system function. *[Land and Water; Biodiversity]*
- The Division will contribute outputs to the following national environmental management initiatives:
 - National Dryland Salinity Program Phase II
 - National Irrigation Science Network
 - Development of a National Rivers R&D Consortium

Planned Investment Profile by Sector (%)

Land & Water	55.5
Field Crops	11.1
Biodiversity	8.1
Services	4.2
Climate & Atmosphere	3.8
Mineral Exploration & Mining	3.1
Built Environment	3.0
Forestry, Wood & Paper Industries	2.7
Other Sectors	9.5

Resource Summary 1999–2000

Total Revenue (\$'000)	45,594
—Direct Appropriation (\$'000)	30,074
—Research & Services (\$'000)	15,100
—Other (\$'000)	420
Earnings Performance Indicator (%)	33.4
Operating Result (\$'000)	308
End of Year Cash Balance (\$'000)	4,830
Research Staff (EFT)	305
Total Staff (EFT)	451

Chief: Dr Ian Sare

FOCUS

CSIRO Manufacturing Science and Technology supports Australian manufacturing industry through the development and exploitation of innovative materials, processes, products and services. Its science and technology foci range from materials development, processing and characterisation, electrochemical technologies, micromanufacturing, plasma and laser processing, joining and cutting technologies, and surface engineering through to pervasive technologies like automation and real time systems, photonics and intelligent manufacturing systems which are broadly important to many industry sectors. The Division aims for a balanced research portfolio delivering quality commercial outcomes to industry while maintaining a strong scientific base.

Outlook and Strategies

Following the research portfolio analysis completed in 1998, reviews of all research projects will be conducted by the Science and Engineering Council during the year.

In the sixth selection round of the Cooperative Research Centres Program renewals were approved for the CRC for Cast Metals Manufacturing, the CRC for Intelligent Manufacturing Systems and the CRC for Welded Structures. A new CRC for Microtechnology was also approved.

A major three/four year research initiative with British Aerospace Australia in the areas of chromium free anti-corrosion coatings, corrosion prediction and structural integrity assessment of pitting corrosion in aircraft structures will commence during the period. The contracts, approaching \$4 million are in conjunction with the Aeronautical and Maritime Research Laboratory of DSTO.

Four DISR/Industry funded projects, each of three years duration are commencing. They are in cold forging, heat treatment, cast tooling and direct reduction of titanium compounds.

Planned Activities and Achievements**Integrated Manufactured Products**

- Adoption of new innovative technologies by targeted key growth industries e.g. new diecasting process technologies for export-oriented automotive component manufacturers, to reduce costs and improve quality.
- Development of a continuous casting and rolling process for the production of superior automotive engine bearings.
- Enhanced sensors for diecasting machine monitoring and control.
- Development of new anti-counterfeiting microstructures specific to plastic substrate applications.
- Prototype X-ray microscope for examining internal features of engineering components.
- Prototype internet-based diagnosis and optimisation system integrated into a machine tool to enable a client to provide advanced remote support service to its customers world-wide.
- Modification to existing manufacturing processes to reduce variability and improve productivity.

Chemical and Plastics

- Continuation of development of tailored ultrafine particles for consumer products, polymer matrix materials and cosmetics.

Energy

- Development of distributed energy systems for incorporation into energynets, contributing to the Towards Sustainable Energy project.

Mineral Processing and Metal Production

- Active dissemination of research results relating to the sulphur dome effect over molten magnesium metal will improve safety procedures in the magnesium industry.
- Development of refractory lining solutions based on system thermo-chemical modelling and materials design for improved operational efficiency for heat containment vessels.
- Development of software and instrumentation for asset life prediction for polymeric materials and elastomers in the minerals industry.

Research Support

- The second stage of the asset replacement and infrastructure upgrade (CAPEX) project will be implemented in 1999–2000 with a resource commitment of \$1.1 million.
- The Clayton East Redevelopment Project involving the half-life refurbishment of the David Rivett Laboratory and new laboratory and office accommodation to house the Division's Preston activities will proceed to construction/development phase.

Planned Investment Profile by Sector (%)

Integrated Manufactured Products	72.3
Chemicals & Plastics	8.5
Energy	6.9
Mineral Processing & Metal Production	5.1
Mineral Exploration & Mining	2.6
Built Environment	2.1
Service	1.5
IT&Telecommunications	0.9
Pharmaceuticals & Human Health	0.1

Resource Summary 1999–2000

Total Revenue (\$'000)	45,958
—Direct Appropriation (\$'000)	27,916
—Research & Services (\$'000)	18,045
—Other (\$'000)	-3
Earnings Performance Indicator (%)	39.3
Operating Result (\$'000)	-940
End of Year Cash Balance (\$'000)	-143
Research Staff (EFT)	248
Total Staff (EFT)	329

FOCUS

CSIRO Marine Research (CMR) provides the scientific basis for ecologically sustainable development of Australia's marine resources, and for understanding and exploiting the ocean's role in determining the impact of climatic variability on Australia's resource productivity, both marine and terrestrial. A diverse skill base, and capabilities that include inshore and blue water research vessels, enable creation of multi-disciplinary teams that deliver outcomes to Australia via the Marine, Climate and Atmosphere, Biodiversity, Petroleum, and Meat, Dairy and Aquaculture Sectors.

Outlook and Strategies

Australia's Oceans Policy is now an approved initiative, with the development of a Regional Marine Plan for the south-east region of Australia over the next three years its highest priority. The Policy formalises an ecosystem-based approach to management of multiple uses of Australia's Exclusive Economic Zone.

There is increasing recognition within the fishing, aquaculture and petroleum industries that an ecosystem-based approach to ecologically sustainable development and risk assessment requires a sound scientific basis. The Division's research is targeted at regional and ecosystem scales, with fundamental research into ecosystem function.

CSIRO is a core partner in the new CRC for the Coastal Zone, Estuary and Waterway Management (CZEW), and a major contributor to the renewed CRC for the Great Barrier Reef World Heritage Area.

CSIRO (including CMR, Tropical Agriculture and Animal Production) is the largest participant in the CRC for Aquaculture. Our research involves technologies to improve production and profitability and to minimise resource use and environmental impact.

Climate change and variability remain high on the national agenda. The Division's research is targeted at prediction of seasonal and long-term variations in climate and identification of impacts and adaptation. CMR is a core partner in the Antarctic CRC.

CMR will complete Stage 1 of the Hobart site redevelopment in 2000 providing space for additional staff and more appropriate housing of the CSIRO Fish Collection. Options for refocusing CMR research activities in Western Australia and rebuilding staff levels at Marmion Laboratory in Perth are being reviewed, with WA government and industry advice, and agreed changes will be implemented in 1999–2000.

Planned Activities and Achievements

- Scientific support for regional ecosystem management plans on the North West Shelf (WA Government) and South East Australia (Oceans Policy implementation), including ongoing development of techniques for rapid, cost-effective environment assessment. [Marine]
- Development of protocols to minimise the physical impacts of trawling in the Great Barrier Reef Marine Park. [Marine]
- Development and evaluation of techniques for stock enhancement (reseeding) of brown tiger prawn (*Penaeus esculentus*) in the tropical Australian prawn fisheries of Exmouth Gulf (WA). [Marine]
- New studies of estuarine and coastal systems in central

and southern Queensland, aimed at improving the marine environment through better catchment and urban water management. [Marine]

- Improvement in aquaculture productivity and profitability through domestication and selective breeding, focusing on kuruma prawn and Pacific oyster. [Meat, Dairy and Aquaculture]
- Screening for genes causing functional sterility, and insertion trials using zebrafish and oysters to develop methods for controlling the fertility of feral populations of exotic species. [Marine; Biodiversity]
- Screening of the CSIRO microalgal collection for bioactive molecules, targeting nutritionally important polyunsaturated fatty acids (PUFA) and developing culture conditions to optimize compound production, including the use of photobioreactors. [Marine; Pharmaceuticals and Human Health]
- Improvements to the Australian Community Ocean Model to better represent circulation near Australia and make optimum use of all available data. Test its efficacy in producing better oceanic and climate predictions. [Climate and Atmosphere; Marine]
- Preliminary assessment of disposal of CO₂ at sea. The spread of CO₂ by currents, reactions with the ocean floor and environmental degradation will be assessed in a major international experiment at Kona, Hawaii. [Climate and Atmosphere; Marine; Petroleum]
- Development of capacity to use latest technologies for global ocean monitoring including autonomous ocean profilers, biogeochemical instruments, satellite data and methods of model/data assimilation. [Climate and Atmosphere; Marine]

Planned Investment Profile by Sector (%)	
Marine	71.9
Climate & Atmosphere	10.4
Meat, Dairy & Aquaculture	10.1
Biodiversity	6.6
Petroleum	1.1

Resource Summary 1999–2000

Total Revenue (\$'000)	33,068
—Direct Appropriation (\$'000)	22,029
—Research & Services (\$'000)	11,479
—Other (\$'000)	100
Earnings Performance Indicator (%)	34.3
Operating Result (\$'000)	-1,206
End of Year Cash Balance (\$'000)	1,978
Research Staff (EFT)	206
Total Staff (EFT)	301

Acting Chief: Dr Murray Cameron**FOCUS**

CSIRO Mathematical and Information Sciences seeks to carry out and deploy research to generate world-class applications, for the benefit of Australia. This research is based on expertise in information technology, mathematical and statistical sciences that is integrated with a sound understanding of the business and scientific/technological context. The principal Sectors in which we work are Information Technology and Telecommunications and Services. We also work actively with the Integrated Manufactured Products, Mineral Processing and Metal Production, Marine, Land and Water and Petroleum Sectors and are responsive to the needs for our expertise that arise in other Sectors.

Outlook and Strategies

In 1999–2000 the Division will complete a strategic plan which covers all aspects of the Division's activities, taking into account the decisions from the triennial funding process. We will develop and implement a systematic process for measuring the performance of key activities. We will complete a review of our current approach to engagement with industry and implement a new approach which will strengthen the sector focus, facilitate the development and resourcing of stronger cross-disciplinary projects, enhance marketing intelligence, and increase the efficiency of business development. In particular, the high-level market comprehension studies undertaken in the Service Sector will be mapped into operational marketing objectives that will guide all business development in the area. As a result of the Divisional human resource planning exercise, strategies will be implemented to address the main business issues of capability development (including succession planning), rewards, recognition, recruitment and retention. We will develop closer links with CSIRO Telecommunications and Industrial Physics and the Australia Telescope National Facility in IT support to deliver cost-effective support to our users, improving network links, system backup and access for mobile users.

Planned Activities and Achievements**Information Technology and Telecommunications**

- Systems to capture, keep, locate and display documents for all time, thereby increasing the efficiency of all organisations.
- New and improved service delivery via the Internet by integrating different systems and platforms operated by a large number of business units.
- Innovative and intuitive interfaces to information systems including those based on touch, spatial sound and visual immersion.
- Tools and systems to improve design and productivity in developing complex distributed information systems.
- New and better information services by tailoring and synthesising documents and multi-media information, underpinning the growth of a significant digital communications industry.

Service

- Development of research projects leading to improved decision making in uncertain business environments (including pricing of complex options, detection of fraud and pricing of vehicle and accommodation rentals).
- Improved productivity and competitiveness of service sector organisations by developing an integrated approach to gathering, analysing, using and storing information in a multiplicity of forms.

- Improved cost effective health care delivery through development of innovative information management and resource optimisation strategies.
- Development and deployment of tools, technologies and prototypes to underpin personalised and enhanced service delivery via electronic commerce.
- Continued development of advanced imaging capability addressing important problems in asset monitoring and management and in the analysis of medical images to enhance diagnostic capability.

Other Sectors

- Simulation and optimisation of manufacturing processes to improve quality, productivity and cost-effectiveness. [*Integrated Manufactured Products*]
- Development of a Joint Venture with Conveyor Dynamics, Inc to build and exploit technologies related to computer simulation of granular flow. [*Mineral Processing and Metal Production*]
- Regional scale mapping and monitoring of vegetation status and regional scale risk analyses of salinity hazard, over the south west of WA, as part of the National Heritage Trust funded Land Monitor projects. [*Land and Water*]
- Commercialisation of the outcomes of the Genesis Project with CSIRO Petroleum Resources and new research activities in risk management. [*Petroleum*]
- Improvement to the reliability of stock estimates for Southern Blue Fin Tuna by explicit modelling of spatio-temporal variation. [*Marine*]

Planned Investment Profile by Sector	(%)
IT & Telecommunications	38.3
Service	18.5
Integrated Manufactured Products	8.1
Land & Water	7.7
Marine	4.9
Climate & Atmosphere	3.9
Mineral Processing & Metal Production	3.5
Built Environment	3.2
Other Sectors	11.9

Resource Summary 1999–2000

Total Revenue (\$'000)	32,178
—Direct Appropriation (\$'000)	22,801
—Research & Services (\$'000)	9,128
—Other (\$'000)	250
Earnings Performance Indicator (%)	28.6
Operating Result (\$'000)	-1,438
End of Year Cash Balance (\$'000)	4,170
Research Staff (EFT)	193
Total Staff (EFT)	264

FOCUS

CSIRO Minerals provides critical research, development and commercialisation support for Australia's mineral processing and metal production, energy, and petroleum industries to remain globally competitive. Its activities transform as—mined ores to mineral concentrates, chemically pure materials, and refined or unrefined metal. It achieves this through the innovative application of mineralogical, pyrometallurgical, hydrometallurgical, chemical, physical, engineering and mathematical skills and experience, and its leading-edge facilities for mineral characterisation, reaction, process modelling and diagnosis, and pilot plant construction and operation. These skills and equipment are applied from the atomic to the plant level to address economic, environmental and social issues driving the industry's profitability and sustainability.

Outlook and Strategies

The minerals industry operates against a backdrop of rapid change, reorganisation and uncertainty, characterised by increasing globalisation, erosion of technical capability, and the need to process ever more complex and often lower grade ore bodies in the face of declining commodity prices and lower profitability. At the same time, there is increasing public scrutiny of the environmental and social impact of mining and minerals processing and the life cycle of metal-containing products.

These pressures reflect on to CSIRO Minerals as an imperative to provide a rapid response to short-term productivity issues, while at the same time developing new technologies and strategies that will sustain the industry in the long term. Increasing salary and research infrastructure costs, in the face of declining industry expenditure on R&D, in turn, drive the need for increased efficiency and a very carefully targeted project portfolio.

To address these issues, the Division will relocate its North Ryde laboratories to QCAT in late 2000 to consolidate the iron ore processing activities in Queensland. The delivery to industry of new hydrometallurgical technologies will be realised in Perth through the expansion of the existing small-scale activities to mini-pilot-plant, continuous scale, in the nearby former Mineral Processing Laboratory of the WA Department of Minerals and Energy. Following the renewal of the AJ Parker and Clean Power from Lignite CRCs, the Division's involvement in both will increase substantially, and benefits will begin to accrue from the establishment of new centres in Industrial Fluid Dynamics, Fluidised Bed Technology, High Pressure Leaching and On-line Analysis. Linkages with industry will be further enhanced through the establishment of Industry Technical Panels and a multi-level Key Account Management system for major clients. Utilisation of the Division's intangible assets will be empowered through the establishment of a Knowledge Assets Management group at a senior level.

Planned Activities and Achievements

The Division is responding to industry's key drivers of profitability and sustainability by developing:

- Technologies for process intensification, simplification and optimisation.
- Technologies for processing lower grade, complex, impure and difficult-to-treat deposits.
- Practices which will increase the recovery of valuable components in ores and reduce waste and greenhouse emissions.

Expected achievements for the Mineral Processing and Metal Production, Energy and Petroleum Sectors:

- Successful commissioning of the Flamemag pilot plant at Clayton.
- Refinement of pressure leaching technologies for Nickel laterite ores.
- Establishment of decision tools for integrating social, political and technical issues.
- Improvements in the flotation of fine-grained base-metal ores.
- Support for the direct iron-making industry.
- Carbothermic routes for the production of aluminium and disposal of associated wastes.
- Fundamental understanding of interfacial reactions in smelting technologies.
- New technologies for in-situ and heap leaching of copper and gold ores, including bio-mineral processing. [cross-Sectoral activity with the Mineral Exploration & Mining Sector]
- Development of business and technological options for the establishment of a Titanium metal industry. [cross-Sectoral activity with the Integrated Manufactured Products (IMP) Sector]
- Improvements in the efficiency of Magnesium metal feedstock production and smelting cell. [cross-Sectoral activity with the IMP Sector]
- Better operations and maintenance scheduling systems.
- Further applications of on-line instrumentation and control technologies.

Planned Investment Profile by Sector (%)	(%)
Mineral Processing & Metal Production	97.0
Energy	2.7
Petroleum	0.3

Resource Summary 1999–2000

Total Revenue (\$'000)	31,795
—Direct Appropriation (\$'000)	20,795
—Research & Services (\$'000)	10,775
—Other (\$'000)	225
Earnings Performance Indicator (%)	34.1
Operating Result (\$'000)	-1,205
End of Year Cash Balance (\$'000)	-365
Research Staff (EFT)	201
Total Staff (EFT)	290

Acting Chief: Dr Albert Mau

FOCUS

CSIRO Molecular Science provides economic, environmental and social benefits to industry and the community by application of expertise in the biological and chemical sciences. Research is carried out in six strategic areas: Specialty Chemicals and Environmental Technologies, Protein and Pharmaceutical Sciences, Applied Chemistry and Polymer Science, Biotherapeutics and Delivery, Molecular Discovery and Processing, and Biomaterials and Bioengineering. This broad research base is applied to the development of industries including: pharmaceuticals and human health, chemicals and plastics, manufactured products, the built environment and petroleum.

Outlook and Strategies

Factors impacting the Sector such as economic viability, environmental sustainability, social responsibility and globalisation, combined with the prospect of high profits from a wide range of biotechnology products, have led to significant industry restructuring into more competitive traditional chemical firms and vertically integrated life science companies.

Our R&D will focus on innovation which will provide competitive advantage in the production of high value-added products, development of feedstocks in Australia, and in the reduction of environmental costs associated with meeting regulatory requirements. There will also be a significant leading edge push in bioprocessing. We will capitalise on our world-leading polymer technology platform developed as a result of the DuPont Strategic Alliance.

Management challenges and initiatives include; further development of our infrastructure; completion of a Divisional planning process to ensure a balanced portfolio aligned with Sector priorities; restructuring a number of support functions; increased attention to strategic HR; and to address issues raised by a recent Customer Satisfaction Survey.

Our aim is a balanced portfolio working with CRCs, government departments, universities and key local SME, large and Australian-based international companies. We will increase emphasis on international collaboration. Establishing intellectual property will remain a key strategy for commercialisation of R&D outcomes.

Planned Activities and Achievements

Pharmaceuticals and Human Health

- Commercialisation of the IGF / EGF Receptor anticancer research activities in collaboration with BRI and Ludwig Institute of Cancer Research .
- Faulding have registered Bleomycin in Australia and Canada, and tentatively in the EU. The drug is in production and will go to market in 1999–2000.
- Establishment of the technology platform and protocols for quality assured practices for Bioactive Molecule Discovery for natural products collections and chemical libraries. [also Chemicals & Plastics]
- Preclinical evaluation of the safety and effectiveness of a gene therapy system for the treatment of prostate cancer will be completed. Initiation of clinical trials is expected by the end of 2000.
- A DNA-based assay for prostate cancer that has shown promise in a small group of patients will be validated in a broader patient group and commercial partners sought for development.

- Evaluation of modified methotrexate derivates prepared by the patented TRIS methodology in the treatment of rheumatoid arthritis and other auto immune disorders.
- Establishment of drug delivery research aimed at capitalising on the polymer skills of the Division.
- New biomaterials developed for in situ cure intraocular lenses and for bone cartilage repair.
- Artificial cornea prototype refined and prepared for evaluation in animal model.

Chemicals and Plastics

- Negotiation with commercial partners regarding licensing arrangements for the Division's technologies in controlled free radical polymerisation.
- Establishment of research which will link microwave and enzymatic methods for manufacture of fine chemicals.
- Development of prototype devices for microwave chemistry and for making carbon nanotubes as electron-emitters for panel displays.
- Application of the CRC for Polymers' reactive extrusion inventions to develop specialty polymers.

Built Environment

- Commercial manufacture of MIEX (Magnetic Ion Exchange) resins for the treatment of drinking water. A plant will be commissioned late 1999.
- Global marketing of the RACOD Meter (for measuring biological contaminants in wastewater) with a royalty flow to CSIRO in late 1999.

Planned Investment Profile by Sector (%)

Pharmaceuticals & Human Health	58.5
Chemicals & Plastics	33.6
Built Environment	3.9
Integrated Manufactured Products	3.5
Petroleum	0.5

Resource Summary 1999–2000

Total Revenue (\$'000)	40,887
—Direct Appropriation (\$'000)	27,771
—Research & Services (\$'000)	11,776
—Other (\$'000)	1,400
Earnings Performance Indicator (%)	29.8
Operating Result (\$'000)	-1,706
End of Year Cash Balance (\$'000)	1,438
Research Staff (EFT)	277
Total Staff (EFT)	354

FOCUS

CSIRO Petroleum Resources' research is directed at maintaining an internationally competitive and sustainable Australian oil and gas industry and focuses on exploration, field appraisal and production. Skills in geology, geophysics, mathematical modelling, geomechanics and petroleum engineering are applied to four underlying themes: improving exploration performance, reducing costs with innovative technology, minimising the industry impact on marine environments, and maximising the value to Australia from its oil and gas resources. The Division, together with its sector partners, maintains strategic relationships within the Australian Petroleum CRC, and other national and international research agencies, together with service and operating companies. The results of our research are applied within the petroleum and energy sectors.

Outlook and Strategies

Oil and gas currently supply 53% of Australia's energy needs (forecast to rise to 62% within 10 years). The volatile oil price, coupled with a significant restructuring of the international industry presents both opportunities and challenges for Australia especially in light of relatively small domestic oil reserves by international standards. Australia is viewed internationally as an attractive place for investment by petroleum companies and given the trend by both operating and service companies to 'outsource' an increasing proportion of their technology development, CSIRO is well placed to make a significant contribution.

In 1998 the CSIRO Executive made a commitment to increase its investment into the petroleum sector, doubling the size of the Division over a period of approximately 5 years. The Division has been progressively expanding its range of research activities and staff numbers have increased. In the context of a detailed science plan, senior appointments have been made in geophysics and gas processing and a number of other appointments have been made in geophysics as well as expanding current activities.

Detailed planning has been completed for the National Centre for Petroleum and Mining Research at Bentley in the Technology Park adjacent to Curtin University; construction is due for completion in late 2000.

With assistance from ACIL Economics, an analysis of the expected value of the Division's research portfolio has been undertaken and has formed the basis of a petroleum sector marketing plan. Preliminary assessments indicate, for the industry, a net benefit to cost ratio exceeding 10 assuming a 20% discount rate.

Eight strategic research objectives have been identified and endorsed as high priority issues by industry:

- Increasing reserves and success rates with exploration.
- Increasing the quality of appraisal and field development.
- Cutting costs and increasing returns from drilling.
- Risk and data integration for business decisions under uncertainty.
- Deriving increased value from gas production and processing.
- Enabling economic flow rates from "tight" reservoirs.
- Geological disposal of CO₂.
- Enabling sustainable disposal of drilling and production waste.

Planned Activities and Achievements**Petroleum**

- Improved geological and geochemical methods for

understanding petroleum generation, charge dynamics, trap delineation and seal integrity.

- A better understanding of the kinetics of organic matter maturation, quantification of oil migration and trapping, and new approaches to determine the thermal histories of Australian sedimentary basins.
- Fault-seal trap assessment obtained through analysis of hydrodynamics in the Timor Sea.
- Technology for pore pressure prediction in advance of drilling.
- Geological / physical modelling capabilities, new techniques for upscaling, and related petrophysical measurements to predict production properties from pore to seismic / reservoir scale.
- Improved methods for interpolating reservoir properties incorporated into a package compatible with software used by industry.
- Modelling studies related to geological sequestration of CO₂.
- Technologies to support longer reach wells including drilling fluid properties.
- Coupled fluid flow—geomechanical models for multi-phase flow in fractured reservoirs.
- Development of environmentally acceptable water-based drilling fluids.
- Commercialisation of Genesis 2000 as a drilling design and learning system.

Energy

- Methods to predict "sweet spots" in tight reservoirs. Research will focus on generating economic gas flows from low permeability coals and sandstones in eastern Australia.

Planned Investment Profile by Sector (%)

Petroleum	96.5
Energy	3.5

Resource Summary 1999–2000

Total Revenue (\$'000)	15,772
—Direct Appropriation (\$'000)	8,736
—Research & Services (\$'000)	6,636
—Other (\$'000)	400
Earnings Performance Indicator (%)	43.2
Operating Result (\$'000)	-81
End of Year Cash Balance (\$'000)	-233
Research Staff (EFT)	50
Total Staff (EFT)	68

Chief: Dr Jim Peacock

FOCUS

CSIRO Plant Industry carries out research in the plant sciences to make Australia's agri-food, fibre and horticultural industries more profitable and sustainable. A major focus is on improving production efficiency and reliability while maintaining the natural resource base. We are placing increasing emphasis on product quality related objectives for the processing and manufacturing sectors and the development of novel plant products. Our research also contributes to conservation of biodiversity in the Australian flora and the implications of global climate change for natural and agricultural ecosystems.

Outlook and Strategies

Participation in CSIRO Sectors and the Division's own strategic thinking have identified areas of research deserving of increased investment to include: genomics; sustainable farming systems research; fungal disease prevention and control; and health potential and human nutrition in plant improvement programs. We intend to extend these priority areas through partnerships with colleagues both in other research institutions and as cross-Sectoral issues within CSIRO.

Intellectual property (IP) development, and freedom to operate other proprietary IP, remains a prominent issue. A major initiative in 1999–2000 will be commencement of research programs in the Graingene Joint Venture between CSIRO, AWB Limited and the GRDC. Agreed programs will span genomics, new breeding and product specification technologies, yield increase and performance traits, resistance to pests and diseases, crop nutrition and abiotic stress and product quality. Each of these should generate important IP for grains industries.

Increased investment in genomics will provide for the acquisition of new microarray technology for understanding the basis of plant development, yield and quality attributes, and the setting up of a gene informatics capability.

80 research and technical staff will occupy the new CSIRO *Discovery* laboratories, providing state-of-the-art facilities for modern plant biology research.

A proportion of resources currently focused on management of grazing systems will be redirected into the management of mixed farming, recognising the critical importance of pastures in the context of sustainable cropping systems.

Planned Activities and Achievements

- Application of the new techniques in genomics to identify genes controlling plant development, using a combination of microarray and gene tagging technology. *[Field Crops]*
- Advanced testing of wheats, selected to have high transpiration efficiency, for grain quality and yield to identify lines for potential commercial release. *[Field Crops]*
- Development of innovative crop rotations which include species that not only break cereal root disease cycles, but also free up some of the 'fixed' soil phosphorus and make it available to subsequent crops such as wheat. *[Field Crops]*
- Estimation of the partition of rainfall between plant uptake and drainage for different ecosystems as the basis

for recommending sustainable agricultural systems, on both spatial and temporal scales. *[Field Crops]*

- Testing of maize rust resistance genes in transgenic barley as a possible additional source of novel disease resistance. *[Field Crops]*
- Identification of major factors in the evolution of genes for disease resistance in crops and native plants. *[Field Crops]*
- Use of decision support tools to evaluate and manage options for mixed farms where crops and pasture-based systems need to be integrated for optimum profit and sustainability. *[Field Crops]*
- Planting, under GMAC guidelines, of Australia's first transgenic grapevines and citrus in the field for experimental evaluation. *[Horticulture]*
- Release of new varieties from the National Citrus Breeding Program to industry for testing and evaluation. *[Horticulture]*
- Development of a framework for identifying different forms of plant rarity and applying this to distribution patterns of Eucalyptus. *[Biodiversity]*
- Establish the validity of using small-scale mixograph measurements to estimate the processing qualities of wheat flour. *[Food Processing]*
- Determine the genetic basis of a new starch-type recently obtained in barley. *[Food Processing]*

The Division will also oversee the development and completion of *Discovery*—including the interactive exhibits, the resource centre, and other public facilities.

Planned Investment Profile by Sector	(%)
Field Crops	46.4
Horticulture	22.9
Biodiversity	9.4
Food Processing	8.6
Meat, Dairy & Aquaculture	6.3
Textiles, Clothing & Footwear	4.7
Climate & Atmosphere	1.4
Integrated Manufactured Products	0.3

Resource Summary 1999–2000

Total Revenue (\$'000)	56,268
—Direct Appropriation (\$'000)	31,586
—Research & Services (\$'000)	23,862
—Other (\$'000)	820
Earnings Performance Indicator (%)	43.0
Operating Result (\$'000)	-1,679
End of Year Cash Balance (\$'000)	5,394
Research Staff (EFT)	442
Total Staff (EFT)	568

FOCUS

The *RV Franklin* is a world-class ocean-going research platform managed by CSIRO on behalf of the marine science community of Australia, and capable of supporting research in physical, chemical and biological oceanography and marine geosciences. Ship time is available to Australian marine researchers and agencies through a competitive proposal process, with the major costs of operation funded by the National Facility. An independent Steering Committee oversees the operation and strategic planning of the facility, and is supported by a Scientific Advisory Committee. Research relevant to the CSIRO Marine, Climate and Atmosphere, Minerals, Energy and Mining Sectors is conducted from the *RV Franklin*. Specialised electronic, data processing, chemical analysis and other scientific and technical services are provided by staff from CSIRO Marine Research, as part of the National Facility.

Outlook and Strategies

Australia's Oceans Policy identifies the need for basic information about the Exclusive Economic Zone, in support of Regional Marine Plans as well as climate and weather services, defence and safety at sea. The *RV Franklin* provides a fully-instrumented, national facility platform for conducting deep ocean surveys in support of Oceans Policy outcomes. That work will be shared with other appropriate research vessels, including the *RV Southern Surveyor*.

The independent Steering Committee includes members from industry, to foster greater marine industry involvement in the strategic management of the National Facility.

A Scientific Advisory Committee, comprised of experienced marine researchers from major marine research agencies and universities with marine programs, provides technical and scientific advice to the Steering Committee, and reviews proposals for usage of the National Facility.

Marine geoscience is an area of increasing demand for the *RV Franklin*, with specialised equipment needs. Some of that work may be more sensibly done on the *RV Southern Surveyor*, which is technically more suitable for heavy lifting and geo-stationary applications. Mechanisms for extending the National Facility to cover use of the *RV Southern Surveyor* will be examined.

Equipment enhancements planned for 1999–2000 include upgrades of the water column profiling equipment (CTDs), a new underway system to measure temperature and salinity, and high precision GPS navigation systems to improve the quality of underway profiles of upper ocean current.

Planned Activities and Achievements

- During 1999–2000 *RV Franklin* will conduct eight cruises in support of the research objectives of CSIRO Marine Research, six Australian Universities and collaborating scientists from eight overseas research institutions in Canada, the USA, Switzerland and Germany.
- Ship operations are scheduled for the Tasman Sea, Coral Sea, Gulf of Carpentaria, the North West Shelf of Australia, and the North-East Indian Ocean.
- Research conducted from *RV Franklin* will contribute to improved understanding and in some cases predictions about:

- the influence of wind and the East Australian Current on biological productivity and fisheries yield along the South-East Queensland and New South Wales coasts.
- basin-scale ocean variability within the Tasman and Coral Seas.
- tidal mixing and the seasonal cycle of the Leeuwin Current.
- Indian Ocean intra-seasonal oscillations, believed to cause winter rain variability in Australia, through southward-propagating disturbances of the monsoon rain patterns of the equatorial Indian Ocean.
- Marine geoscientific cruises around Australia in 1999–2000 will examine:
 - sedimentation processes and paleoceanographic variability in sediments from isolated carbonate plateaus in the western Coral Sea.
 - the nature and origin of modern and Late Quaternary carbonate sediments on the southern and central North West Shelf and whether economically viable deposits of precious and industrial minerals are present.
 - the geological structure of the earth's crust in the Gulf of Carpentaria, particularly the electrical conductivity anomaly, and an understanding of the tectonic evolution of northern Australia.
- An acoustic source will be installed in the vicinity of the Cocos Islands as a key element of the acoustic thermometry network, with the long term objective of measuring climate scale temperature change in the Indian Ocean.

Planned Investment Profile by Sector (%)

Marine	100
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Resource Summary 1999–2000

Total Revenue (\$'000)	4,643
—Direct Appropriation (\$'000)	4,463
—Research & Services (\$'000)	150
—Other (\$'000)	30
Earnings Performance Indicator (%)	3.3
Operating Result (\$'000)	-681
End of Year Cash Balance (\$'000)	364
Research Staff (EFT)	0
Total Staff (EFT)	8

Chief: Dr Dennis Cooper**FOCUS**

CSIRO Telecommunications and Industrial Physics (CTIP) provides innovative commercial solutions for industry in the telecommunications, security, medical, manufacturing, mining and energy areas and provides national standards of measurement and traceability supporting product development, testing and trade. It continues to invest in a long-term, flexible strategic research base in telecommunications, imaging, industrial sensing, services and measurement. CTIP is responsible for the National Measurement Laboratory (NML)—a National Facility—and NASA Operations in Australia.

Outlook and Strategies with Planned Activities and Achievements—by Sector

Information Technology and Telecommunications

To maximise benefits to Australia from industry opportunities triggered by deregulation, growth of the Internet and changes to defence purchasing policy, CTIP has established linkages with multinationals and their Australian alliance partners and is applying its unique skills to broadband wireless networks, mobile communications, broadband telecommunications networking and defence sub-systems.

- Transfer to industry of new microwave integrated circuit technology and a world-first two-way emergency mine communication system.
- Work on 3rd generation mobile systems will begin (with the Australian Telecommunications CRC).
- A major new demonstration broadband-wireless-access system.
- A space-qualified transponder for an Australian satellite (FedSat) due for launch by 2001.
- New millimetre-wave power circuits at frequencies up to 100GHz using Gallium Nitride.
- Evaluate the first Indium Phosphide technology communications circuits and submit revised designs. (Chief Executive's special project)

Integrated Manufactured Products

CTIP's major goal is to assist in raising the capacity of local manufacturers to compete globally in the areas of instrument manufacture and process control.

- The Australian Precision Optics Centre will be introduced as a marketing tool in the development of a start-up, small-volume, niche market manufacturing activity foreshadowed for 2002.
- Highly efficient electric drive systems will be developed for use in hybrid motor vehicles.
- A new range of high-resolution ground-probing radar instruments targeting surveillance and land mine detection markets will be produced for license to an Australian SME.

Measurement Standards

New global Mutual Recognition Agreements between National Metrology Institutes will have a major impact on the NML. New technologies, environmental issues and health and safety requirements will bring increasing demands for new services and expertise.

- New calibration services for electromagnetic compatibility test equipment and ultrasonic power.
- Participation in regular international 'key comparison' programs and third-party accreditation to ISO 17025 for NML's calibration services.

- Leading-edge R&D into 'trapped-ion frequency standards' and an 'atomic-based mass standard'.

Service Sector

The marketing and delivery of services is increasingly dominated by the Internet and electronic commerce. With an aging population there is an urgent need to control the rising cost of health care while maintaining equity of access and quality of service.

- Home care of elderly people will be enhanced using expertise in sensors and telecommunications.
- Commercialisation of the SQIS face recognition technology will proceed in areas such as physical access control, user verification and searching of police databases for wanted and missing persons.
- 'Face-in-a-crowd' software will be used to develop surveillance applications for areas such as airports, railways stations and casinos.
- The development of an acoustic vision system to image underwater mines will continue.

Built Environment

The electrical power industry continues to face deregulation and privatisation, with an increasing emphasis on efficient utilisation of assets.

- Technologies for next generation superconducting tapes with much higher current carrying capacity.
- Development of a new range of sensors for monitoring electricity supply industry assets to improve service life and reduce maintenance costs.
- Design and testing of underground power transmission cables.

CTIP participates in six Cooperative Research Centres.

Planned Investment Profile by Sector (%)

IT & Telecommunications	33.1
Integrated Manufactured Products	23.5
Measurement Standards	22.4
Service	10.5
Built Environment	3.9
Other Sectors	6.6

Resource Summary 1999-2000

Total Revenue (\$'000)	55,750
- Direct Appropriation (\$'000)	39,750
- Research & Services (\$'000)	15,700
- Other (\$'000)	300
Earnings Performance Indicator (%)	28.3
Operating Result (\$'000)	149
End of Year Cash Balance (\$'000)	10,373
Research Staff (EFT)	342
Total Staff (EFT)	465

FOCUS

CSIRO Textile and Fibre Technology services the Textiles, Clothing and Footwear (TCF) Sector and provides social and economic benefits to Australia through research into and the development of, advanced technologies for the Australian wool, cotton, textiles and leather industries. Research areas range from the specification of raw wool, to finished wool fabric, to production of hides, skins and leather with minimal impact to the environment. The emphasis is on ensuring sustainable production at all levels. The Division has a wide range of multidisciplinary skills capable of servicing wool, cotton, textiles and leather at national and international levels. We are recognised as the world's leading wool research laboratory supporting Australia's third largest earner of export revenue.

Outlook and Strategies

The Australian wool industry continues to suffer depressed prices due to low consumer demand and the slow recovery of the Japanese economy. Australian cotton production now exceeds wool production although exports of raw wool still exceed \$3 billion compared with cotton and hide, skins and leather exports at \$1 billion each.

The sheep skin sector is contracting whereas the amount of finished leather continues to grow slowly. High quality products are successful.

In response to a significant reduction in wool industry funding the Division is refocusing its activities to rebuild its external income by broadening its customer base to service the cotton and textile industry.

A cotton textile research unit has been established as part of the CRC for Australian Cotton. Cotton and textile technology skills are being acquired. The Division's name has been changed to reflect its broader research base and a new management structure has been implemented.

The Division will grow its consulting activities with Australian industry and build longer-term relationships through an account management system. The business development activities will be strengthened by the appointment of a marketing manager and production of new marketing material to advertise the wider capabilities of the Division to the TCF Sector.

Planned Activities and Achievements

Textiles, Clothing and Footwear

- A new version of Sirolan Laserscan, which will completely replace the airflow method for all pre-sale testing of greasy wool, will be released through our licensee, the Australian Wool Testing Authority Ltd.
- A major international trial to establish the processing benefits of long wools, which are increasingly becoming available through new breeding schemes, will be completed and the results reported to growers, breeders and processors.
- A new instrument for the detection and classification of coloured fibre contaminants will be developed and commercialised to the global wool textile industry.
- New spinning technology developed with The Woolmark Company to improve the durability of appearance in wool knitwear will be commercialised following the completion of trials with key spinners in Italy, Australia and Japan.

- New fabric conditioning technology, "CLIMA", developed with an Italian textile machine manufacturer will be commercially released in June 1999.
- Two manufacturers will be licensed for the manufacture of Sportwool fabrics.
- Research on wool fibre formation and structure-property relationships, conducted within the CRC for Premium Quality Wool, will be completed, with emphasis on studies of wools from transgenic sheep.
- A new initiative, supported by DISR, will provide specialised training to industry.
- A collaborative project with The Woolmark Company and a local cotton processor is aimed at developing high performance products in blends of cotton with wool.
- A technology for the production of pure wool, easycare trousers that can be machine-washed, tumble-dried and require no ironing will be commercialised.
- Tannery processes to increase production, yield and profitability are being trialed by industry and a new thickness measuring system will be commercialised.
- A new patented card wire will be commercialised by a large overseas manufacturer of cotton and synthetic card wire. This should drive an effective program of improvement in the processing of wool and hence the return to the woolgrower.
- New markets for wool poor blend yarns in apparel and upholstery fabrics will be developed in conjunction with an Australian spinning plant.

Planned Investment Profile by Sector (%)

Textiles, Clothing & Footwear	100
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Resource Summary 1999–2000

Total Revenue (\$'000)	21,823
—Direct Appropriation (\$'000)	12,523
—Research & Services (\$'000)	8,900
—Other (\$'000)	400
Earnings Performance Indicator (%)	41.5
Operating Result (\$'000)	-454
End of Year Cash Balance (\$'000)	5,933
Research Staff (EFT)	129
Total Staff (EFT)	222

Chief: Dr Elizabeth Heij

FOCUS

Tropical Agriculture provides options and solutions for northern Australian agriculture and related natural resource systems. The region's agricultural industries—beef cattle, aquaculture, sugar, and dryland cotton and grains—have three common concerns. These are: to increase the efficiency and profitability of production; to improve the quality and hence international competitiveness of their products; and to ensure that their production systems are ecologically sustainable. The Division takes a strong systems approach in addressing the R&D needs of these and other industries. In doing so, it draws on a broad range of skills and disciplines, ranging from molecular biology to natural resource economics.

Outlook and Strategies

1999–2000 will see an upswing in political and financial interest in the “biotechnology revolution,” with an accompanying focus on securing a competitive place for Australian science and industry through public and private investment in biotechnology R&D. Commodity prices, however, will remain under downward pressure, driving agricultural producers to focus on profitability. At the same time, public concerns will heighten scrutiny of the environmental credentials of these enterprises.

In response to these global drivers the Division will increase emphasis on molecular genetics and genomics, and enhance its systems approaches to enterprise and whole-of-industry profitability linked with minimisation of undesirable on-site and off-site impacts. Investment of appropriation funds will be 80% to industry profitability and industry-linked resource management (Field Crops; Meat, Dairy & Aquaculture) and 20% to catchment and regional scale resource issues (Land & Water; Biodiversity; Climate & Atmosphere; Marine).

Planned Activities and Achievements**Meat, Dairy and Aquaculture**

Development of research capabilities in functional genomics and systems approaches to the cattle production value chain; building capacity to develop strategies and tools for integrating production, profitability, and resource management in livestock enterprises. Improved control of meat quality characteristics through breeding plans based on advanced genetic technologies; genetic information delivered to industry via innovative spin-off and licensing mechanisms. Continuing participation in the CRC for Cattle and Beef Quality.

Field Crops

Genetic improvement of field crops (grains and sugar), focussing particularly on development and application of biotechnology approaches. Strategic research on development of economically and environmentally sustainable farming systems for grains/cotton and sugar. Continuing participation in the CRCs for Sustainable Sugar Production and Tropical Plant Protection.

Land and Water, and Marine

Implementation of a new multi-Division, multi-agency program in north Western Australia for collaborative R&D on integrated management of land, water and marine resources. Redesign of northern cropping systems to improve utilisation of water and nutrients for improved efficiency and sustainability of production.

Biodiversity

Improving understanding of the impacts of land use on biodiversity in northern rangelands. Developing principles of land management for conserving critical elements of biodiversity and maintaining ecosystem function. Defining impacts of exotic tropical woody weeds and developing strategies to reduce the impacts.

Climate and Atmosphere

Improving predictive capability for the impacts of climate variability and climate change on northern production systems, including assessment of the value of long range forecasts for managing production, economics and natural resources.

Research Infrastructure and Support

Joint redevelopment of the Cunningham Laboratory site at St. Lucia in Brisbane (with the University of Qld), will move into the construction phase; joint master-planning of the adjacent CSIRO Long Pocket and State Government Science Centres at Indooroopilly in Brisbane will be completed to the point of seeking major investment; and cooperative arrangements with Central Queensland University will be progressed through Rendel Laboratory in Rockhampton.

Following recent staff reductions and line management restructuring, 1999–2000 will be a year of consolidation. There will be additional focus on developing strategic business capability, and on linking forward planning aspects of finance and human resource management to science needs and overall business strategy.

Planned Investment Profile by Sector	(%)
Meat, Dairy & Aquaculture	40.6
Field Crops	39.8
Land & Water	10.9
Biodiversity	4.8
Climate & Atmosphere	2.0
Marine	1.9

Resource Summary 1999–2000

Total Revenue (\$'000)	33,262
—Direct Appropriation (\$'000)	21,853
—Research & Services (\$'000)	10,283
—Other (\$'000)	1,126
Earnings Performance Indicator (%)	32.0
Operating Result (\$'000)	205
End of Year Cash Balance (\$'000)	2,779
Research Staff (EFT)	202
Total Staff (EFT)	293

FOCUS

The Division's focus is the terrestrial ecology of Australian landscapes; landscapes that are used for productive purposes as well as those managed for conservation. With specialist skills in a broad range of ecological and biological disciplines it tackles national, regional and local scale resource management issues which require a strategic research foundation. The Division places particular importance on developing Australia's capacity to predict and respond aptly to future environmental change, whether caused by global warming, land degradation or the interaction of many other possible causes. Producing tools which assist policy makers and land managers make complex decisions about competing uses of land is often a key objective.

Outlook and Strategies

Internally, a productive, stable year is anticipated. Improvements in project strategic planning were successfully implemented in the last year; this year they will be complemented by changes in our internal review and evaluation processes. The successful renewal of two CRCs in which the Division has a major involvement will ensure minimal disruption during the transition towards the new sets of objectives.

A significant new research direction will be initiated during the year, using resources re-directed from existing work. The new area aims to explore and establish the economic value of the services provided by ecosystems to people. Most of these services, such as crop pollination, water filtration and maintenance of soil productivity are uncosted and unpriced in the market, so send no signals to the market about their status and supply. The major outcome from this research will be a capacity to use our natural resources more sustainably.

Five new post-doctoral fellows were appointed during the last year as the result of a legacy. These will enhance our research outputs on: biodiversity indicators; modelling and genetic analysis of the conservation significance of dispersal by native animals in fragmented ecosystems; and modelling of the complex human and natural systems of Australia's agricultural zone.

Externally, the general trend for governments to induce the private sector and communities to share in the task of conserving Australia's natural resources will continue. While this makes it challenging for the Division in gaining support for much needed research at larger scales, it also offers exciting opportunities for researchers to work with communities in achieving significant conservation outcomes.

Planned Activities and Achievements

- Identification of current best practice for managing mice on irrigated farms in southern Australia.
[Field Crops]
- Achievement of immune enhancement for an immunocontraceptive antigen from the fox, suitable for use in bait delivered vaccines. [Biodiversity; Meat, Dairy and Aquaculture; Textiles, Clothing and Footwear]
- Assessments of the value of re-releasing rabbit calicivirus in the Southern Tablelands. [Biodiversity; Meat, Dairy and Aquaculture; Textiles, Clothing and Footwear]

- Comparison of the relative sustainability of stakeholders' land use scenarios in the Western Division of NSW and completion of indicative plans for preferred land use in the NE Goldfields of WA. [Biodiversity; Land and Water; Textiles, Clothing and Footwear]
- Recommendations for the management of foxes, feral cats and their habitat in white box woodland to provide refuges for wildlife. [Biodiversity]
- Methods and tools for deriving maps of the original distribution of plant species and communities in the Central Lachlan Valley for use in revegetation programs. [Biodiversity; Land and Water]
- Assessment of the implications of long term degradation drivers on broad scale agricultural production in the future. [Biodiversity; Land and Water]
- Completion of a comprehensive set of policy recommendations on the use of incentives for protecting remnant vegetation. [Biodiversity]
- Methods for costing the regional implementation of grazing management strategies for conserving biodiversity in two areas of the rangelands. [Land and Water; Biodiversity]
- Assessment of the degree to which key prospective tax instruments could contribute to sustainable management of rangelands by pastoralists. [Land and Water; Meat, Dairy and Aquaculture]

Planned Investment Profile by Sector (%)	
Biodiversity	53.9
Land & Water	15.0
Textiles, Clothing & Footwear	9.5
Meat, Dairy & Aquaculture	6.7
Field Crops	6.2
Climate & Atmosphere	3.4
Other Sectors	5.3

Resource Summary 1999–2000

Total Revenue (\$'000)	22,890
—Direct Appropriation (\$'000)	15,977
—Research & Services (\$'000)	6,521
—Other (\$'000)	391
Earnings Performance Indicator (%)	29.0
Operating Result (\$'000)	187
End of Year Cash Balance (\$'000)	3,818
Research Staff (EFT)	129
Total Staff (EFT)	204

The Chief Executive and four Deputy Chief Executives, collectively CSIRO's Executive Committee, provide high level strategic leadership, business development, performance review and management of the Organisation. The Chief Executive is accountable to the Minister and the CSIRO Board for the total performance of the Organisation. The Deputy Chief Executives are accountable to the Chief Executive for the performance of groups of Sectors, Chiefs and their Divisions. They are also responsible for the oversight of areas of corporate support, for major sites and their development, for fostering cross-Divisional collaboration and for promoting CSIRO through internal and external interactions.

Outlook and Strategies

CSIRO is beginning to reap the benefits of strategies implemented at the commencement of the triennium:

- the new Sector Advisory Committees have made a valuable contribution evidenced in a progressive sharpening in the focus of Sector research portfolios;
- the merger of Divisions and other initiatives taken to streamline or restructure Divisional operations have resulted in most Divisions now enjoying a more robust financial position.

These achievements, combined with a steady Budget outcome, strengthen CSIRO's capacity to make further significant contributions to the achievement of national economic, social and environmental goals. They firmly position CSIRO as Australia's leading provider of multi-disciplinary, team-based, strategic research for industry and government.

The Executive will now seek to take these recent advances to the next level by further developing mechanisms to strengthen, in particular:

- accountability for performance within the Organisation;
- business planning and development skills;
- the early identification and involvement of specific customers or collaborators whose participation in particular R&D programs will facilitate improved capture of benefits from scientific achievements.

The Executive will maintain its focus on developing high level strategic relationships with senior representatives of key customer, collaborator and stakeholder groups in order to:

- ensure that CSIRO has access to the best advice and can make effective contributions to government and industry decision making, particularly through the input of Sector Advisory Committees;
- identify, assess and implement appropriate strategic responses to significant national and international issues and changes as they occur;
- secure appropriate terms for funding of CSIRO research by government agencies and R&D corporations.

Where consistent with CSIRO's strategic directions, further opportunities for development of more effective collaboration between CSIRO and other research providers will be pursued.

Planned Activities and Achievements

- Monitor and support progress of the eight 'Executive's Special Projects' announced in December 1997 with funding of \$22.4m over three years.
- Oversee the development of Sector Plans for the funding triennium 2000–01 to 2002–03 in accord with decisions on Sector priorities and investments announced in May 1999.
- Consider options for better coordination and enhancement of CSIRO's capabilities in biotechnology and bioengineering for a range of outcomes across many Sectors.
- Initiate new Executive's Special Projects in specific areas of national and international importance identified through the Sector planning process.
- Monitor progress in implementation of actions in response to issues raised in the 1998 staff opinion poll.
- Strengthen mechanisms of business reporting to the Board, including development of improved measures of organisational performance.
- Decide, after full consultation and discussion with staff, on revised mechanisms for CSIRO's current performance appraisal and remuneration systems.
- Foster implementation of approved processes for key-account management.
- Oversee continuing development of R&D infrastructure through implementation of approved property management and capital investment plans, co-location initiatives, and consolidation of sites and site services.
- Monitor performance of CSIRO's multi-million dollar contract to help LIPI, the Indonesian national R&D agency, strengthen its research management and commercialisation practices.

Resource Summary 1999–2000

Estimates for the CSIRO Executive are incorporated in the resource summary for the Corporate Units.

FOCUS

The role of CSIRO's Corporate Units is to promote organisational cohesion and facilitate the research and development activities undertaken by CSIRO's Division in an efficient manner. The specific role of each unit is described below, together with a statement of activities and achievements planned for 1999–2000.

Corporate Executive Office

The Corporate Executive Office provides integrated support to the Board, Chief Executive, Deputy Chief Executives and Chiefs/Divisions to assist them in the efficient conduct of their business in the areas of policy development, interaction with Ministers and government departments/agencies, international matters, the public awareness and promotion of science, school education activities and the provision of an enquiry service for the public and industry. The Office provides briefing and action advice on meetings, correspondence and activities involving the Chairman, Board members and Chief Executive, and is responsible for the coordination and management of Board and Executive meetings. In 1999–2000, a central task will be the completion of the corporate governance framework, much of which was developed and put in place during 1998–99. The Corporate Executive Office encompasses the following Corporate Units: Government Business, International Scientific Liaison, CSIRO National Awareness Program, CSIRO Education Programs and CSIRO Enquiries.

Government Business provides a central contact point, co-ordination, analysis and quality control for CSIRO's corporate interactions with the Minister for CSIRO, other Ministers as appropriate, Government Departments and other parts of the Australian R&D system. Planned activities and achievements include:

- Coordination and management of CSIRO's negotiations on Government policy issues, including the 2000–2003 Triennium Funding Output Purchasing Agreement, associated Performance Indicators and the study proposed by the Department of Finance and Administration on CSIRO's Outcome-Outputs framework, and developments with the Cooperative Research Centres Program. Liaison with Government Departments and agencies (including committees with ISR, AFFA and DSTO) and with other parts of the research system, enabling input on issues relevant to CSIRO and collaboration when appropriate. Support for CSIRO's representations to Government on the importance of R&D and appropriate levels of funding. Organisation of a useful and interesting Workshop with Government in February 2000 as part of finalising the CSIRO Strategic Research Plan.
- Provision of briefings for the Chief Executive, particularly for participation on high level councils and committees (Prime Minister's Science, Engineering and Innovation Council, the Standing Advisory Committee

for PMSEIC, the Coordination Committee on S&T, the CRC Committee) and facilitation of CSIRO's contributions in those fora. Representation of CSIRO on working groups and interdepartmental committees as appropriate. Provision of briefings for meetings with portfolio Ministers. Provision of quarterly summaries of a wide range of policy issues and inquiries to alert senior staff to opportunities for input relevant to their areas. Preparation or coordination of corporate submissions and other input to external inquiries which arise during 1999–2000. Awareness of national and international developments in S&T policy and programs and provision of briefing and advice to senior staff when relevant to CSIRO.

- Coordination and provision of Ministerial briefings and correspondence; briefing of Ministerial staff in portfolios with a major interest in R&D; briefings for other Parliamentarians on CSIRO; coordination of briefings for Senate Estimates hearings and follow up questions; coordination and preparation of CSIRO responses and contributions to Questions on Notice and Question Time Briefs; coordination of Parliamentarians' visits to CSIRO sites; advice to Chief Executive and Deputy Chief Executives on matters raised in Parliament affecting CSIRO; advice to senior CSIRO staff on protocols and processes associated with Parliament. Responsibility for obtaining and securing Cabinet documents and acquiring coordination comments. Maintenance of database of Ministerials, particularly Ministerial approvals required under the *Science and Industry Research Act 1949*.

International Scientific Liaison supports CSIRO's corporate and statutory responsibilities in relation to international matters, with emphasis on international scientific liaison. Planned activities and achievements include:

- Provision of advice and support for the development of corporate policy on international matters. Preparation of submissions and representation of CSIRO for Government inquiries on international matters. Administration and review of CSIRO's international S&T agreements and facilitation of activities under them. Strengthening of CSIRO's liaison on international matters with Departments, agencies and external bodies such as specific country business councils and embassy staff. Monitoring of developments in international fora such as APEC, to enable CSIRO input.

- Fostering of CSIRO's contributions to international scientific and technical cooperation. Effective briefing of the Chief Executive and Deputy Chief Executives for high level international meetings and seminars.
- Representation of CSIRO and coordination of CSIRO's interface with visiting delegations. Representation of CSIRO on the Australian Steering Committee on Collaboration for S&T Australia/Indonesia and representation of Australia on the Commonwealth Science Council, focussing on practical ways to achieve effective collaboration.
- Provision of a corporate focus for development of activities with selected countries, particularly Indonesia, China, Italy, France and other countries/institutions for which CSIRO provides corporate funding. Support for the development of strategies and activities associated with the CSIRO Indonesia Committee. Briefings for Divisions on how International can assist in identifying and facilitating international opportunities and sources of support; assistance with Divisional presentation overseas of corporate as well as Divisional information. Maximisation of the benefits of aid-related activities, including through provision of training placements.
- Management and enhancement of the CSIRO International website, annual updating of the CSIRO internal information document Funds for International Scientific Activities, management of a comprehensive database on CSIRO's international activities and its relationship with the emerging PSS, and presentation of an annual report on CSIRO's international activities to the Board, with subsequent release as a public document.

CSIRO National Awareness Program seeks to achieve increased national awareness of CSIRO's research activities, particularly via the media; improved industry awareness of the benefits of research; and enhanced political awareness of the importance of science and the contribution of CSIRO. Planned activities and achievements include:

- Enhancement of national and overseas media coverage of CSIRO scientific achievements, particularly via the "Australia Advances" and "Sci-Files" television and radio series.
- Consolidation of high quality National Science Briefings in Federal Parliament and State Parliaments and introduction of Parliamentary Information Initiative.
- Further development and consolidation of a program for industry and national media using a network of professional science writers delivering major articles to influential publications.
- Preparation and delivery of the CSIRO Annual Report according to Parliamentary legislation and new regulations in the Commonwealth Authorities and Companies Act.

CSIRO Education Programs aims to alert school students, their families and teachers of science to the contribution of CSIRO and other scientific research to our

community, encourage students to participate in scientific activities, especially those related to the applications of science, and encourage students to take up careers in science. Planned activities and achievements include:

- Targets for 1999/2000 include 150,000 students/teachers attending CSIROSEC sessions, 17,000 members of CSIRO's Double Helix Science Club, an audited circulation of 19,000 for The Helix magazine, circulation of 3,000 for Scientific magazine, 300 students in CSIRO Student Research Scheme, 5,000 students achieving CREST Awards, 750 student entries in the BHP Science Awards and 250 schools participating in the GLOBE program.
- Obtain external funding for a number of the programs and, in particular, CSIRO's Double Helix Science Club.

CSIRO Enquiries serves the Organisation's stakeholders by responding to requests for information about its research and activities. The major aim of the unit is to support Divisions by handling general enquiries on their behalf and to enhance CSIRO's reputation as Australia's leading research institution by making information about its research easily accessible. The unit receives in excess of 40,000 enquiries annually from its clients, the general public (55%), students and educators (18%), the commercial sector (20%) and other research institutions (7%). The predominant method of client contact is by telephone via a national telephone number, although an increased use of the Internet is becoming evident. Specific information programs have been established to service major client groups. The unit maintains an information resource database, on which is recorded reference to all Divisional and corporate information sheets, publications, CD roms and videos, media releases, promotional literature and information on consulting and commercial services offered to industry. Planned activities and achievements include:

- Surveying of CSIRO Divisions to determine the level of satisfaction with the current services provided by CSIRO Enquiries and to gather suggestions for improvements or additional services required.
- Surveying schools throughout Australia to determine how CSIRO Enquiries can best meet the information needs of students and educators in the new millennium, also gathering data on preferred methods of information-delivery.
- Liaising with Sector Coordinators to ascertain how CSIRO Enquiries can support sector marketing activities and developing programs and procedures to assist.

Corporate Finance

Corporate Finance provides advice and services to support financial planning and financial management within CSIRO. It also specifies and implements financial systems to meet line management and statutory reporting requirements. Planned activities and achievements include:

- Support for the Chief Executive and Board in the development of strategy for securing funding from Government for the next triennium.

- Improvement of financial planning and management in CSIRO by working with Divisions to improve budgeting, accounting and management practices, especially in the areas of costing, pricing and project accounting.
- Preparation of the Organisation's financial data for Federal Budget documentation. In partnership with the Government Business unit, development of the related triennium funding agreement.
- Development of financial performance reports for Executive Committee and the Board. Production of CSIRO's statutory financial reports, including facilitation of Audit Committee review and Board approval.
- Development and promulgation of financial policies and procedures relevant to CSIRO's business and statutory requirements.
- Support and development of UNIBIS and financial reporting systems, in particular, prepare for implementation of a GST.
- In partnership with Corporate Information Technology Services, development, implementation and subsequent support of PSS and associated management reports to meet the needs of project managers in Divisions and the Organisation's Sector planning and reporting process.
- Review CSIRO's purchasing credit card facilities and implement replacement of the Government Purchasing Card

Corporate Human Resources

Corporate Human Resources provides strategic leadership through the provision of advice and the development of processes and policies that will maximise the contribution of staff to the achievement of CSIRO goals. Planned activities and achievements include:

- Development, in collaboration with Divisions of an effective CSIRO-wide HR Network.
- Further improvements to the performance management process in CSIRO.
- Further improvements to employee consultation arrangements.
- Provision of high quality HR and non-commercial legal advice to the Executive and Divisions.
- Implementation of the agreed occupational safety, health and environment strategy.
- Arrange the conduct of a review of salary and classification systems and performance management as provided in paragraph 3 and 4 of Schedule 1 of the CSIRO Enterprise Agreement 1998, and arrange the implementation of changes agreed to as a result of that review.
- Development of improved workforce planning processes and tools.
- Formulation of a strategic legal compliance program and development of specific control systems including environmental, privacy and conflict-of-interest.
- Carry out other tasks and reviews as provided in the CSIRO Enterprise Agreement 1998 and review and simplify CSIRO's awards as required by legislation.

Corporate Property

Corporate Property provides a property management and facility development service that ensures CSIRO has appropriate and functional research accommodation and facilities at the most effective cost. Corporate Property also seeks to maximise the utility of CSIRO's Sites and enable the Organisation to apply cost effective and efficient practices. Planned activities and achievements include:

- Implementation of the Board approved Property Management Plan 1997–2000 to include strategies such as rationalisation and consolidation of specific sites; the development of joint State or University / CSIRO initiatives; and evaluating industry and other research establishment's capital investment benchmarks.
- Development and management of the Capital Investment Plan in recognition of emerging Sectoral priorities.
- Management of CSIRO's Internal Leasing Scheme for cost effective use of premises.
- Management of major CSIRO development initiatives, such as North Ryde (Riverside) NSW; Pinjarra Hills, Qld (Stage 2); and Bentley, WA (Stage 1).
- PWC approvals for the CSIRO developments at North Ryde (Food Science), Werribee (Food Science), St Lucia (Tropical Agriculture), Clayton (Manufacturing Science and Technology), North Ryde (Building, Construction and Engineering), Newcastle (Energy Technology) and implementation of the design development and tendering processes.
- Participation on the Organisation's Environmental Committee, to develop and implement a CSIRO Environmental Policy and Management System together with developing strategies to audit and remediate all contaminated sites, in particular Samford (Qld), Woodstock (Qld), Deniliquin (NSW), O'Halloran Hill (SA), and Bradfield (NSW).
- Apply the Commercial Property Principles to the management and development of CSIRO's property portfolio so as to provide CSIRO with the most cost-effective means of achieving its scientific and research objectives and comply with Commonwealth guidelines.
- Implementation of the Organisation's Security Policy with development of localised Security expertise.
- Monitoring of the Organisation's Energy usage with associated development of strategies/advice to effectively utilise energy.
- Implementation of planning and "value adding" strategies for the disposal over the next 1 to 3 years of Ryde (NSW), Syndal (Vic), Preston (Vic), and Samford (Qld). An accommodation / site review is to occur for Hightett (Vic), Yarralumla (ACT) and parts of Black Mountain (ACT) and Floreat Park (WA).

Information Technology Services

Information Technology Services provides and maintains CSIRO's corporate information infrastructure. This includes:

transmission of voice, data and image Australia wide; support of the Unix and NT operational environments for corporate applications; maintenance and development of corporate systems such as the payroll, human resources, finance, contracts and project support systems; coordination of IT Security across the Organisation; and support of the provision of library and records management systems and services both corporately and in Divisions. In keeping with these functions ITS develops corporate strategic plans for information technology, networks, telecommunications and integrated information management. Planned activities and achievements include:

- Continuation of the corporate infrastructure equipment rolling upgrade to enhance responsiveness to users.
- Implementation of an architecture for a single IT systems log-on across CSIRO utilising the Microsoft NT domain model.
- Deployment of Microsoft NT file server environment and Exchange based messaging services across CSIRO.
- Plan for and deliver new electronic library and information services across CSIRO.
- Implement improved records management and record-keeping practices throughout CSIRO, including electronic and scientific records. Establish access to the records management system on the desktop and introduce electronic document management.
- Use the data network lines for telephone traffic by replacing voice tielines with Voice over IP technology. This will drastically reduce telephony costs.
- Conduct a major review of data links to all sites and upgrade those links underperforming.
- Continued development of the CSIRO Project Support System including implementation of a Commercial Support component by October 1999.
- Development of user requirements for a possible replacement or redevelopment of the human resources applications.
- Continued support and enhancement of the Unibis financial system.
- Redevelopment of CSIRO corporate and sector external WWW by December 1999.
- Completion of Y2K changes in the human resource application by June 1999 and Y2K compliance testing of all corporate systems.
- Provision of expert technical and systems advice and, where required, development and implementation of cost effective solutions in consultation with relevant system owners, Divisional staff and the Executive.
- On going monitoring, reporting and assistance for Y2K remedial activities and contingency planning in Divisions and corporate groups.
- Achieve economies of scale, expertise and approach through cooperative activities with similar external organisations (eg CAUL, CAUDIT, science agencies cluster).

- Continue to work with the Office of Asset Sales and IT Outsourcing (OASITO) to implement government policy on IT Outsourcing in a way that is consistent with Government policy and the scientific requirements of CSIRO.
- Develop strategies and solutions to support the integration of common information management work tools on the desktop.
- Negotiate and manage Corporate IT and library materials purchasing agreements to achieve economies of scale for the Organisation.
- Coordination of IT Security strategies, standards and practices across the Organisation.
- Implementation of security firewalls across all major network points-of-presence.

Risk Assessment and Audit

Risk Assessment and Audit conducts a comprehensive audit program approved by the Chief Executive and endorsed by the Audit Committee. The program focuses on safeguarding assets, compliance with internal policy and external regulations, integrity of information and effectiveness and efficiency of operations. The Unit also assesses risks (other than those associated with the success of research) and evaluates controls in high risk areas. Operations are performed in accordance with the approved three year strategic plan commencing 1997–98. Planned activities and achievements include:

- Ensuring the internal control framework is operating effectively by conducting audits to assess compliance with internal policies and procedures and external regulations.
- Updating risk assessments to ensure management focus is on issues that are critical to the on-going success of the Organisation.
- Providing assurance on the integrity of management information systems.
- Providing regular advice to management and the Audit Committee on issues relating to policy and statutory requirements.
- Continued education in risk management techniques and cost effective control procedures through training workshops.
- Continued development of self assessment tools and techniques to assist management in the identification, evaluation and treatment of risks.

Strategic Planning and Evaluation

Strategic Planning and Evaluation promotes and facilitates a strategic approach to planning and evaluation at all levels of CSIRO; provides or locates planning and evaluation services for CSIRO managers; coordinates the Sector planning process; and coordinates the preparation of corporate planning and evaluation documents. A particular challenge is to maintain the momentum of the new Sector planning process to achieve the revitalisation of CSIRO as a single entity serving the diverse sectors of the Australian economy.

Planned activities and achievements include:

- Preparation of planning and performance information for federal budget documentation and the CSIRO Annual Report.
- Preparation and provision of data on CSIRO's research effort in response to internal and external needs.
- Streamline performance and accountability measures for Executive Committee's strategic management of CSIRO.
- Coordinate the completion of Sector Plans and CSIRO's Strategic Research Plan for the next funding triennium.
- Work with Divisions to integrate evaluation metrics and reporting standards in planning processes.
- Manage a consultancy on analysis of citations to CSIRO publications in patent applications in conjunction with the Australian Research Council.

Training and Development

The Leadership, Career and Team Development group provides corporate policies and advice on education, training and development and provides learning opportunities for staff at significant, career transition points. All major programs are accredited with Deakin University and the Association of Professional Engineers, Scientists and Managers, Australia (APESMA) and provide status towards the University's Graduate Certificate, Diploma and Masters courses on technology management. Planned activities and achievements include:

- The Effective Research Teams Program to enhance team performance, particularly in relation to multi functional and multi disciplinary teams.
- The Team Leadership in CSIRO program to provide communication, performance management and coaching skills for leaders of teams in all functional groups.
- Project Leadership Courses for staff moving into research project leadership roles.
- Leadership in Innovation courses (in collaboration with the Business/Higher Education Round Table) for leaders of multi organisational teams in universities, the private sector, public sector research agencies and Cooperative Research Centres.
- A new program on leadership in situations of increasing complexity and uncertainty.
- The Leadership Development Program to develop senior staff and to support succession planning.
- The Leadership Consortium: a group of organisations who collaborate to develop and promote leadership within their own business.
- Consultancy services to Divisions on leadership, team development, change management and strategic planning.
- Research on the effectiveness of R&D teams and leaders.
- Change management and leadership development for the Indonesian Institute of Sciences (LIPI).

Legal Network

Through a complement of qualified legal practitioners at the Executive and Business Unit levels of the Organisation and

quality external legal providers, the Legal Network ensures the provision of accurate, timely and practical legal input to CSIRO's management. Increased external interest in CSIRO's management and compliance systems has followed passage of the Commonwealth Authorities and Companies Act.

Planned activities and achievements include:

- Development of strong strategic corporate governance and compliance programs in relation to matters including the environment, competition, conflicts of interests and privacy.
- Continued strong emphasis on provision of quality and practical commercial advice to support CSIRO's commercialisation efforts.
- Strengthening of the network of CSIRO lawyers.
- Preparation and maintenance of CSIRO's preferred form of agreement and support in negotiating standard form contracts with major clients including research and development corporations.
- Provision of legal advice and related services to Chiefs, Business Managers and other research managers on legal aspects affecting their business units particularly in relation to commercialisation.
- Provision of legal advice to the Board, the Executive and General Managers on their roles and responsibilities including compliance with legislation and general law.
- Management of litigation on behalf of CSIRO.
- Facilitating access to legal information and materials through further development of the CSIRO Legal website.
- Establishment of electronic corporate registers to support corporate governance systems.
- Decentralisation of legal services and improvement of outsourcing arrangements through monitoring of CSIRO Legal Panel relationships.

Commercial Committee and Network

The CSIRO Commercial Committee and Network have responsibility to ensure that CSIRO's interaction with industry leads to an appropriate capture of the benefits from investment in research, occurs in an appropriate fashion, and enables the Organisation to respond to changes in the external environment. The CSIRO Commercial Committee develops policy in this area, monitors implementation of the policies, and facilitates interaction between professionals in the legal, intellectual property and commercial areas across the Organisation. The Committee is responsible to the Executive Committee which acts as a point of accountability for a number of functions in the commercial, legal and intellectual property areas. The Commercial Network was established by the Commercial Committee and covers all staff with a professional role in the commercial activity of the Organisation. The Network is involved in dialogue with the Commercial Committee and is the principal conduit for staff in raising the professional standards in the commercial activity of the Organisation.

Planned activities and achievements include:

- Revision of the CSIRO Commercial Practice Manual to reflect changes in the Organisation and in the commercial environment in which the Organisation operates. This is an annual activity.
- Consolidation of customer, contract and project information into an organisation-wide database to assist staff to improve CSIRO's level of customer service.
- Revision of CSIRO's standard form contractual documents for use in research contracts, technology licences and collaboration with other parties.
- Establishment of a more extensive resource base and improvement to the processes for an account management system which facilitates interaction between the Organisation and its key customers.
- Improvements to the management of Intellectual Property within the Organisation, particularly through the implementation of a new data base and access to world patent literature.
- Implementation of the recommendations of the review of the business and commercial skills within the Organisation.
- Education of staff in the commercial area through induction and training programs, workshops and conferences.
- Provision of advice to the Executive Committee on matters including: CSIRO's equity holdings in companies formed to commercialise CSIRO technology; use of the Development Fund and other means of facilitating the effective commercialisation of technologies; and preparation of a revised statement of the Organisation's commercial vision and objectives.

CSIRO Publishing

CSIRO Publishing operates within CSIRO on a commercial basis publishing quality science for both Australian and overseas markets in three main product streams: primary research journals; academic and reference books and CDs; and secondary education and general reference books, magazines and CDs. It also supplies publishing and communication services to CSIRO on a fee-for-service basis.

Planned activities and achievements include:

- Publication and distribution of 96 issues of 14 primary research journals to customers world-wide in both print and online formats.
- Publication of more than 30 new academic reference titles in both print and CD-ROM format with international appeal and sales potential.
- Broadening the readership of *Ecos*, CSIRO's science and environment magazine to reach both print subscribers and online browsers.
- Publication of a broader range of science-based products, in print and CD-ROM for the school and home education markets, with an emphasis on developing co-publishing arrangements with other academic-based publishers.

- Development of Landlinks Press aimed at readers in the rural sector needing practical information.
- Enhance the CSIRO Publishing online catalogue of products and content to ensure 24-hour access to customers in all countries.

Resource Summary 1999–2000

Total Revenue (\$'000)	32,228
—Direct Appropriation (\$'000)	25,395
—Research & Services (\$'000)	6,071
—Other (\$'000)	763
Earnings Performance Indicator (%)	17.4
Operating Result (\$'000)	-81
End of Year Cash Balance (\$'000)	2,999
Research Staff (EFT)	12
Total Staff (EFT)	300

This summary includes resourcing estimates for all the above Corporate Units and the CSIRO Executive.

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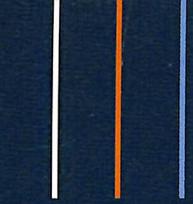
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Our Purpose

We serve the Australian community through outcomes which provide:

benefit to Australia's industry and economy

environmental benefit to Australia

social benefit to Australians

support to Australia's national and international objectives

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

