CSIRO Operational Plan

1996–1997

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ralia's Future

CSIRO
AUSTRALIA

CSIRO Operational Plan 1996 -1997

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Foreword

The CSIRO Operational Plan 1996-97 documents our planned outcomes in terms of research results and research support, as well as our financial position. The Plan sets out in broad terms those things for which we will hold ourselves accountable, individually and collectively. It provides the framework within which individual performance planning and evaluation (PPE) objectives are set.

The year before us will be a year of transition. It marks the last year of the current funding triennium and the research priorities and commitments which we set ourselves in 1993. It also marks the first year of our new structural and management arrangements which were announced on 19 March 1996.

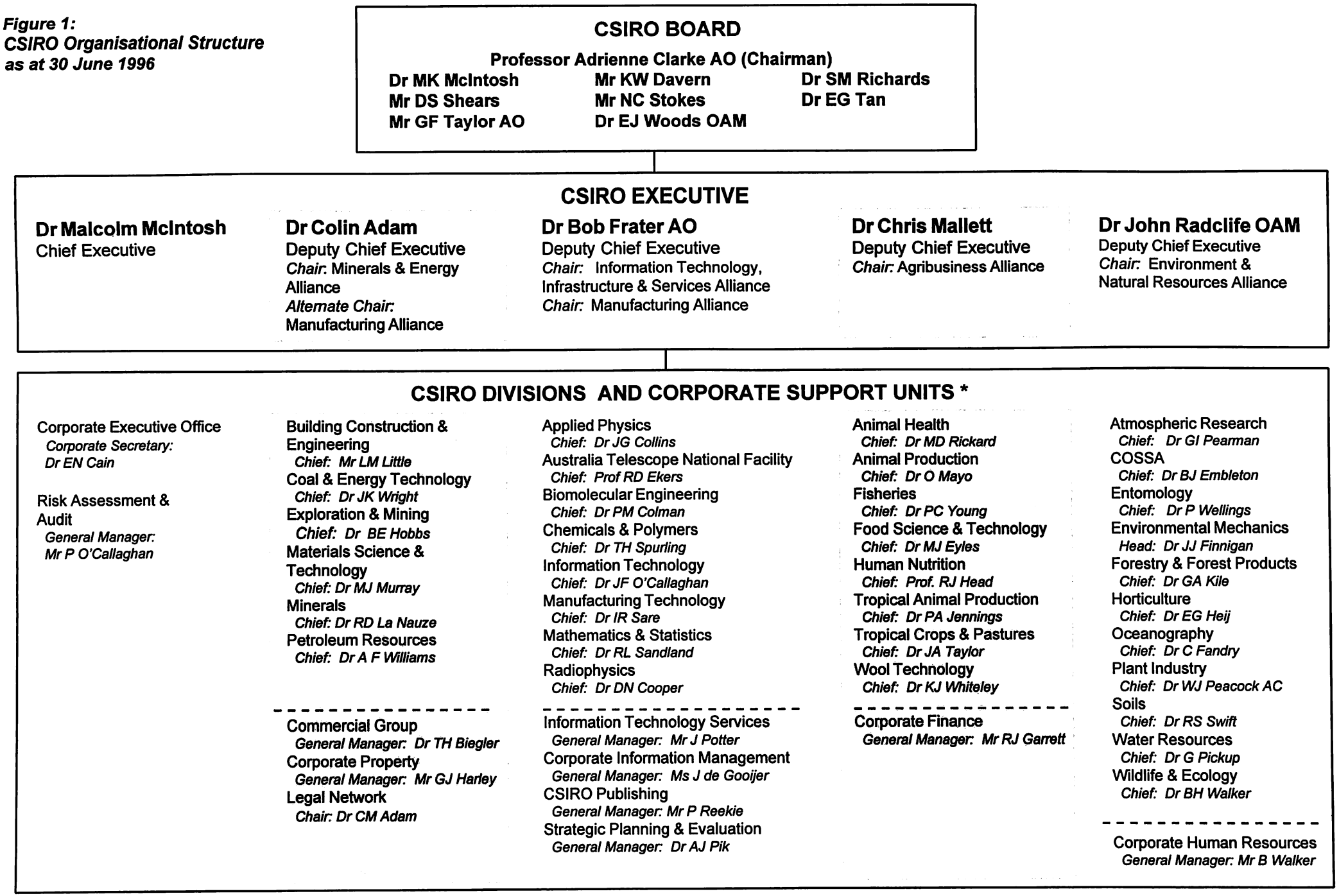
As a result, the Institute structure adopted by CSIRO in 1988 will be abolished and research planning, prioritising and resourcing will instead be facilitated via Sectoral considerations with external advice channelled through Sector Advisory Committees. Divisions will continue to be the prime business units of the Organisation with their budgets resourced on the basis of Sector Plans. Four Deputy Chief Executives have been appointed each having a mix of Sectoral, Divisional and corporate responsibilities. The Organisational Chart illustrates the new structure and the accountabilities.

Our new Sectoral planning procedures are currently in progress. The resource allocation decisions and Plans for the Sectors arising from them will not take effect until the start of the new funding triennium beginning on 1 July 1997 and will hence be documented in the new Strategic and Operational Plans to be finalised next year.

In the meantime I invite you to familiarise yourself with the activities and outcomes we have planned and committed ourselves to in 1996-97.

Malcolm McIntosh
Chief Executive
June 1996

Figure 1:
CSIRO Organisational Structure
as at 30 June 1996



* *Divisions and Corporate Support Units are shown below the Executive member having oversight of the Division/Unit*

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INTRODUCTION

This Operational Plan provides an overview of CSIRO's objectives, strategies, planned outcomes and distribution of resources in 1996-97. For research effort, the Operational Plan indicates how the strategic research priorities determined for the current funding triennium are being implemented. These are documented in *"Research Priorities and Strategies 1994-95 to 1996-97"*.

The basic criterion used by CSIRO to assess research opportunities is "return to Australia". This in turn is based on an assessment of the attractiveness and feasibility of research directed toward the achievement of particular social, economic or environmental objectives. A more detailed outline of the methodology, which includes extensive input from CSIRO staff and external stakeholders, is also included in *"Research Priorities and Strategies"*.

OUTLOOK FOR 1996-97

1996-97 is the final year of the current funding triennium and will be an important year of transition for CSIRO, marked by the implementation of significant changes in the way CSIRO is managed internally and in the way the organisation works with its many customers and stakeholders. The changes were announced by the new Chief Executive, Dr Malcolm McIntosh, on 19 March 1996.

Divisions will remain as the core research units. However, the six Institutes, which have served since 1988 as a level of line management between the Chief Executive and the research Divisions, will cease to exist. Resources will now be allocated directly to Divisions rather than through the Institutes. A new executive team, consisting of the Chief Executive and four Deputy Chief Executives, has been put in place (see Figure 1).

Concurrent with the implementation of these changes there will be a major effort devoted to planning for the 1997-98 to 1999-2000 funding triennium. Planning will be based on an assessment of research opportunities in the 22 Sectors listed below. The Sectors are not determined by CSIRO's existing capabilities but are externally focussed, with each Sector encompassing an industry group, market or natural resource of national significance. As indicated, the Sectors are grouped into five broad Alliances. Alliances are strategic (not structural) groupings of Divisions that make a significant contribution to a group of Sectors. This recognises the significant relationships which exist between many Sectors.

CSIRO will establish and maintain strong links with each Sector through a Sector Advisory Committee appointed by the CSIRO Board. Working closely with Sector Advisory Committees, Sector Coordinators will develop a Sector plan and a balanced portfolio of projects based on the short, medium and long term needs of customers, private and public, in that Sector. Based on the Sector plans, each Division will contribute relevant skills to appropriate Sectors and may be represented on one or more Alliance. Sector Coordinators will facilitate the interaction of the various Divisions in planning and delivering research outcomes to clients and stakeholders in each Sector.

CSIRO ALLIANCES AND SECTORS*

Sectors in the Minerals and Energy Alliance
- *Mineral Exploration & Mining*
- *Mineral Processing & Metal Production*
- *Coal & Energy*
- *Petroleum*

Sectors in the Manufacturing Alliance
- *Pharmaceuticals & Human Health*
- *Chemicals & Plastics*
- *Integrated Manufactured Products*

Sectors in the Information Technology, Infrastructure and Services Alliance
- *Information Technology & Telecommunications*
- *Measurement Standards*
- *Infrastructure*
- *Services*
- *Radioastronomy*

Sectors in the Agribusiness Alliance
- *Horticulture*
- *Field Crops*
- *Food Processing*
- *Forestry, Wood & Paper Industries*
- *Meat, Dairy & Aquaculture*
- *Wool & Textiles*

Sectors in the Environment and Natural Resources Alliance
- *Climate & Atmosphere*
- *Land & Water*
- *Biota*
- *Marine*

*as at June 1996

1996-97 RESOURCES SUMMARY

Table 1 provides a Divisional level summary of staff numbers in equivalent full time units (EFT), and of planned financial performance for 1996-97. The estimates are as at June 1996.

Figure 2 shows CSIRO's planned distribution of total expenditure by research purpose (Socio-economic Objective) for 1996-97.

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.

OUR VISION : To be a world class research organisation vital to Australia's future

VALUES CRITICAL TO OUR SUCCESS

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

•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 policy and science and technology 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.	•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.	We work together to create an organisation that: •Seeks to recruit the best and the brightest, provides a stimulating environment to encourage individuals to develop their full potential and provides career opportunities which make CSIRO an attractive development base for future industry leaders. •Fosters adaptability and recognises exceptional performance with appropriate rewards. •Cares for the safety and well being of all employees with employment policies to support corporate goals. •Fosters creativity which underpins our performance and delivery. •Draws upon the breadth and depth of our skills to assemble excellent teams to tackle major challenges and uses networks of special skills inside and outside CSIRO. •Respects the unique skills, professionalism and knowledge of all our employees, and recognises that we are responsible for creating and maintaining our reputation.	•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 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 workface.

Table 1: ESTIMATED RESOURCES BY DIVISION 1996-97

(Estimates for 1996-97 as at 15 June 1996)

	Direct Appropr	External Revenue	Total Revenue	Operating Result	Cash Balance	Research[1] Staff	Total[2] Staff
	($'000)	($'000)	($'000)	($'000)	($'000)	(EFT)	(EFT)
CSIRO Executive	16,776	2,553	19,330	2,105	-3,161		40
Animal Health[3]	11,657	9,809	21,466	314	-1,742	124	269
Animal Production	13,883	5,790	19,673	-731	-3,970	157	255
Applied Physics[4]	19,863	7,600	27,463	-744	452	192	278
Atmospheric Research	7,562	4,300	11,862	-985	1,157	94	142
Australia Telescope National Facility[5]	11,121	5,160	16,281	-2,279	595	59	110
Biometrics Unit	1,562	313	1,875	-208	380	20	23
Biomolecular Engineering	11,731	4,089	15,820	-412	39	120	161
Building, Construction and Engineering	18,050	9,050	27,100	0	987	189	286
Chemicals and Polymers	12,126	5,467	17,593	1,157	77	140	182
Coal and Energy Technology	11,346	7,110	18,456	-1,375	1,419	133	181
CSIRO Office of Space Science and Applications	2,486	995	3,481	-636	63	8	14
Entomology	14,091	13,176	27,267	-1,508	476	235	311
Environmental Mechanics	2,464	1,369	3,834	345	-607	29	45
Exploration and Mining	15,933	13,427	29,360	737	1,415	153	231
Fisheries	13,791	8,274	22,065	-1,401	2,065	156	208
Food Science and Technology	14,879	10,770	25,649	163	6,568	160	226
Forestry & Forest Products	16,656	9,803	26,460	63	7,479	210	287
Horticulture	5,873	2,892	8,765	-271	1,064	76	98
Human Nutrition	5,860	2,992	8,851	37	2,145	43	111
Information Technology	8,239	3,804	12,043	-953	71	90	126
Manufacturing Technology	13,744	9,355	23,099	561	-815	148	196
Materials Science and Technology	12,264	4,975	17,239	1,231	582	97	148
Mathematics and Statistics	7,876	2,610	10,485	-1,202	1,071	66	98
Minerals	19,732	13,150	32,882	-6,484	-1,901	206	313
Oceanography	5,961	2,783	8,743	-518	2,356	66	106
Petroleum Resources	5,541	4,596	10,137	85	-1,919	48	73
Plant Industry	22,875	12,313	35,188	-966	3,382	337	433
Radiophysics	13,652	5,237	18,889	-606	1,055	130	216
RV *Franklin* (A National Facility)[5]	4,194	535	4,729	-514	432		10
Soils	11,669	4,198	15,867	-768	-191	112	181
Tropical Animal Production	7,818	4,760	12,578	53	2,715	72	134
Tropical Crops and Pastures	11,962	6,237	18,199	-310	2,647	145	197
Water Resources	13,652	8,629	22,282	-1,231	1,559	180	266
Wildlife and Ecology	14,524	8,330	22,854	344	2,692	173	259
Wool Technology	11,547	11,421	22,968	-2,499	7,284	166	288
Centre for Mediterranean Agricultural Research	126	9	135	-87	64		6
CSIRO Supercomputing Facility	1,500	36	1,536	-1,481	257		3
INRE Projects Office	670	2,379	3,049	766	1,287	6	12
Minesite Rehabilitation Program	758		758	0	40	25	28
Capital Program[6]	257	500	757	6,380	-4,835		
Corporate Funds[7]	2,791	250	3,041	2,713	-5,788		
Corporate Support Units	24,333	6,106	30,439	-188	119		330
TOTAL	443,395	237,152	680,548	-11,303	29,065	4,365	6,881

[1]Includes Research Scientist/Engineer, Research Projects and Research Management functional classifications.

[2]Includes Research Staff plus Technical Services, Communication and Information, Administrative Services, General Services, Corporate Management and Senior Specialist functional classifications.

[3]Includes Australian Animal Health Laboratory

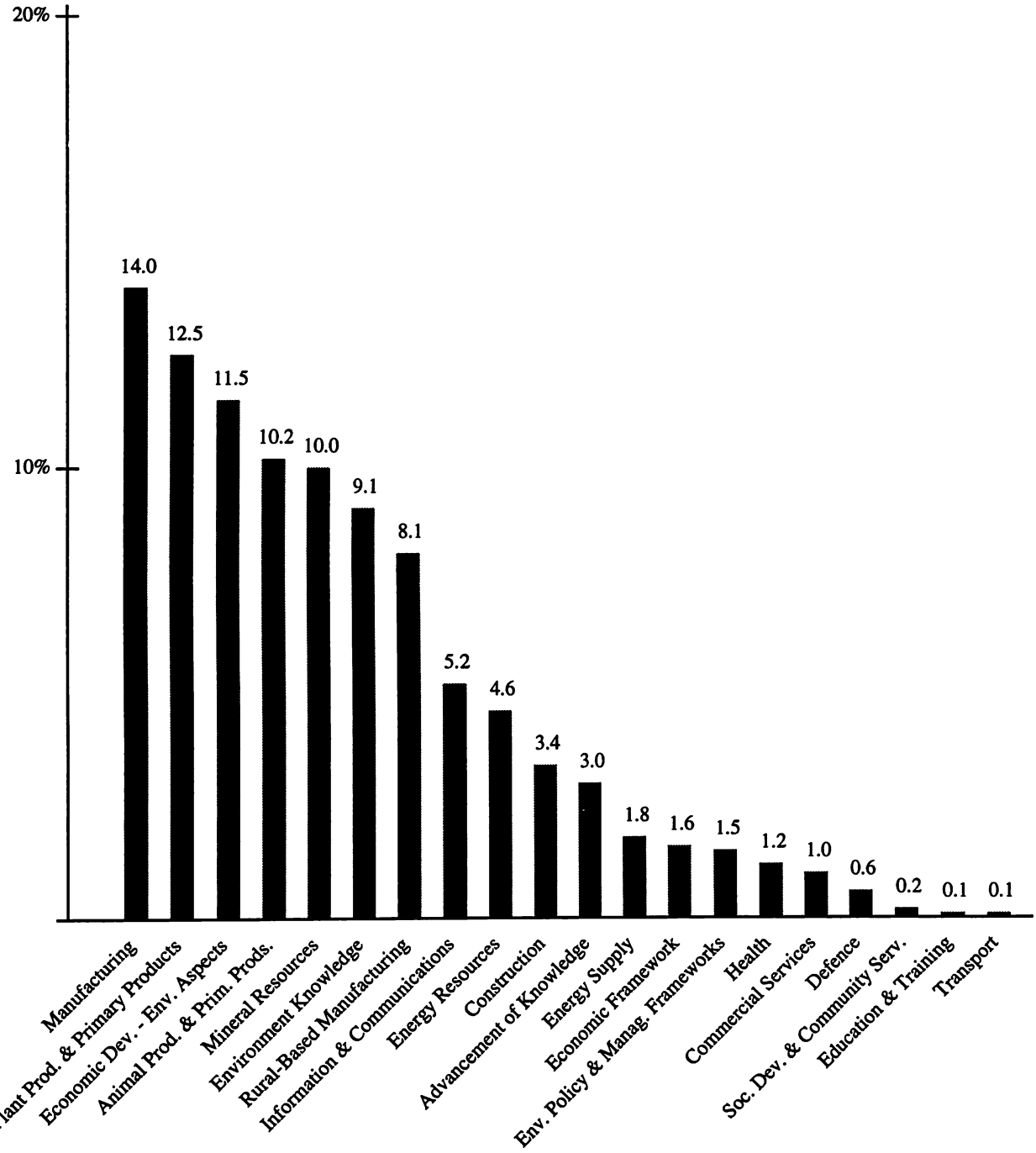
[4]Includes Australian National Measurement laboratory

[5]A National Facility managed by CSIRO on behalf of the Government.

[6]The total capital program for 1996-97 is $40,156,200. This is mostly funded from an internal lease charged to, and included in, the budgets of operating units.

[7]Appropriation funds over allocated or under allocated to business units.

Figure 2: PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1996-97



LIST OF MULTI-DIVISIONAL PROGRAMS 1996-1997*

Plant Production and Primary Products

MDP01	Gene Shears
MDP02	Novel Management Techniques for Plant and Plant Product Pests
MDP33	Tropical Agricultural Exports
MDP35	Rejuvenating the Murray-Darling Basin with Forest Products Industries
MDP36	Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities

Animal Production and Primary Products

MDP03	Fibre Utilisation
MDP34	CSIRO Aquaculture Initiative (CAI)

Mineral Resources

MDP04	Alumina Production
MDP06	Heavy Mineral Processing
MDP07	Integrated Geological, Geophysical, Mine Design Visualisation
MDP08	Iron Ore Processing
MDP09	Magnesium Alloys
MDP10	Magnesium Production
MDP37	Processing of Nickel Ores

Manufacturing

MDP13	Biomaterials and Medical Devices
MDP15	Process and Maintenance Optimisation in Manufacturing
MDP27	Biosensors
MDP28	Smart Manufacturing

Commercial Services

MDP16	Urban Water Systems

Environment Knowledge

MDP17	Climate Change
MDP18	Conserving Biodiversity for Australia's Future
MDP29	Climate Variability and Impacts

Environmental Aspects of Economic Development

MDP21	Coastal Zone Program
MDP23	Management of Marine Living Resources
MDP24	Minesite Rehabilitation
MDP30	Air Quality
MDP31	Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity
MDP32	Dryland Farming Systems for Catchment Care

*The MDPs are grouped according to their major research purpose (Socio-economic Objective classification)

MULTI-DIVISIONAL PROGRAMS

CSIRO's strong commitment to multi-disciplinary research has long been reflected in high levels of informal inter-Divisional cooperation and collaboration with researchers in other organisations. This and the following section of the Operational Plan provide information on the Organisation's involvement in two programs of a more formal nature which aim to build on the strengths of a cooperative approach to research.

Multi-Divisional Programs (MDPs) are programs of research involving two or more CSIRO Divisions and for which a formal management structure such as a steering committee or program coordinator has been established. The section below sets out the research objective, major planned outcomes and participating Divisions for each MDP, with the lead Division named first. The MDPs have been grouped according to the major CSIRO research purpose served by the program.

Plant Production and Primary Products

MDP01 *Gene Shears*

Objective:
To apply second generation ribozyme core technology to quality-related goals in the agribusiness and pharmaceutical industry systems and to develop an intellectual property position through Gene Shears Pty Ltd, based on further molecular parameters of ribozyme action in support of Australian competitiveness in Asian and global markets.

Planned Outcomes:
1 To generate Australian controlled technology through development of ribozyme alternatives to antisense and other down-modulators of gene expression.
2 Incorporation of ribozymes into gene construct cassettes for wide application in gene delivery systems for agri-business production plants.
3 Development of rules of ribozyme design and construction for optimisation of effectiveness against specific gene targets.

Participating Divisions:
Plant Industry
Biomolecular Engineering

MDP02 *Novel Management Techniques for Plant and Plant Product Pests*

Objective:
To lessen our dependence on chemical pesticides, by developing alternative, biologically based control products and processes.

Planned Outcomes:
1 Optimisation of heliothis stunt virus gene combinations for engineering heliothis resistance into cotton.
2 An industrial partner secured to commercialise transgenic cottons expressing heliothis stunt virus genes.
3 *In vitro* culture of the "Stone River" isolate of cane grub entomopoxvirus.
4 Molecular analysis of the "Stone River" entomopoxvirus to establish a patent position.
5 Preliminary tests of pilot scale hot disinfester for bulk bin quantities of citrus.

Participating Divisions:
Entomology
Plant Industry
Horticulture
Biomolecular Engineering

MDP33 *Tropical Agricultural Exports*

Objective:
To strengthen CSIRO's collaborative research for plant- and animal-based industries in tropical Australia. The expected outcomes are enhanced exports of sugar, live cattle and beef, cotton, mangos, soybeans and cashews; more efficient management of woody weeds, and reduced soil acidification; and increased training and educational opportunities in tropical Australia.

Planned Outcomes:
1 Small scale field trials of fruit baits completed, and provisional patents lodged.
2 Backcross lines of japanese soybean varieties homozygous for the long-juvenile trait produced.
3 Root distribution studies of cashew trees of various ages completed in the NT.
4 First potential biocontrol agent for mesquite imported under quarantine.
5 Information on rate of soil acidification in tropical stylo-based pastures compiled.
6 Gene constructs to suppress enzymic browning in cane sugar prepared.

Participating Divisions:
Tropical Crops and Pastures
Horticulture
Entomology
Soils
Plant Industry
Tropical Animal Production

MDP35 *Rejuvenating the Murray-Darling Basin with Forest Products Industries*

Objective:
The aims of the project are to provide research underpinning for expansion of a plantation resource in the region, to investigate the range of products that could be made from species grown in the area and carry out economic analyses of the prospects for the establishment of forestry and forest-based products industries.

Planned Outcomes:
1 Comparison of water use by 5 year old trees in a species trial planted on a salinity gradient.

2 Prediction of growth potential for key plantation species across the southern MDB using PlantGro.

3 Provenance trials *E. maculata*, *E. benthanii* and *E. camaldulensis* established near Deniliquin.

4 The suitablity of farm forestry species for veneer production determined in collaboration with State Forests NSW.

5 A major trial established to assess use of treated eucalypt poles as vineyard trellis at Sunraysia.

Participating Divisions:
Forestry & Forest Products
Entomology

MDP36 *Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities*

Objective:
To develop a co-ordinated CSIRO research program for the Mediterranean climatic region of Australia with a mission to develop profitable sustainable agricultural systems.

Planned Outcomes:
1 Development of a wool pipeline model for the Mediterranean region of Australia, in conjunction with Agriculture WA and the Centre for International Economics.

2 Second rotation bluegum experiments established with a major industry partner, to provide key information on the sustainability of production for the woodchip, pulp and paper industries.

3 Integrated pasture-crop experimental site, established and managed with Agriculture WA to allow diverging productivity of crops and pastures, to develop high productivity farming systems which are profitible and sustainable.

4 Movement of water and nutrients, especially nitogen, through duplex and sand profiles tracked to identify major constraints to productivity and offsite effects.

Participating Divisions:
Centre for Mediterranean Agricultural Research
Animal Production
Entomology
Forestry & Forest Products
Plant Industry
Soils

Animal Production and Primary Products

MDP03 *Fibre Utilisation*

Objective:
To increase the efficiency of ruminant production by enhancing the fermentation of forage fibre and the utilisation of derived nutrients by the animal.

Planned Outcomes:
1 Establishment of 'proof of concept' that a mixture of recombinant bacterial strains benefit fibre digestion in mixed rumen culture.

2 Expression of further recombinant esterase genes in rumen bacteria in stable form if esterase shown to be active against fibre.

3 Strain-specific PCR techniques established to detect clone fungal enzymes in rumen contents.

4 Assessment of persistence of newly produced microbes in ruminants, and effects on digestion in the rumen.

5 Isolation of rumen organisms with the capability of degrading phenolics or phenolic/protein complexes from shrub legumes.

6 Survey of rumen micro-organisms of exotic animals likely to be benefit to fibre digestion in domestic ruminants.

7 Assessment of at least 2 northern Australian isolates of *B. fibrosolvens* for use as candidates for recombinant manipulation.

8 Development of at least one functional promoter for construction of expression.secretion cassettes of fungal cellulase and xylanase in *Butyrivibrio fibrosolvens*. Assessment of the strength of the promoter.

9 Functional expression of the *celA* gene in yeast and analysis of the properties of the CELA enzyme so produced.

10 Quantitation of the hydrolysis of cellulose and plant fibre by CELA and CELD cloned from *N. patriciarum* relative to commercial cellulases from *T. reesei*.

11 Determination of the ability of 3 isolates of non-indigenous anaerobic fungi to colonise the sheep rumen in the presence of indigenous sheep fungi.

12 Evaluation of experimentally-induced changes in rumen fungi populations using DNA-based quantitative methods.

13 Identification of a sulphur compound which quantitatively stimulates fungal activity in the rumen of sheep on a low sulphur feed.

Participating Divisions:
Tropical Animal Production
Tropical Crops and Pastures
Animal Production

MDP34 *CSIRO Aquaculture Initiative (CAI)*

Objective:
To combine and apply the skills of researchers throughout CSIRO to increasing the product diversity, productivity and profitibility of the aquaculture industry through improved technology and better environmental management.

Planned Outcomes:
1 With a commercial partner, develop a least-cost feed formulation for *Penaeus monodon*.

2 Estimate heritability of growth in *Penaeus japonicus* and isolate micro-satellite markers to use in selective breeding trials.

3 Continue screening the Division for Fisheries Microalgal Culture Collection to identify species with commercially important compounds and those capable of heterotrophic growth.

4 Trial the Geographic Information System with Queensland government departments to assess its application to aquaculture site selection and coastal zone management.

Participating Divisions:
Fisheries
Oceanography
Animal Production
Food Science and Technology
Tropical Animal Production
Entomology
Plant Industry

Mineral Resources

MDP04 *Alumina Production*

Objective:
To improve the productivity, product quality and product range of Australian alumina refineries.

Planned Outcomes:
1 Increases in the efficiency of oxalate removal circuits by establishment of the relationship between the surface absorption characteristics of organic impurities and the crystallisation of sodium oxalate.

2 Improvement in industrial mixing, clarification and thickening practice through identification of the optimal hydrodynamic and process conditions.

3 Improvement in the performance of industrial precipitators by establishment of the relationship between gibbsite nucleation, agglomeration and growth processes.

Participating Divisions:
Minerals
Building, Construction and Engineering

MDP06 *Heavy Mineral Processing*

Objective:
To raise the competitiveness of Australian titanium mineral processing operations by improvement of existing routes and by the introduction of new technologies and marketable products.

Planned Outcomes:
1 Optimisation of the chemistry and hydrodynamic mixing characteristics of the aeration step in the Becher process for synthetic rutile production.

2 Optimisation of a model for the prediction of ilmenite reduction behaviour in Becher processing.

3 Establishment of methods for the removal of radionuclides from zircon.

Participating Divisions:
Minerals
Building, Construction and Engineering
Mathematics and Statistics

MDP07 *Integrated Geological, Geophysical, Mine Design Visualisation*

Objective:
To develop an integrated system capable of handling three dimensional geoscientific data derived from

exploration and mining.

Planned Outcomes:

1 Prototype 3D Geoscience Data Model.

2 Prototype 3D Geoeditor.

3 Software to interface between existing commercial mining packages.

4 Software for delivery of new visualisation products to industry.

5 Applications software for minescale geophysics, 3D geotechnical data, deformation modelling and exploration geophysics.

Participating Divisions:

Exploration and Mining
Information Technology

MDP08 *Iron Ore Processing*

Objective:

To improve the competitive position of the Australian iron ore industry through technological advances in beneficiation, process modelling, sintering, instrumentation, quality and process control.

Planned Outcomes:

1 Demonstration of the benefits of on-stream analysis of iron ore immediately after primary crushing.

2 Revision of International Standards for sampling iron ores.

3 Completion of an assessment of infra-red methods for classification of iron-ores.

Participating Divisions:

Minerals
Exploration and Mining

MDP09 *Magnesium Alloys*

Objective:

To develop metal refining, casthouse and downstream casting technology for magnesium metal and to develop new magnesium alloys and composites and to evaluate materials properties and product performance.

Planned Outcomes:

1 Development of refining and casting technology for high purity magnesium alloy ingots and high value added components.

2 Development of new magnesium alloys for casting technology applications.

3 Appraisal of casting characteristics of existing and new magnesium alloys.

Participating Divisions:

Manufacturing Technology
Materials Science and Technology

MDP10 *Magnesium Production*

Objective:

To support the development of technology for the production of magnesium from magnesite, to initiate a magnesium metal industry in Australia and establish a strategic research base to assist the industry in future years.

Planned Outcomes:

1 Identification and optimisation of conditions for producing anhydrous magnesium chloride and transferring this material to electrolytic cells.

2 Establishment of process conditions for the electrowinning of magnesium.

3 Development of hydrodynamic models of magnesium electrowinning cells that provide the basis for improvements in cell design and power utilisation.

4 Scaled-up production to kg scale and evaluation of flow sheets for commercialisation of Mg by carbothermic reduction.

5 Evaluation of refactories used in magnesium electrowinning cells to identify materials that maximise operating life.

Participating Divisions:

Minerals
Building, Construction and Engineering
Manufacturing Technology
Materials Science and Technology

MDP37 *Processing of Nickel Ores*

Objective:

To develop economically feasible methods for improving nickel recovery from difficult-to-treat ores and for improved separations during nickel refining.

Planned Outcomes:

1 Extension of current mineralogical assessment methods for nickel ores to finer textures and grain boundaries.

2 Assessment of options for improving flotation performance for serpentinite ores.

3 Assessment of alternative methods for recovery of nickel from nickel tailing deposits.

4 Assessment of alternatives for separation of nickel and cobalt by hydrometallurgy.

Participating Divisions:
Minerals
Exploration and Mining

Manufacturing

MDP13 *Biomaterials and Medical Devices*

Objective:
To develop novel biomaterials based on functional molecular design for manufacture of implantable medical devices.

Planned Outcomes:
1 Identification of functionally important sites in key molecules involved in the biomaterial tissue interface.
2 Development of novel polymeric materials, including those which incorporate biological components.
3 Evaluation of prototype materials through *in vitro* testing methods.
4 Testing of selected materials in functional models.
5 New products for ophthalmic and cardiovascular applications.

Participating Divisions:
Biomolecular Engineering
Chemicals and Polymers

MDP15 *Process and Maintenance Optimisation in Manufacturing*

Objective:
To develop more productive and competitive manufacturing enterprises by the creation and integration of new systems to provide managers, operators and technical support staff, with the information they need to effectively manufacture and deliver products and services in domestic and export markets.

Planned Outcomes:
1 Three strategic research programs: Applications for Robust Manufacturing (ARM), Process Improvement for Robust Manufacturing (PIRM), Process Advisory Control Systems (PACS) - to deliver over the next 3 years, a coherent set of products and services through transfer of research outcomes to industry: 1) methods and tools for process improvement and system optimisation, 2) decision support and advisory applications, 3) collaborative and contract research projects with industry clients and industry partners for systems development and technology transfer.
2 In collaboration with international manufacturers and software product suppliers in manufacturing and food processing industries, develop systems for client enterprises: 1) plant and equipment asset management decision support systems, 2) real-time production planning and scheduling systems, 3) comprehensive condition monitoring and diagnostic systems, 4) operator guidance systems to sustain continuous improvement and optimisation of integrated manufacturing processes.
3 Collaboration with a global manufacturer in a comprehensive systems optimisation program to achieve substantial reductions in product delivery lead times.
4 A portfolio of on-going consultancy services contracts with food processing and manufacturing industry clients for technology transfer of research outcomes.

Participating Divisions:
Mathematics and Statistics
Manufacturing Technology
Information Technology
Food Science and Technology

MDP27 *Biosensors*

Objective:
To develop a research base which will underpin the establishment of a biosensor manufacturing industry in Australia. To identify specific market opportunities, to develop prototype biosensors to exploit these opportunities, and to assist industrial partners in commercialisation.

Planned Outcomes:
1 Formalisation of links with key industrial partners and key users in the potable water, food quality and environmental management sectors.
2 Evaluation of the gated-ion channel transducer for application in aerosol environments.
3 Construction and demonstration of an antibody and a DNA receptor for a targeted food quality/environmental application. The effective immobilization of these receptors onto transducer substrates as evidenced by their ability to respond to target DNA and antigen fragments.
4 Development of sample handling and concentration protocols to enable sensing in very dilute analyte solutions.
5 Establishment of unique source/supply of Legionnella antibodies.

Participating Divisions:
Chemicals and Polymers
Applied Physics
Animal Health
Biomolecular Engineering
Plant Industry
Food Science and Technology

MDP28 *Smart Manufacturing*

Objective:
Maximise the responsiveness of manufacturing operations to market opportunities by adopting "agile" manufacturing structures, systems and production technologies. Effective use of capital and revenue expenditure by minimising manufacturing "dwell time", work in progress and stock levels.

Planned Outcomes:
1 Development of the scientific basis for the manufacture of rapid prototype tooling together with appropriate conversion technologies to create functional parts from a variety of materials.

2 Flexible automation for the optimisation and control of material processing to produce products of uniform quality in manufacturing sectors including metals and food processing.

3 Development of specialised hardware, software and optical modules for high speed machine vision and provision of machine vision solutions to specific industrial problems.

4 Provision of generic framework and software tools and methodology for enterprise integration.

Participating Divisions:
Manufacturing Technology
Materials Science and Technology
Chemicals and Polymers
Food Science and Technology
Mathematics and Statistics
Information Technology
Applied Physics

Commercial Services

MDP16 *Urban Water Systems*

Objective:
To demonstrate new options for urban development and renewal through better management of the water and wastewater cycle and to develop strategies for efficient and effective hydraulic control, decontamination and utilisation of urban stormwater.

Planned Outcomes:
1 HYDRA, a graphical interface for integrating urban hydrological, hydraulic, and other models: the collaboration with Sydney Water extended into a fourth phase. Emphasis on linkage of models to assess water resources impacts of urbanisation, while generalising driver design functions and identifying cost-effective model linkage strategies.

2 The TOPAZ-SUCO model for integrated hydrological/hydraulic/infrastructure planning applied to the problem of water supply development for the northern Spencer Gulf region.

3 Development of an Expert System to aid urban planners and water managers in deciding on wastewater treatment strategies, and particularly the choice of technology given environmental conditions and objectives. Prototype tested.

4 Further development of practical procedures for injection of treated wastewater and stormwater into aquifers, with emphasis on contaminant transport and attenuation issues. Development of a pilot demonstration project at the MFP Adelaide Greater Levels site.

5 Development of novel, high-rate processes for the removal of pollutants from sewer overflows before they enter receiving waters.

6 The FILTER technique for crop irrigation using secondary-treated effluent progressed to pilot plant stage at Griffith, NSW.

7 Conclusion of experimental studies in Brisbane, Melbourne, Sydney and Perth, on the efficacy of community involvement approaches for stormwater management.

Participating Divisions:
Water Resources
Building, Construction and Engineering
Chemicals and Polymers
Information Technology
Mathematics and Statistics

Environment Knowledge

MDP17 *Climate Change*

Objective:
To predict changes in the global and Australian regional climate over the next decade to century and the environmental impacts arising directly from them. To determine the contribution of human activities in Australia to the alteration and regulation of global atmospheric composition and through that to climate change. To advise government and the Australian community of the current scientific understanding of climate change.

Planned Outcomes:

1 Major revision of climate change scenarios for the Australian region.

2 Analysis of results from the experiment.

3 Completion of a 'Mark 3' version of the CSIRO coupled ocean-atmosphere-sea ice climate model for greenhouse studies.

4 Estimates of the variability of the stable carbon isotope in South Ocean surface waters, seasonal changes in the air-sea-flux of CO_2 in the sea-ice zone, and the relative importance of air-sea exchange and deep convection as sources of carbon to phytoplankton, in order to obtain estimates of C uptake by the Southern Ocean.

5 Analysis of the historical changes of the concentration of trace gases in air extracted from Antarctic ice cores, Antarctic firn and from archived air, with particular focus on the last one to two thousand years. Measurements in air above Cape Grim of changes to oxygen concentrations brought about by combustion of fossil fuels and the exchange of carbon dioxide with the oceans and the terrestrial biosphere.

6 Continued advice to stakeholders of the current scientific understanding of climate change.

Participating Divisions:

Atmospheric Research
Oceanography
RV *Franklin* (A National Facility)
Water Resources
Fisheries
Plant Industry
Wildlife and Ecology
Environmental Mechanics

MDP18 *Conserving Biodiversity for Australia's Future*

Objective:

To contribute to a national framework for conserving biological diversity and maximizing its economic benefits, through a national collaborative venture involving all appropriate agencies.

Planned Outcomes:

1 Characterising, estimating and sampling biodiversity; identification of areas of significant diversity in target taxa; development of GC-FAME technology as a new tool for studying the biodiversity of soil microbial communities; analysis of experiments determining effects of silvicultural treatments on genetic diversity of eucalypt species using DNA markers.

2 Biodiversity and the sustainability of rural production systems; characterisation of shifts in the genetic structure of nitrogen-fixing bacteria and in diversity of microbiol communities in soils under different land uses; establish studies of impacts of forest management on ectomycorrhizal fungi.

3 Experimental elucidation of extinction processes; commencement of habitat quality and predation treatments in an extinction experiment; prepare for major review of faunal patterns over 10 years in the Wog Wog habitat fragmentation experiment.

4 Resource use and management for conserving biodiversity; integration of pastural land data and values into the rangelands regional model, completion of a land allocation model for Wallatin Creek catchment in WA; development of mechanisms for regional integration, biodiversity, conservation and production.

Participating Divisions:

Wildlife and Ecology
Plant Industry
Entomology
Soils
Forestry & Forest Products

MDP29 *Climate Variability and Impacts*

Objective:

To co-ordinate research that enhances the nation's ability to manage the impacts of natural climatic variability.

Planned Outcomes:

1 Systematic assessments of the sensitivity of Australian agriculture, fisheries, forestry, pests and urban water supplies to natural climate variability.

2 Development of seasonal climate predictions and investigation of methods to integrate predictions with decision support systems to improve management of risk associated with climatic variability in agriculture.

3 Development of an improved ocean model for use in climate prediction, and production of hindcasts of seasonal climate predictions from numerical models in order to assess their utility for land management.

4 Better utilisation of current knowledge of climatic variability in providing strategies for managing its impacts.

5 Community awareness that the impacts of climate variability effect all Australians.

Participating Divisions:
Oceanography
Atmospheric Research
Water Resources
Fisheries
Soils
Plant Industry
Wildlife and Ecology
Animal Production
Tropical Crops and Pastures
Forestry & Forest Products
Building, Construction and Engineering
Environmental Mechanics
Biometrics Unit

Environmental Aspects of Economic Development

MDP21 *Coastal Zone Program*

Objective:
Develop a quantative description of the impact of urban and agricultural development on Australian catchment-estuary systems to provide the necessary understanding for better management.

Planned Outcomes:
1 Documentation of the effects of land use change on runoff quality and quantity in the Herbert River catchment using data from monitoring equipment installed in 1995-96.

2 Mesocosms used to measure and understand the fate and effects of contaminants in marine sediments. Studies of filter feeder biology completed and impacts on coastal environments documented. Development of models suitable for management of impacts.

3 Measurements of distributions of metal and organic contaminants in coastal marine waters using novel techniques.

4 As part of the Ecumene initiative, development of the capability to model the impacts of human populations on coastal environments in eastern Australia.

5 Contributions to the National Marine Information System (ERIN unit of DEST).

6 In conjunction with external partners, further development of a comprehensive spatial database of shallow marine ecosystems and substrates for use in coastal management.

7 Completion and delivery of final report for the Port Phillip Bay Environmental Study.

8 In conjunction with other groups and Agencies, contribution to the development of a national coastal research program.

Participating Divisions:
Environmental Mechanics
Coal and Energy Technology
Fisheries
Oceanography
Soils
Water Resources
Tropical Crops and Pastures
Wildlife and Ecology

MDP23 *Management of Marine Living Resources*

Objective:
To quantify and model the effects of man-induced and natural impacts on fisheries and the environment that supports them; and to integrate ecological, economic and environmental issues in the sustainable development of Australia's marine living resources.

Planned Outcomes:
1 Application of the framework for evaluating the costs and benefits of research for fishery management to stock-structure uncertainty in the orange roughy fishery.

2 Managers and industry in the gemfish fishery provided with options for harvest strategies. Implementation of gemfish harvest strategies based on evaluation of management options.

3 Further development of integrated biological, economic and oceanographic evaluation of management strategies for southern rock lobster.

Participating Divisions:
Fisheries
Oceanography

MDP24 *Minesite Rehabilitation*

Objective:
To develop for the mining industry and legislative authorities cost-effective strategies for returning minesites (land disturbed by mining) to agreed community land use.

Planned Outcomes:
1 Planning strategies, based on effective research, for whole-of-mine environmental protection and rehabilitation to agreed land use for a working coal mine.

2 Comprehensive review of acid mine drainage impacts and controls at a number of mines throughout Australia, in collaboration with ANSTO.

3 Implementation of major field trials for capping tailings dams, based on innovative geotechnichal design criteria.

4 Instrumentation of tailings repositories for effective monitoring of consolidation behaviour.

5 Fire management strategies for protecting mine infrastructure and managing native ecosystems in tropical northern Australia.

6 Characterisation of the degree of contamination of the River Dee by discharges from the Mount Morgan Mining Leases.

7 Description of the effectiveness and rate of colonisation of rehabilitated areas of selected mines by soil animal communities.

8 Prediction of dust generation from blasting in open pits, and modelling of dust behavious in relation to environmental impacts.

9 Preliminary modelling of close-out options for tailings dams.

10 Predicted impacts of subsidence on soil landscapes from udergrround coal mining.

11 Definition of indicators of rehabilitaion success at selected mines throughout Australia.

12 Whole-of-mine hydrolical models to predict contaminant pathways and impacts.

Participating Divisions:

Soils
Exploration and Mining
Coal and Energy Technology
Wildlife and Ecology
Water Resources
Tropical Crops and Pastures
Entomology
Environmental Mechanics

MDP30 *Air Quality*

Objective:

To provide improved methodologies and information systems for the assessment and management of air quality in the urban and regional environment. To underpin this systems development with a focussed core research program. To provide a coordinated approach to air quality consulting work within CSIRO.

Planned Outcomes:

1 Integration of the work of participating Divisions with complementary expertise in air quality research and applications.

2 Development of a 'total catchment' approach to air quality assessment of atmospheric emissions and impacts through model development.

3 Coordination of consulting activities through a consortium approach to external consultancies and contracts, both nationally and internationally.

4 Enhanced collaboration in key priority areas, where advantage can be taken of the complementary skills across the Divisions.

5 Development of initiatives in the area of health risk assessment.

Participating Divisions:

Atmospheric Research
Coal and Energy Technology
Building, Construction and Engineering
Environmental Mechanics

MDP31 *Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity*

Objective:

To evaluate the utility of soil properties and remotely-sensed data in explaining the distribution and productivity of forests. To develop a basis for spatial prediction of eucalypt forest distribution and growth in complex terrain.

Planned Outcomes:

1 For the Bago-Maragle Ecological Sustainable Management project with State Forests NSW (SFNSW); completion of reconnaissance soil survey of the 144 sites, analysis of selected sampled soil layers, and initiation of GIS modelling of soil attributes using terrain climatic, and radiometric coverages. A 2nd-stage soil sampling strategy developed to produce a selection of sites for verifiication of predicted soil attributes and/or for detailed soil monitoring investigations. Historic forest growth data from SFNSW compiled to obtain estimates of forest productivity across the forests and to help further selection of growth plots for intensive investigations. A remeasurement program for selected forest plots established in conjunction with SFNSW.

2 Analysis of relationships between rock geochemistry and soil chemistry completed for the major parent materials of the SE forests. A set of alternative geochem indices prepared for testing in forest response models of the SE region.

3 A collaborative research project initiated with SFNSW to test the effectiveness of remote-sensing and terrain/regolith data in extending moist hardwood plot structure and biomass estimates over areas of Glenbog State Forest. Development of a temporal sequence of imagery for 3 plots and relation of this remotely sensed data to the reconstructed stand structure and biomass data. Production of DEMs and terrain attribute coverages across the area to aid in the modelling.

4 A collaborative research project initiated with Forestry Tasmania to test the effectiveness of remote-sensing and terrain/regolith data in extending forest permanent plot (CFI) growth data over the area of the Southern Forests.

5 Using the Wombat State Forest dataset obtained from Victorian DCNR and regression based modelling techniques, relationships between forest productivity attributes (such as height, basal area and/or volume PAI) and spectral and spatial variables as well as geographic variables such as altitude, temperature and topographic position.

6 Continued development of relationships between Landsat™ and Compact Airborn Spectrographic Imager (CASI) and forest standing volume, density and leaf area at Bateman's Bay NSW. Incorporation of soil data collected at the plots into the existing models utilising environmental and remotely sensed data.

Participating Divisions:

Forestry & Forest Products
Wildlife and Ecology
Soils

MDP32 *Dryland Farming Systems for Catchment Care*

Objective:

To develop an improved capability to analyse and predict the impacts of farming and grazing systems on the land and water quality of the catchment. To develop with farmers, other land managers, regulatory bodies and policy makers, guidelines and the means to assess the ecological sustainability of farming and grazing systems and their

Planned Outcomes:

1 Establishment of effective partnerships and collaboration with CSIRO and with TCM/ICM community groups, State agencies and landholders for each of the three primary research activities, namely: how catchments respond to farming systems; models of farming systems that can predict both farm production and the impact on catchment land and water resource; indicators of catchment health.

2 Publication of a book entitled "Farming Action: Catchment Reaction" to provide information for the Landcare and Catchment Management Communities on, the state of our knowledge in these areas, the utility of our current technology, and evaluation of barriers and inhibitors to adoption and achievement of catchment health, and recommendations for more effective participation of clients in the research process.

3 Identification and characterisation of the processes by which dryland farming and grazing activity impact on water and land quality within a catchment. Key issues include farming practices as they effect surface and groundwater, the location of a farming enterprise within the catchment, and the speed with which water and land quality change in response to new farming practices.

4 Establishment of an agreed protocol to facilitate cross-compatibility and integration of models of pasture and cropping systems which provide predictions of salinisation and erosion risk for current farming practices. Test and evaluate the utility of these tools in two focussed catchments of the National Dryland Salinity Program in close collaboration with Catchment groups and State agencies.

5 Collation of available information on utility of current and proposed indicators of catchment health and publish the outcomes as a book, entitled "Indicators of Catchment Health" along with guidelines and practical field manuals which assist the application and adoption of indicators in and monitoring of catchment condition.

6 Provision of advice and policy analysis on catchment management under dryland farming for Local, State and Federal Governments.

Participating Divisions:

Soils
Plant Industry
Tropical Crops and Pastures
Animal Production
Forestry & Forest Products
Water Resources
Wildlife and Ecology
Entomology

CSIRO PARTICIPATION IN COOPERATIVE RESEARCH CENTRES

Cooperative Research Centres (CRCs) are collaborative ventures bringing together researchers and research groups from universities, State government instrumentalities, business enterprises and Commonwealth research organisations such as the CSIRO. 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.

Since the launch of the CRC Program in May 1990, 61 Centres have been established over four rounds in six broad fields of research: Manufacturing Technology, Information and Communications Technology, Mining and Energy, Agriculture and Rural Based Manufacturing, Environment, and Medical Science and Technology.

CSIRO is a core participant in the 52 Centres listed below.

Manufacturing Technology

CRC for Materials Welding and Joining
- Division of Manufacturing Technology

CRC for Polymer Blends
- Division of Chemicals and Polymers

CRC for Molecular Engineering and Technology: Sensing and Diagnostic Technologies
- Division of Food Science and Technology
- Division of Applied Physics
- Division of Biomolecular Engineering

CRC for Industrial Plant Biopolymers
- Division of Food Science and Technology

CRC for Intelligent Manufacturing Systems and Technologies
- Division of Manufacturing Technology

CRC for Alloy and Solidification Technology
- Division of Manufacturing Technology

CRC for International Food Manufacture and Packaging Science
- Division of Materials Science and Technology
- Division of Food Science and Technology

Information and Communications Technology

CRC for Intelligent Decision Systems
- Division of Information Technology

CRC for Robust and Adaptive Systems
- Division of Radiophysics

Australian Photonics CRC
- Division of Applied Physics

CRC for Advanced Computational Systems
- Division of Information Technology

Research Data Network CRC
- CSIRO-Macquarie University Joint Research Centre for Advanced Systems Engineering
- Division of Information Technology

Mining and Energy

CRC for Mining Technology and Equipment
- Division of Exploration and Mining
- Division of Minerals
- Division of Manufacturing Technology
- Division of Coal and Energy Technology
- Division of Applied Physics

G K Williams CRC for Extractive Metallurgy
- Division of Minerals

A J Parker CRC for Hydrometallurgy
- Division of Minerals

Australian Petroleum CRC
- Division of Petroleum Resources

CRC for Australian Mineral Exploration Technologies
- Division of Exploration and Mining

Australian Geodynamics CRC
- Division of Exploration and Mining

CRC for New Technologies for Power Generation from Low-rank Coal
- Division of Minerals

CRC for Black Coal Utilisation
- Division of Coal and Energy Technology

CRC for Landscape Evolution and Mineral Exploration
- Division of Exploration and Mining

Agriculture and Rural Based Manufacturing

CRC for Legumes in Mediterranean Agriculture
- Division of Plant Industry
- Division of Entomology
- Division of Animal Production

CRC for Plant Science
- Division of Plant Industry

CRC for Tropical Plant Pathology
- Division of Tropical Crops and Pastures

CRC for Tropical Pest Management
- Division of Entomology

CRC for Temperate Hardwood Forestry
- Division of Forestry and Forest Products

CRC for Hardwood Fibre and Paper Science
- Division of Forestry and Forest Products

CRC for Viticulture
- Division of Horticulture

CRC for Premium Quality Wool
- Division of Animal Production
- Division of Wool Technology

CRC for the Cattle and Beef Industry (Meat Quality)
- Division of Animal Production
- Division of Animal Health
- Division of Food Science and Technology
- Division of Tropical Animal Production

CRC for Aquaculture
- Division of Fisheries
- Division of Animal Health

CRC for Sustainable Cotton Production
- Division of Plant Industry
- Division of Entomology

CRC for Food Industry Innovation
- Division of Food Science and Technology
- Division of Human Nutrition

CRC for Quality Wheat Products and Processes
- Division of Plant Industry

CRC for Sustainable Sugar Production
- Division of Tropical Crops and Pastures
- Division of Soils

Environment

CRC for Waste Management and Pollution Control
- Division of Water Resources
- Division of Chemicals and Polymers

CRC for Soil and Land Management
- Division of Soils

CRC for Catchment Hydrology
- Division of Water Resources

CRC for Biological Control of Vertebrate Pest Populations
- Division of Wildlife and Ecology

CRC for the Antarctic and Southern Ocean Environment
- Division of Oceanography

CRC for Freshwater Ecology
- Division of Water Resources

CRC for Southern Hemisphere Meteorology
- Division of Atmospheric Research
- Division of Applied Physics

CRC for Tropical Rainforest Ecology and Management
- Division of Wildlife and Ecology
- Division of Plant Industry

CRC for Water Quality and Treatment
- Division of Chemicals and Polymers

CRC for Weed Management Systems
- Division of Plant Industry
- Division of Entomology

CRC for Sustainable Development of Tropical Savannas
- Division of Wildlife and Ecology
- Division of Tropical Crops and Pastures

Medical Science and Technology

CRC for Tissue Growth and Repair
- Division of Human Nutrition

CRC for Cellular Growth Factors
- Division of Biomolecular Engineering

CRC for Eye Research and Technology
- Division of Chemicals and Polymers
- Division of Biomolecular Engineering

CRC for Cardiac Technology
- Division of Biomolecular Engineering
- Division of Chemicals and Polymers
- Division of Applied Physics

CRC for Vaccine Technology
- Division of Animal Health
- Division of Tropical Animal Production

CRC for Diagnostic Technologies
- Division of Biomolecular Engineering

Guide to Operational Unit Entries

Each of the components which make up the following operational unit entries is described briefly below:

Objective

A statement of the purpose, goal or result to which the unit's activities are directed.

Strategy

A unit's strategy describes the way it seeks to achieve its objective. In most cases the strategy is introduced by a brief statement of the operational context in which the strategy is put into effect.

Multi-Divisional Collaboration

Divisional entries include a list of the formal Multi-Divisional Programs (MDPs) in which the Division participates. Each MDP is numbered for ease of reference and details of each MDP are included in Section One. Other less formal forms of inter-divisional collaboration, though not detailed in this Operational Plan, are also of major importance.

Specific Objectives

These are more detailed objectives, printed in bold type. They are specified for all operational units. For Divisions they often correspond to particular research programs. After each specific objective there is an estimate in parenthesis of the percentage of resources devoted to the pursuit of that specific objective.

Planned Outcomes

For each operational unit progress to be achieved in 1996-97 toward stated objectives is detailed in a list of selected planned outcomes.

Summary of Resources, 1996-97

Staffing levels are shown in equivalent full time units classified by functional area. **Research Staff** includes the Research Scientist/Engineer, Research Project and Research Management classifications. **Other Staff** includes the Technical Services, Communication and Information, Administrative Services, General Services, Corporate Management and Senior Specialist classifications.

Financial estimates are shown as direct appropriation revenue, revenue from other sources, total revenue, operating result and end-of-year cash balance for 1996-97.

All figures in the summary of resources section are estimates as at June 1996.

Objective

Provide high level strategic leadership, business development, performance review and management of the Organisation.

Strategy

The Chief Executive will be accountable to the CSIRO Board for the total performance of the Organisation. The Deputy Chief Executives will:

- Chair the Alliances and be accountable for their performance.
- Be accountable to the Chief Executive for the performance of Chiefs and their Divisions.
- Foster cross-Divisional project opportunities.
- Oversee areas of corporate support for the Organisation as a whole.
- Oversee major sites and their development.
- Promote CSIRO through internal and external interactions.

Specific Objectives & Planned Outcomes

Protect and enhance CSIRO's capacity to fulfil its mission by exercising leadership and stewardship of CSIRO's human, financial and physical resources.

1 Efficient transition by Divisions to a Sector-Alliance mode of operation and increased collaborative research between Divisions which were formerly part of different Institutes.

2 Assessment of research opportunities at the Sector level and allocation of resources to Divisions in accordance with identified priorities.

3 A balanced portfolio of research and development which utilises CSIRO's core strength in strategic research to address key national requirements and deliver outcomes which focus on customer and stakeholder needs.

4 Strengthening of CSIRO's financial position, including a satisfactory outcome to triennium funding negotiations.

5 Formulation of a strategic plan for CSIRO for the 1997-2000 triennium.

6 Implementation of specific actions to promote internal communication as a line management responsibility.

7 Development of an integrated framework of policy and processes for leadership, career and team development in CSIRO, focussing on the behaviours and skills required for collaborative, cross-functional and multi-disciplinary team performance.

8 Adherence to all legal requirements and Board policies.

Develop and maintain high level strategic relationships with key customers, collaborators and stakeholder groups.

9 Frequent interaction with senior government, industry and community representatives, successful conduct of the second CSIRO/Government Workshop in early 1997, and effective contribution to government policy making.

10 Establishment of 22 Sectoral Advisory Committees and their effective operation.

11 Identification of significant current and emergent changes in government, industry, the community and internationally; assessment of the implications for CSIRO; and implementation of appropriate strategic responses.

12 Development of more effective collaboration between CSIRO and other research agencies, in line with CSIRO strategic directions.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$16,776,000
External Revenue	$2,553,000
Total Revenue	$19,330,000
Operating Result	2,105,000
End of Year Cash Balance	-3,161,000

Staff by Functional Classification 1996-97*

Research	0
Total	40

*estimates as at June 1996

2. Division of Animal Health

Objective

To be a national centre for animal health enhancing the international competitiveness of Australia's animal industries, the well-being of Australians and the quality of their environment through the application of excellent research and quality services.

Strategy

As global free trade increases, new international standards for disease surveillance are being developed. Customers are also demanding quality food free from chemical residues and microbial contaminants, and are increasingly aware of issues relating to global sustainability and the environment. The opportunities for Australia's livestock industries grow, provided that Australia keeps in front of these changes.

As a national centre of excellence in disease diagnosis, research and policy advice in animal health, the Division of Animal Health helps enhance the competitiveness of Australian agriculture and trade.

The Division will:

- Maintain a high state of preparedness to rapidly diagnose exotic diseases of livestock and aquatic animals, and develop its ability to identify endemic diseases in livestock, aquatic animals and native fauna.
- Underpin its diagnostic capability by constantly improving diagnostic tests to make them more rapid, simple, accurate, sensitive and cost effective.
- Develop improved vaccines and therapeutics for cattle, sheep, pig and poultry industries using existing and novel vaccine strategies. Vaccines for exotic diseases, horses and companion animals will be developed where a clear return to Australia can be demonstrated.
- Improve the quality and safety of food by focusing on the development of improved diagnostics to measure microbial and natural toxicant contamination in food to aid in the development of management strategies and surveillance.
- Collaborate with State agencies to increase national disease preparedness by transferring and providing training in appropriate diagnostic technologies and disease recognition.
- Provide advice to government where requested on importation issues, risk assessment and technical matters, importation protocols and biocontainment.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Program:

Biosensors - MDP27

Specific Objectives & Planned Outcomes

Provide diagnostic services and sciences relevant to the maintenance and improvement of the health of Australia's livestock, fish and shellfish in support of agricultural production and trade (43%)

1 Rapid diagnosis of samples submitted for exotic disease exclusion to the satisfaction of State agriculture agencies

2 Determination of the disease process of equine morbillivirus pneumonia in horses

3 Assessment of certain pathogenic viruses as biological control agents for the cane toad

4 Test developed to distinguish the fish viruses IHN and VHS using PCR

5 Diagnostic tests for duck virus enteritis developed and used in Vietnam as part of an ACIAR collaborative project

6 Field strains of rabbit calicivirus strains isolated and components of their genomes sequenced

7 Complete trials of a vaccine against annual ryegrass toxicity.

Enhance Australia's disease control capacity by improving our understanding of viral and bacterial disease processes, and mechanisms of disease control (31%)

8 Improved understanding of equine morbillivirus molecular biology through characterisation of structural proteins and virus/cell interactions.

9 Assessment of improved tests for bovine Johne's disease using cell-mediated immunity

10 Experimental model for enterohaemorrhagic *E. coli* established in calves.

11 Classical swine fever recombinant proteins gp53 and p80 evaluated for use in an improved diagnostic test.

12 An experimental bluetongue vaccine using ovine cytokines and bluetongue antigens expressed in vaccina virus.

Develop new vaccines and biological therapeutics to combat infectious diseases of production and companion animals (16%)

13 Phase I *Pasturella haemolytica* vaccine evaluated in cattle trials

14 Live rationally attenuated vaccines for bacterial infections of pigs evaluated

15 Australian isolates of bovine and porcine adenoviruses isolated for potential use as vaccine vectors

16 Therapeutic value of recombinant chicken gamma interferon assessed

17 Porcine cytokine genes cloned, expressed and evaluated as adjuvants.

As part of the CRC for Vaccine Technology, develop the science and technology needed to improve the efficacy of current vaccines and assist in the design and delivery of the next generation of vaccines. (10%)

18 The adjuvant potential of recombinant cytokines assessed in gastrointestinal nematode vaccine

19 Assessement of the immune response of animals to parasite antigens delivered using a bacterial vector.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,657,000
External Revenue	$9,809,000
Total Revenue	$21,466,000
Operating Result	314,000
End of Year Cash Balance	-1,742,000

Staff by Functional Classification 1996-97*

Research	124
Total	269

*estimates as at June 1996

3. Division of Animal Production

Objective

To deliver products, processes and information to our customers through creative science and innovative technology directed towards improving product quality and diversity; ensuring sustainability of agricultural systems and increasing the efficiency of animal production. Our customers are wool and meat producers and processors, agribusiness and the scientific community.

Strategy

An economic downturn in the rural sector has caused a reduction in the funds available from industry research funds, particularly for Australia's two major livestock industries, beef cattle and wool. Further growth, however, appears likely in the intensive livestock industries. In this context the Division will build on established relations with rural funding bodies to keep agreed research priorities aligned to industry needs. The Division will also rationalise its research portfolio to accommodate budget reductions and will strive to:

- deliver outcomes that improve the competitiveness of the Australian animal industries.
- provide research outcomes that reduce the cost of production and improve the quality of products in sustainable production systems.
- develop procedures that reduce the environment impact of animal production and improve the welfare of animals.
- maintain and develop strategic alliances with strong growing companies in the global animal production industries.
- exploit to the full the collaborative links it has established with three CRCs and four MDPs.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Fibre Utilisation - MDP3

Climate Variability and Impacts - MDP29

Dryland Farming Systems for Catchment Care - MDP32

CSIRO Aquaculture Initiative (CAI) - MDP34

Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities - MDP36

Specific Objectives & Planned Outcomes

To improve production efficiency, sustainability and animal welfare in Australian livestock production enterprises, especially intensive systems (18%)

1 Version 3 of AUSPIG decision support software for piggeries β-tested and commercialised; Version 4 (sow) β-tested.

2 Version 1 of Feedlot Management Recording System software β-tested and commercialised.

3 A commercialisation strategy completed and commercial partner obtained for an Anaesthetic Depth Alert Monitor.

4 Results of Rumentek protected nutrient trials in California completed and analysed.

5 Prototype prawn aquaculture diets for Australian conditions developed.

6 ACTH γ and adrenergic γ genes of pigs cloned.

7 Report delivered on feasibility of skin test for selection of sheep resistant to fleece rot and flystrike.

8 Relationships between putative management-induced stressors and immune competence determined.

To use genetic engineering technology to enhance the quality of animal products and improve the efficiency of production (4%)

9 Transgenic sheep produced containing a growth hormone gene construct that results in improved growth rate and body composition.

10 Technology developed that improves the efficiency of gene insertion and the production of transgenic animals.

11 Efficacy of recombinant chitinase-like molecules against sheep blowfly larvae demonstrated on the sheep's back.

12 Transgenic sheep produced containing a recombinant microbial biochemical pathway for producing the essential amino acid cysteine.

To improve profitability of the wool and meat industries through manipulation of hair follicle function (10%)

13 Biological Wool Harvesting (BWH) technology commercialised and additional applications developed for BWH, including improved leather and skins.

14 Understand sufficiently the biological control of wool/hair cycles to manipulate their function to the potential benefit of the sheep, cattle and pig industries.

To improve profitability of sheep production in seasonally fluctuating environments (7%)

15 Recommendations for supplement formulation and timing of supplementation delivered to sheep production advisers to aid feeding strategies for breeding ewes and weaners.

16 Information to assist adoption by industry of high staple strength genotypes delivered.

To improve wool quality, production efficiency and profitability in the Australian sheep industry through superior breeding strategies (18%)

17 DNA fingerprinting methodology developed that enables cost-effective identification of both male and female parents of progeny within the stud sheep industry.

18 Technology to breed for resistance to internal parasites delivered to the sheep industry.

19 Software package developed that predicts consequences of a range of selection strategies for customised breeding objectives involving fleece weight, mean fibre diameter, staple length and staple strength.

20 Determination of the increased economic returns achievable for wool producers from using new measurements of follicle densities.

To sustain the long term profitability of animal production by grazing animals (18%)

21 Agreement signed to commercialise the use of a naturally occurring rumen defaunating agent.

22 Syndication established to further develop the immunisation of animals against specific rumen organisms.

23 An objective specification system suitable for classifying hays according to animal performance described and tested.

24 A procedure for processing desirable fungi for storage and subsequent inoculation of animals developed.

25 A technique to measure toughness of vegetative plant material in routine use and combined with the use of alkanes in the analysis of grazing systems.

26 Techniques to measure variations in the utilisation of protein in feed grains evaluated and in routine use.

To develop sustainable control strategies for internal and external parasites of sheep and cattle (25%)

27 Novel technology developed with commercial partner to improve efficacy of off-shears treatment of sheep against body louse.

28 Putative genetic markers for resistance to helminth parasites tested in several sheep flocks.

29 A commercial formulation of fungal spores developed in a feed supplement block to control infective stages of parasitic nematodes on pasture.

30 Incorporation of urea molasses blocks for nutritional supplementation and prophylactic anthelmintic delivery into livestock production systems in Malaysia, Fiji and India.

31 Genetic marker(s) for ivermectin resistance in sheep nematodes developed and evaluated for use in diagnostic assay.

32 Performance of sheep selected for resistance to helminth parasites assessed under field conditions for their value in strategic worm control.

33 Prototype recombinant vaccine against *Haemonchus contortus* tested in lambs under field conditions.

34 Novel technology developed for incorporation and expression of protective helminth antigens in Salmonella delivery vector.

35 Selection of an adjuvant for internal parasite vaccine, based on immune responses of high responder lambs.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$13,883,000
External Revenue	$5,790,000
Total Revenue	$19,673,000
Operating Result	-731,000
End of Year Cash Balance	-3,970,000

Staff by Functional Classification 1996-97*

Research	157
Total	255

*estimates as at June 1996

4. Division of Applied Physics

Objective

To apply the Division's expertise in physical sciences and related disciplines to the development of the technological base of Australian industry. To establish, maintain and disseminate Australia's physical standards of measurement, including those required under the National Measurement Act 1960.

Strategy

- Strengthen alliances with firms in the manufacturing and energy distribution sectors, with emphasis on industrial machinery and equipment, quality assurance technology, flow metering, sensing instruments, and the electricity supply industry.
- With leading firms in the above sectors, develop and implement substantial R&D projects and commercialisation plans that have the potential to be of considerable benefit to Australia's economy.
- Conduct strategic and short-term R&D in physics and engineering with emphasis on developing new or improved products, industrial measuring techniques and manufacturing processes.
- Through the National Measurement Laboratory (NML) maintain Australia's national standards of measurement, provide a first-level calibration service, and collaborate with national and international organisations concerned with standards, measurement and testing.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Biosensors - MDP27

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

Undertake R & D and participate in regional and other international activities to maintain Australia's standing in international metrology, maintain Australia's standards for physical quantities, and provide and support calibration services for the national measurement system. (36%)

1 Maintenance and dissemination of an effective national measurement system for Australia in the fields of electric potential and impedance, ac electrical quantities, high voltage, time and frequency, magnetic quantities and dielectrics, mass and related quantities, temperature, acceleration, acoustics, ultrasonics, hardness, length, angle and other dimensional quantities, photometry, and optical radiometry.

2 Completion of the design of a new bridge to facilitate the calibration of standard inductors and to simplify the evaluation of the uncertainties in inductance measurements.

3 Completion of the design and construction of a standard TEM cell for producing known electromagnetic fields for use in establishing traceability for electromagnetic compatibility (EMC) measurements in Australia.

4 Evaluation of the absolute uncertainty in the clock frequency of the buffer gas-cooled trapped ytterbium ion standards, and demonstration of a frequency-doubled diode laser source for the 369 nm laser radiation required by the standards.

5 Completion of a detailed evaluation of a project to establish a new definition of the kilogram and to contribute to an international determination of a new value for Avogadro's Constant.

6 Coordination of the Asia/Pacific Metrology Programme (APMP) involving 22 countries and territories; completion of Stage 3 of a collaborative program to gain international recognition of Indonesia's national standards of measurement; completion of initial programs to gain international recognition of national standards of measurement in Vietnam and the Philippines.

Develop electrotechnology of current or potential value to Australian industry. (15%)

7 Delivery of new sensing and noise specifications for the SQUID-based magnetometer instruments, in association with our commercial partner; participation in field trials and effective modification of the equipment as required.

8 Transfer of our high-temperature superconductor measurement and characterisation expertise to the Metal Manufactures' Pilot Plant at Australian Technology Park, Redfern; achievement of the milestone targets relating to tape specifications and theoretical understanding.

9 In association with the major syndication partner, setting of prototype development goals for the CRC for Molecular Engineering & Technology, and progress towards achieving those goals.

10 In association with the CRC for Mining Technology & Equipment, completion of the field trials and intrinsic safety procedures for the bore-hole and machine guidance radar projects targeting the Australian coal industry; establishment of a network position in association with the University of Sydney in the proposed extension bid for the CRC MTE.

11 Completion of the research, development and manufacturing assessment of a sensing instrument based on surface plasmon resonance technology for a Brisbane-based SME, allowing a commercial position to be taken during 1996/1997.

Develop thermal, magnetic and electromagnetic technology of current or potential value to Australian industry, and develop ozone assessment models for environmental evaluations. (14%)

12 Continued development of both 2-D and 3-D stratospheric models for prediction of ozone levels on a time-scale of decades; continued leadership of model development work in the CRC for Southern Hemisphere Meteorology; continued collaborative work with NASA through the Global Modelling Initiative.

13 With the Division of Manufacturing Technology and Siddons Ramset Plasma Ltd, completion of an industrial facility for the destruction of ozone-depleting substances; continuing study of diagnostic and modelling techniques of plasma-based processes appropriate to the development.

14 Development with UVS Ultraviolet Pty Ltd of ultraviolet excimer lamps to improve the efficiency of the production of ozone for disinfection purposes.

15 In collaboration with Casttikulm Research Pty Ltd, completion of the design, construction and testing of a 50kW motor for a high-speed compressor.

16 Continued development for Transfield Technologies of a production prototype electro-mechanical prime mover.

17 Continued development with ORAD of a water pump that operates at 150°C for powering an oil-mule in oil wells.

18 With Pacific Power, TransGrid and ESAA, continuation of a study of the ageing of transformer oils and of suitable procedures for condition monitoring.

Develop acoustical, ultrasonic, and surface mechanical technologies of current or potential value to Australian industry. (26%)

19 Development of novel acoustic and ultrasonic non-destructive testing techniques in collaborations with Boeing and AEA Technologies and in support of Australian aerospace and marine manufacturers and maintenance organisations.

20 In collaboration with Australian Gas Light Company, completion of a second stage of development of, and completion of Australian and international licensing arrangements for, a new-generation ultrasonic gas meter; extension of the technique to other gas-flow metering applications.

21 Transfer of the technology for the manufacture of the Ultra-Micro Indentation System to an Australian manufacturer; provision of ongoing support to that manufacturer through further developments in the technology.

22 Development of the Filtered Arc Deposition System precision surface-coating technology for application to Australian tool, die and instrument manufacture, in particular with Surface Coating Technologies Pty Ltd and a consortium of manufacturers.

23 Development of novel ultrasonic liquid-flow meters for manufacture by Australian companies, including Email Meters.

Develop optically-based technologies and instrumentation of benefit to Australian industry, and maintain a scientific base in optics through provision of optical fabrication, coating and metrological services. (9%)

24 Using microwave-assisted plasma-impulse chemical vapour deposition (PICVD) equipment, production of optical coatings suitable for narrow bandwidth laser filters for use in defence-related applications.

25 In collaboration with the Division of Exploration and Mining, conducting and evaluating field trials of the SIROJOINT equipment.

26 Development of an operational laboratory prototype compact optical surface profiler (OSP) using zoom lens technology.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$19,863,000
External Revenue	$7,600,000
Total Revenue	$27,463,000
Operating Result	-744,000
End of Year Cash Balance	452,000

Staff by Functional Classification 1996-97*

Research	192
Total	278

*estimates as at June 1996

5. Division of Atmospheric Research

Objective

To solve significant problems concerning the physics, dynamics and chemistry of the atmosphere over the Australian region, and of the globe insofar as it affects the Australian region, and provide the best possible scientific advice on problems and issues involving the atmosphere.

Strategy

- To undertake studies of processes controlling atmospheric behaviour and to apply this knowledge to problems concerning Australia's weather, climate, atmospheric pollution and water resources.
- To determine the causes of current atmospheric concentrations and to predict future trends in climatically-active and ozone-destroying gases and aerosol influenced by human activity.
- To describe and quantify the radiative aspects of the earth's atmosphere and surface, especially the interaction of radiation with clouds and water vapour.
- To solve a range of practical problems associated with urban and regional air pollution, and to apply increased knowledge of surface, orographic and boundary-layer processes to the improvement of modelling systems.
- To develop and maintain a hierarchy of climatic models capable of addressing current and perceived developing environmental issues of regional and global concern.
- To provide advice and information to stakeholders on a range of environmental issues, including the enhanced greenhouse effect, ozone depletion, regional air quality and drought.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Climate Variability and Impacts - MDP29

Air Quality - MDP30

Specific Objectives & Planned Outcomes

Investigate the science of urban and regional air pollution meteorology and chemistry, and apply knowledge to consultancy applications. (19%)

1 Development of a two-particle dispersion model to include atmospheric boundary layer flows and direct numerical simulations of turbulence.

2 The Port Pirie dispersion consultancy completed for Pasminco. Further specific air quality consultancies undertaken as they arise.

3 Provision of model results for sulfur-based acidic deposition in the Asian region for comparison with overseas studies.

4 A study of airborne fine particles in the Jakarta region for Bapadel.

5 Provision of training and transfer of knowledge overseas relating to the Lagrangian Atmospheric Dispersion Model.

6 Divisional limited-area model applied to pollution dispersion on inter-regional scales and including deposition processes.

7 Publication of results from recent haze studies in scientific literature.

8 An experimental study of tropical tropospheric chemistry at Charles Point, Northern Territory.

To apply an improved knowledge of frontal and severe storm systems to specific applications such as catchment hydrology and limited-area model development. (5%)

9 Coupling of the cloud model to a run-off model and a geographic information system to form a prototype infrastructure planning tool.

10 Provision of precipitation estimates for specific catchments, based on computer modelling studies of severe storms.

Investigate factors which determine interactions and feedbacks between the energy and hydrological cycles in the atmosphere, and investigate dynamical processes that affect these cycles. (13%)

11 Identification of moisture influences on monsoons, major NW-SE cloud bands, and other large-scale atmospheric disturbances.

12 Investigation of atmospheric energy spectra, with view to improving sub-grid parameterisation of large-scale turbulence in climate models.

13 Further development of field sites for study of surface radiation budget at Hay, NSW and Alice Springs, NT.

14 Investigation of the relationship between satellite observations of the surface radiation budget and *in situ* observations — three-year analyses.

15 Validation of the radiation budget in climate models through comparison with other models and with global observations — emphasis on clear sky fluxes and cloud forcing.

16 Investigation of the role of water vapour in climate system using GPS information and analysis of model thermal emission spectra.

17 Consolidation of data analysis and interpretations for the Southern Ocean Cloud Experiment.

Apply recent developments in remote sensing instruments to research and commercialisation. (3%)

18 Application of three-wavelength lidar to atmospheric observations of power-station plumes and atmospheric clouds.

19 Analysis of lidar data from major field experiments, including Port Pirie, MCTEX and SOCEX.

Development and application of powerful computer climate models of the global atmosphere and of the combined atmosphere-ocean system to investigate climate variability including drought, and climate change associated with the enhanced greenhouse effect. (14%)

20 Final development and testing of the Mark 3 fully-coupled climate model, including the Modular Oceanic Model Mark 2.

21 Analysis of a climate model with transiently increasing carbon dioxide growth and inclusion of sulfate aerosol.

22 Development and testing of a coupled atmosphere-oceanic model for multi-seasonal predictions.

23 Hindcast experiments with the T63 CSIRO9 model based on Cane and Zebiak sea-surface temperature predictions from 1970-1990.

24 Prediction experiments with the T63 CSIRO9 model for 1996-97 using Cane and Zebiak sea-surface temperatures.

Incorporate into climate models improved descriptions of dynamical systems and of the interaction of radiation with clouds and the earth's surface. (6%)

25 Participation in, and analysis of data from, the New Zealand Southern Alps Experiment.

26 Testing and development of cloud parameterisations using the Division's limited-area model and the Mark 3 climate model.

27 Implementation of updated snow scheme into the Mark 3 climate model.

Assess regional extent and impact of future climate change caused by the enhanced greenhouse effect. (18%)

28 Development and application of methodologies for analysis of climate change data. Second annual report for northern Australia on likely regional climatic impacts.

29 Further investigations into the likely impact of the enhanced greenhouse effect on phenomena such as extreme events.

30 Climatic research experiments using a regional numerical model at 70-km resolution.

Investigate the past and present composition of the atmosphere, with particular emphasis on sources and sinks of trace gases and aerosol, in order to provide the basis for an assessment of future trends and likely climate impact, as well as to provide the information needed to gauge the efficacy of remedial action. (22%)

31 Analyses of radiatively active and ozone-depleting gases and their isotopes as part of global monitoring of these species.

32 Analysis of past changes in levels of trace gases and oxidants in air from Antarctic ice cores, Antarctic firn and from the Division's archived air, with particular focus on the last one to two thousand years.

33 Numerical modelling of atmospheric transport of greenhouse gases to deduce sources and sinks.

34 Multi-decadal modelling of carbon dioxide to project future levels and analyse paleo-records.

35 Refinement of global and national budgets of greenhouse and ozone-depleting gases using atmospheric observations and process-based modelling.

36 Studies of marine aerosol formation and the aerosol cloud albedo mechanism of climate regulation over the Southern Ocean.

37 Measurement and modelling of factors regulating ozone and oxidant concentrations over the Southern Ocean.

38 Measurements in air above Cape Grim of changes to oxygen concentrations brought about by combustion of fossil fuels and the exchange of carbon dioxide with the oceans and the terrestrial biosphere.

39 Scientific leadership of the Australian Baseline Air Pollution Station.

40 Advice to government, industry and other groups concerning ozone depletion, the enhanced greenhouse effect, and climatically active aerosol.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$7,562,000
External Revenue	$4,300,000
Total Revenue	$11,862,000
Operating Result	-985,000
End of Year Cash Balance	1,157,000

Staff by Functional Classification 1996-97*

Research	94
Total	142

*estimates as at June 1996

6. Australia Telescope National Facility

Objective

To operate and develop the Australia Telescope National Facility as a prestigious and world class radio astronomical observatory dedicated to the advancement of knowledge.

Strategy

Exploit the unique southern location and technological advantages of the Australia Telescope to maintain its position as a world class facility supporting both Australian and international researchers.

- Use the strong basic scientific research program to direct the instrumental development of the Australia Telescope and ensure a high profile for radio astronomical research in Australia.
- The ATNF's broad system engineering design capability and sophisticated end users, in combination with key technologies provided by the Division of Radiophysics, result in an extraordinary degree of vertical integration. This generates great opportunities for future developments and technology transfer and provides a showpiece for Australian technology.

Specific Objectives & Planned Outcomes

To pursue a program of research in astronomy and astrophysics. (10%)

1 The properties of radio stars, pulsars, supernovae remnants, molecular clouds, star formation, galaxies and quasars investigated.

2 At least 50 scientific papers published in refereed journals.

3 The first survey of HI in the local universe commenced, utilising the new multibeam system at Parkes. At least 15% of Southern Sky and 30% of "Zone of avoidance" (the region close to the galactic plane) completed in this period.

To operate the Narrabri and Mopra Observatory as a National Facility. (33%)

4 Access to the Narrabri facilities that satisfies the community of scientific users.

5 At least 60% utilisation of the Compact Array and time lost during scheduled observing periods kept to less than 5%.

6 Support of 85-115 GHz observations at Mopra with remote receiver tuning, on a shared-risk basis.

To operate the Parkes Observatory as a National Facility. (11%)

7 Access to the facilities that satisfies the community of scientific users.

8 At least 60% utilisation of the telescope and time lost during scheduled observing periods kept to less than 5%.

9 The HI multibeam system brought into regular operation.

To operate the Long Baseline Array (LBA) network as a National Facility. (3%)

10 Access to the facilities that satisfies the community of scientific users.

11 Full operation of the new 6-station LBA correlator facility.

12 The Japanese VSOP Space VLBI mission supported with allocated observing times of 5% at Parkes , 5% at Narrabri and 25% at Mopra.

13 Scheduled observations on the Asia Pacific Telescope (APT) network supported.

To operate and develop the computing facilities. (7%)

14 Hardware and software for the joint ATNF-Radiophysics network of computers needed to satisfy the operational and research environment requirements at all sites developed, operated and maintained.

15 Coordination of computer systems development at all observatories.

16 Continued active participation in the AIPS++ development. AIPS++ used to analyse HI multibeam data.

To upgrade the ATNF and VLBI facilities in accordance with the Major National Research Facilities (MNRF) program. (20%)

17 High frequency receivers for Compact Array, Mopra, Hobart and Ceduna designed.

18 Local oscillator upgrade for Compact Array designed.

19 Construction of 3 new stations for Compact Array commenced.

20 New Parkes RF/IF conversion system completed.

21 VLBI receivers for the Ceduna antenna completed, in a collaboration with the University of Tasmania.

22 Hydrogen masers for Ceduna and Narrabri specified.

23 Design phase completed, as part of strategic research for future developments of: Ceduna feed and subreflector upgrade; focal plane arrays; holography; Mopra tertiary optics/surface; 225 GHz water vapour radiometer; interference excision.

24 Support of international collaborations via the MNRF program.

To develop the next generation of ATNF instrumentation. (5%)

25 Commissioning of the HI multibeam system at Parkes.

26 The joint ATNF- Radiophysics 3mm focal plane array study progressed to cryogenic testing of microwave monolithic integrated circuit (MMIC) devices.

27 The Australia Telescope Observing Management System (ATOMS) development commenced.

To satisfy external agreements for telescope use . (6%)

28 The Galileo mission at Parkes supported for up to 10 hours/day from Nov 1996 to Dec 1997, under contract with NASA, utilising the frequency agility capabilities of the upgraded focus cabin.

29 Agreement for European Southern Observatory (ESO) use of ATNF negotiated if Australia joins ESO.

To promote the activities of the ATNF, and provide information and educational resources. (5%)

30 The Parkes and Narrabri visitor centres operated and maintained at a level satisfying their customers.

31 Educational opportunities provided at the high school, undergraduate, graduate and post doctoral levels. These include: a work experience program, training for sandwich-course engineering students, a summer undergraduate program, collaborative PhD programmes in engineering and astronomy and post doctoral positions.

32 General public and educational institutions informed about Australia's research activities in astronomy, through print material, media coverage, talks, teacher workshops and special events.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,121,000
External Revenue	$5,160,000
Total Revenue	$16,281,000
Operating Result	-2,279,000
End of Year Cash Balance	595,000

Staff by Functional Classification 1996-97*

Research	59
Total	110

*estimates as at June 1996

7. Biometrics Unit

Objective

Promote the effective and efficient use of experimental resources in CSIRO' s agricultural, environmental and natural resources research, through improved experimental design and more informative methods of statistical analysis.

Strategy

In the present climate of scant resources it is essential for scientists to use cost-efficient experimental designs and to extract as much valid information from data as possible. Statistical methodology is vital to achieving these aims. The Unit, which is to be located at the Division of Mathematics and Statistics from 1 July 1996, will:

- Collaborate in Divisional research projects.
- Provide a high quality statistical consulting service.
- Train Divisional staff and commercial customers in using basic statistical methods and statistical computer packages.
- Carry out biometrical research relevant to Divisional programs.
- Locate staff with relevant Divisions, or visit such Divisions regularly.
- Undertake direct external consultancies which utilise the Unit's biometrical expertise.

Specific Objectives & Planned Outcomes

Develop a collaborative research contribution to a number of biological Division projects, ensuring that the Biometrics contribution adds significant value to the projects, either by increasing the efficiency of resource utilisation, or by providing novel solutions to research problems. (60%)

1 Full participation in client research reporting, demonstrating significance of biometrical contribution.

2 Publication of novel methods of statistical analysis in the peer reviewed literature.

Improve the effectiveness of biological research through timely and relevant statistical consultancy. (30%)

3 Improved use of experimental resources (more precise estimation of relevant parameters for fixed cost, or lower cost estimates for fixed precision), documented in consulting reports which clearly demonstrate the value of the consultancy.

4 More informative statistical analyses which provide more precise and more reliable estimation of parameters, documented in consulting reports and collaborative papers.

Develop the statistical skills and knowledge of Divisional staff, improving the effectiveness of their statistical design and analysis. (5%)

5 Short courses at sites throughout Australia, relevant to the needs of biological and environmental Divisions, and which obtain high scores in post-course feedback questionnaires.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$1,562,000
External Revenue	$313,000
Total Revenue	$1,875,000
Operating Result	-208,000
End of Year Cash Balance	380,000

Staff by Functional Classification 1996-97*

Research	20
Total	23

*estimates as at June 1996

Objective

To assist in the development of Australian pharmaceutical and health care industries by undertaking research on the structure and function of biological macromolecules; to assist other CSIRO biological research activities where appropriate.

Strategy

- Maintain a core of long-term strategic research in the areas of protein structure and engineering, gene structure and regulation, molecular virology and antiviral agents, receptor biology and structure, and biomaterials.
- Maintain high level experimental facilities and capabilities for the analysis of the structure and function of biological macromolecules.
- Develop appropriate links with other organisations for further development and ultimate commercial exploitation of this knowledge. Such links include the CRC for Cellular Growth Factors, the CRC for Eye Research and Technology, the CRC for Cardiac Technology, CRC for Diagnostic Technologies, the Biomolecular Research Institute and the South-Eastern Area Health Service, NSW.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1

Novel Management Techniques for Plant and Plant Product Pests - MDP2

Biomaterials and Medical Devices - MDP13

Biosensors - MDP27

Specific Objectives & Planned Outcomes

To acquire knowledge of the structure of protein molecules relevant to the development of new pharmaceuticals. (9%)

1 This program forms part of the Biomolecular Research Institute, a joint venture between CSIRO and the Strategic Industry Research Foundation (SIRF). The percent resources shown do not include the matching funds from the SIRF.

2 Phase III clinical trials with the anti-influenza compound GG167, developed from CSIRO research in collaboration with BIOTA Holdings, commenced by Glaxo.

To devise new pharmaceutical agents and diagnostic strategies based on the structural analysis and engineering of proteins, particularly targeted to antibodies and other members of the immunoglubulin superfamily. (15%)

3 Development of generic library technology, bispecific reagents and expression systems as specific research projects within the CRC for Diagnostic Technologies.

4 Production and characterisation of antibody fragments for biosensor applications with MDP27 and CRC-MET.

5 Development and evaluation of controllable lytic peptides, encompassing their application as immunotoxins for cancer therapy.

6 Development of immunomodulators for treatment of autoimmune diseases.

To design, develop and evaluate novel compounds and molecules useful for human gene therapy and the treatment of acquired human diseases. (31%)

7 Design and evaluation *in vivo* of minizymes with improved cleavage activity against therapeutically important targets.

8 Acquisition of basic knowledge in gene regulation and its application to the problems of multidrug resistant bacteria, gene therapy for prostate cancer and the control of specific eukaryotic genes.

9 Design, construction and testing of recombinant adenoviruses for targeted delivery of therapeutic genes.

10 Development and testing of new transfection reagents for delivery of nucleic acids (in collaboration with FH Faulding).

11 Development of novel diagnostic methods for analysis or prostatic cancer based on protease detection.

12 Evaluation of the delivery and efficacy of fatty-acyl drug complexes (in collaboration with FH Faulding).

To develop anti-viral compounds based on the structure and function of viral regulatory proteins and molecular mechanisms employed in virus replication cycles. (8%)

13 The Program forms part of the Biomolecular Research Institute, a joint venture between CSIRO and the Strategic Industry Research Foundation. The percent resources shown do not include the matching funds from the SIRF.

To elucidate the structure and function of cell surface receptors for the development of new pharmaceuticals and health control strategies. (21%)

14 Continuation of genetic constructs, medium to large scale mammalian cell fermentation and purification of tens of milligram quantities of purified domains of different members of the insulin receptor family for structural studies in collaboration with the commercial partner Biota Holdings Ltd and the BRI with additional GIRD funding.

15 Continuation of electron microscopic and protein crystallisation analyses of purified insulin receptor, insulin-like growth factor receptor and insulin receptor-related receptor domains and their complexes with antibodies and/or ligand in collaboration with the commercial partner Biota Holdings Ltd and GIRD funding.

16 Elucidation of molecular mechanisms involved in insulin receptor signaling pathways, with particular emphasis on the neuronal homologues controlling glucose transporter vesicle translocation.

17 Structural characterisation and functional evaluation of a natural product with insulin-like effects.

18 Continuation of involvement in CRC for Cellular Growth Factors providing expertise in mammalian cell expression and fermentation for large-scale production of recombinant receptors and cytokines.

19 Characterisation of the molecular requirements of lytic peptides and fusion inhibitors and their evaluation for therapeutic purposes.

To develop biomaterials and pharmaceuticals for use in tissue replacement and repair. (17%)

20 Protein preparation and crystallisation studies on selected molecules which are targets for control of fibrotic disorders.

21 Development of collagens from novel sources for clinical and commercial applications.

22 Evaluation of novel commercial and CSIRO candidate materials for use in artificial cornea applications.

23 Utilisation of performance data from candidate artificial cornea materials to design additional novel materials for this application.

24 Characterisation of the effects of vascular extracellular matrix and growth factors on vascular cells.

25 Characterisation of the role of perlecan in the biology of vascular cells.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,731,000
External Revenue	$4,089,000
Total Revenue	$15,820,000
Operating Result	-412,000
End of Year Cash Balance	39,000

Staff by Functional Classification 1996-97*

Research	120
Total	161

*estimates as at June 1996

Objective

To improve the quality and cost-effectiveness of building, construction and engineering through world class research and development.

Strategy

The construction industry represents about 8% of GDP for new construction and 15% including operation, servicing, maintenance and refurbishing. It addresses more than 70% of total fixed capital investment (much of it on the public sector) and is rapidly increasing its export of goods and services particularly to the growing economies of SE Asia. Restructuring and reform of the industry has incorporated more R & D to bring it to international competitiveness.

- Engender a strong customer focus and market orientation which allows customer needs to be anticipated and met. A major representation of this focus is the identification of 5 major market segments: - Planners and Designers - Building Product Manufacturers - Contractors - Building Owners Managers and Facilities Engineers - Asia.
- Develop strong collaborative research ties with industry through the successor to the Construction Industry Development Agency (CIDA) and the Construction Industry Institute Australia (CII); and with governments through the Australian Housing and Urban Research Institute (AHURI) and the Building Regulations Future Directions program; and with universities.
- Establish effective communication and technology transfer links to businesses that service the industry. Develop collaborative R&D projects and consultative investigations for industry. Input to 140 national and international standards committees, to industry and professional associations and to education and training courses.
- Collaborate with international agencies through CIB - the Council for International Building, RILEM - the Union of materials and structures laboratories, and with Government agencies for export aid and scientific agreement programs.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4

Heavy Mineral Processing - MDP6

Magnesium Production - MDP10

Urban Water Systems - MDP16

Climate Variability and Impacts - MDP29

Air Quality - MDP30

Specific Objectives & Planned Outcomes

Improve the efficiency of planning and design and reduce the costs of operating facilities through the development of knowledge bases and decision support systems for planners and designers of housing, commercial and industrial structures, infrastructure and urban systems. (23%)

1 Development of computer based information and management systems for: planning and evaluation of urban land use, transport, communication and utilities distribution; project management and asset management; the design of improved knowledge based systems adaptable to a range of building applications; infrastructure planning using geographic information systems.

2 Development of an integrated design environment including decision support system modules for performance evaluation, material selection, structural performance and process management tools.

3 Development of facility planning tools for solid waste management, hospitals, retail developments and fire brigade facilities.

4 Development of integrated planning appraisal and optimisation models for urban land use.

5 Continued development of broadband applications in construction.

6 Further development of industry and demographic forecasting methodologies.

7 Provision of research and assistance relating to urban planning and design for Jakarta.

8 Development of integrated urban water system model for the design of water infrastructure which incorporates economic impacts, environmental impacts and the evaluation of land use option.

9 Development of fire growth field models.

Improve construction processes and increase efficiency through off-site production, robotics and automation, decision support systems and electronic data interchange. Provide performance measures to allow reliable benchmarking relative to world's best practice standards. (9%)

10 Development of computer simulation, scheduling, visualisation and optimisation tools to improve the construction process and eliminate problems well before actual construction begins.

11 Development of a real-time computer based communication system for CAD and other construction data and information between various project participants irrespective of their office and site locations, including mobile communication to on-site personnel.

12 Provision of documented examples of re-engineering construction processes demonstrating time and cost savings and quality improvements.

13 Report analysing the construction communication and information flow process and identification of causes and amount of rework.

14 Development of new construction materials scheduling and handling processes.

15 Development of accelerated processing technology for pre-cast products.

16 Development of condition monitoring systems for improving speed of construction.

Improve the life cycle performance of products. Increase use of recycled building and construction materials and industrial by-products. Reduce the cost of fire and natural disasters. Assist with the adoption of more efficient manufacturing processes and suitable standards for indoor air quality. (22%)

17 Development of computer based design tools predicting the service life of timber, metallic and coated metallic components used in building envelopes under micro-climatic conditions encountered in tropical and temperate zones.

18 Production of Aust/NZ Standard for structural glazing.

19 Development of models for predicting the degradation and long term performance of different polymers and composites used in the building, pipeline and construction industries.

20 Construction of microwave scanner prototypes for CLT and DART machines in timber sorting processes.

21 Development of processing and treatment methodology for industrial and domestic waste materials based on chemical and mineralogical constitution and physical properties.

22 Development of high performance composites, utilising high volume waste materials, for use in aggressive environments.

23 Development of standard protocols for assessing VOC emissions of materials.

24 Development of alternative surface engineering processes for controlled surface engineering of polymeric material, organic/inorganic fibres, particulate fillers and rubbers.

Improve the life cycle cost of materials, components and systems, improve energy efficiency in buildings, improve the performance of engineered products and services, reduce industrial energy usage and costs in industrial processes and improve management of land, air, water and noise pollution. (46%)

25 Development of advanced fire suppression technologies.

26 Development of new fire code for buildings.

27 Provision of redesigned agitator systems capable of reducing scale growth by an order of magnitude while also reducing power consumption for the alumina industry.

28 Development of improved fixing systems to reduce the process time taken to produce synthetic rutile.

29 Development of an efficient method for introducing Caro's acid into Pachucas during the leaching process in Uranium production.

30 Development of computer code capable of capturing the transients which occur in industrial fluid and granular flows.

31 Development of a suite of performance based facilities, techniques and services to model, control and improve energy flows, heating, cooling and ventilation processes in domestic, commercial and industrial processes and to evaluate the life cycle impacts of constructed facilities.

32 Development of a gas burner which is 20% more energy efficient and has reduced greenhouse and toxic emissions for use in gas fired appliances/furnaces and refrigeration systems.

33 Development of a condition monitoring, diagnosis and information management system for safety maintenance and rehabilitation of buildings and infrastructure.

34 Development of models to predict the life cycle performance, safety and cost of building and infrastructure components and systems.

35 Development of standard processes for environmental assessment, management, maintenance and repair of buildings, infrastructure and construction sites.

36 Development of intelligent software incorporating image processing, visualisation and analysis for automatic fault diagnosis in water pipes.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$18,050,000
External Revenue	$9,050,000
Total Revenue	$27,100,000
Operating Result	0
End of Year Cash Balance	987,000

Staff by Functional Classification 1996-97*

Research	189
Total	286

*estimates as at June 1996

Objective

In collaboration with enterprises involved in the use of chemical, polymer, water and wastewater technologies, to create wealth for Australia and to enhance the quality of life in Australia, by conducting research, and by contributing to the formulation of public policy.

Strategy

The chemical industry is one of the largest value-added mainstream sectors in the Australian economy. However, Australia is a net importer of chemicals, with the difference between the value of imports and exports of chemicals adding $5 billion to the trade deficit in 1994/95. The chemical industry is of vital importance to the Australian economy and will find increasing relevance in the shift from a nation of low value-added exports to a manufacturing nation exporting high value-added products.

The basis for such a development will be research. Experience has established that the research in the Division of Chemicals and Polymers is internationally competitive. Accordingly the Division is well placed to make a major contribution to Australia's progress in this field.

Manufacturing industry, and in particular the chemical industry, is increasingly subject to controls designed to protect the environment. This context creates opportunities for CSIRO to both provide leadership in policy formulation and to undertake research which acknowledges environmental concerns.

With this in mind the Division will:

- Collaborate with industry on research projects at as early a stage as possible to ensure that commercial insights influence research directions.
- Collaborate with research colleagues in industry, universities and other CSIRO Divisions to take maximum advantage of Australia's research expertise.
- Develop new chemical products and processes for world markets through manufacture in Australia or technology export.
- Develop new processes for water and wastewater treatment which achieve better environmental outcomes for Australia and which provide technology for export.
- Provide leadership in the development of public policy and public understanding in the chemical area.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Biomaterials and Medical Devices - MDP13

Urban Water Systems - MDP16

Biosensors - MDP27

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

Generate biologically active chemicals for evaluation in crop protection, and investigate pre-industrial scale production of fine chemicals to determine optimum conditions for maximising outputs. (31%)

1 Synthesis of new biologically active compounds for evaluation as environmentally friendly insecticides, herbicides and fungicides.

2 Development of downstream processing and technology for new antibiotic products by fermentation.

3 Development of processes for the production of a number of fine chemicals.

4 Increased use of the Division's process-bay facilities by Australian chemical producers and other Divisions.

Invent and synthesise organic compounds with biological activity which have potential as pharmaceuticals. (9%)

5 Completion of animal tests for compounds active against Hepatitis B.

6 Synthesis of target compounds functioning as glycosylation inhibitors for testing as anti-viral agents.

7 Expansion of newly discovered chemical agents against other viral vectors eg. Herpes viruses and cytomegaloviruses.

Develop new polymer products utilising expertise in monomer synthesis, polymerisation processes, reactive processing of plastics, chemical/physical/mechanical characterisation of polymeric materials. (16%)

8 Development of new invention for the production of ultra narrow polydisporsity polymers.

9 Generation of a new class of toughening agents for nylon using CSIRO's macromonomer chemistry.

10 Increases in the melt strength and heat distortion temperature of PET by reactive extrusion.

11 Formulation of fibre-epoxy resin composites and their use to construct automobile parts and anti-ballistic panels for armoured vehicles.

12 Provision of consultancy services to a range of Australian enterprises, with an emphasis on SMEs.

Use microwave and membrane technology to make chemical synthesis more efficient and environmentally friendly, develop materials with properties necessary for human medical applications, and develop processes and products useful to the security devices industry. (16%)

13 Materials for high performance contact lenses and artificial corneas developed and evaluated.

14 Joint development with companies of polyurethanes which are blood and tissue compatible and show better retention of strength and elasticity under long term implantation, to replace the currently available materials.

15 Assistance provided in the development of current security devices. Research into new generation of banknote products.

16 Commercialisation of membrane reactors for effective chemical synthesis, and membrane use as sensors.

17 Further upgrade of microwave chemical reactors to broaden scope of application.

Apply knowledge of surface and colloid properties of materials to enable manufacturers to create new products and to meet environmental standards and to apply physicochemical knowledge to the treatment of industrial effluents. (17%)

18 Correlations established between surfactant structure and wool scouring efficiency for use in the design and optimisation of surfactants.

19 Evaluation of naturally sourced coating materials for paper board products with respect to waterproofing efficacy, recyclability, reusability and environmental acceptability.

20 Design and assessment of traceable polymers and organic removal from waters and establishment of a full scale demonstration plant for removal of organics from water.

21 Establishment of new capabilities in high resolution microscopy, particularly in atomic force microscopy, for the definition of biological receptors in monitoring devices.

22 Establishment of commercialization opportunities for integrated processes for arsenic, selenium and manganese removal from wastewaters.

23 Development of robust thin films for application with photovoltaic and prototype biosensing devices.

24 Collaboration with industrial partner on pilot plant for the recovery of valuable components from waste explosive emulsions.

25 Evaluation of novel combination of physical and chemical process for sludge dewatering.

Apply physicochemical and biological knowledge through laboratory and pilot scale operation to the treatment of potable water, wastewater and sewage. (11%)

26 Application of understandings of the processes of biological phosphorus removal to the design, construction and operation of large commercial plants.

27 Production of commercial prototypes of the RACOD (Readily Assimilable Chemical Oxygen Demand) instrument in collaboration with commercial partner.

28 Establishment of a commercialization plan for removal of ammonia from waste waters.

29 Development of processes for the treatment of storm water.

30 Evaluation of new opportunities for the application of novel magnetic microparticle technology in high rate filtration.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$12,126,000
External Revenue	$5,467,000
Total Revenue	$17,593,000
Operating Result	1,157,000
End of Year Cash Balance	77,000

Staff by Functional Classification 1996-97*

Research	140
Total	182

*estimates as at June 1996

Objective

To improve the competitive advantage and environmental acceptability of the coal, energy and related industries.

Strategy

The continuing growth in demand for energy in Australia's export markets, and the close links between energy efficiencies and environmental impacts, provides expanding opportunities for R & D to meet both long and short-term needs. The coal, power generation and metallurgical industries continue to support R & D, while the renewable energy industry is gaining momentum. Government agencies and industry supports work on environmental issues in urban emissions. This, plus growing worldwide demand for new technologies and processes will provide cleaner production and improved waste management, and support the development of a strong environmental focus within the Division.

- Develop a balanced portfolio of research projects which attracts industry support and incorporates both strategic and applied research.
- Enhance marketing and commercialisation strategies to maintain industry funding levels and facilitate the transfer of technology.
- Promote the environmental benefits gained by improved and new processes and technologies.
- Strengthen synergies between the Division and research groups both within and outside CSIRO.
- Foster creative, productive interaction between staff to develop a stimulating work environment.
- Create a continuous improvement culture within the Division to improve the delivery of quality R&D.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Air Quality - MDP30

Specific Objectives & Planned Outcomes

Optimise the yield and quality of coal recovered in preparation plants, generate new and improved preparation technologies and products, and minimise environmental impact. (30%)

1 Binderless briquetting progressed to commercial implementation.

2 Demonstration scale projects on size classification and coal recovery from tailings substantially progressed or completed.

3 Pilot plant projects on selective breakage and coarse and fine coal centrifuges substantially progressed or completed.

4 Projects on ash/moisture washabilities, coal variability, rapid turn around analyses, improved sensor and instrumentation and process control of coal.

5 Pilot scale projects established for slurry subdivision and turboflotation; demonstration scale project initiated for air purged centrifuge.

6 Marketing and development strategies involving external consultants developed for all areas of the Division's activities.

7 Initiation of projects on fine coal flotation and control and teetered bed separation.

Reduce the environmental impact of the energy and minerals industries by development of new processes for minimisation, removal and destruction of waste. (15%)

8 Commercialisation of new processes for the destruction of PCBs in transformer oils.

9 Complete demonstration of the technical feasibility for recovering hydrogen fluoride.

10 Completion of a laboratory study on the use of electrokinetic methods for the removal of heavy metal and PCB contamination from soil.

11 Demonstration of technology for removal of chlorinated hydrocarbons from soils.

12 Development of new technology for safe destruction of chlorinated hydrocarbons.

13 Support organised for setting up an Australian laboratory for the analysis of toxic trace organic contaminants.

Assess and control the impact on the atmosphere and on freshwater and marine systems of pollutants arising from the energy, minerals and other industries and from urban and rural activities. (20%)

14 Ok Tedi Mining Ltd provided with an improved understanding of the bioavailability of copper in the Fly River.

15 Development of a sensitive bioassay for copper in waters.

16 Understanding the processes controlling trace metal contaminant bioavailability in sediments to permit the development of reliable sediment quality criteria.

17 Successful application of intact core leaching to evaluate nutrient and toxicant release from contaminated sediments.

18 Understanding of mercury cycling in Tasmanian lakes displaying elevated mercury concentration in their fish stocks.

19 Porgera Joint Venture provided with a comprehensive interpretation of the processes controlling the fate of mine derived heavy metals in the Strickland River system.

20 Commercialisation of a portable monitor for sewage pollution in beach waters.

21 Improved bioassays developed for the assessment of contaminated soils.

22 The use of wetlands for the removal of contaminants from the Ranger mine successfully evaluated.

23 In stream processes controlling nutrients and metal contaminants successfully studied and modelled.

24 Estimating fluxes and understanding the processes controlling selenium mobilisation from sediments.

25 Development and demonstration of air quality monitoring data interpretation techniques using five instrument Airtrak network operating in Adelaide.

26 The probable consequences for photochemical smog and air quality of nitrogen oxide emissions from proposed, major new cogeneration plants determined.

27 The toxic and trace gases emitted from spontaneous combustion of coal and coal waste measured and assessed.

28 Evaluation of the effects of ethanol addition to gasoline on the quantity and reactivity of volatile organic compounds emitted by motor vehicles.

29 Completed determinations of methane emission fluxes from landfills.

30 Measurements of the CO, VOC and NO_x emissions from unregulated engines.

Develop new technologies for energy storage and the utilisation of renewable energy. (10%)

31 Negotiation of support from industrial clients for phase 2 of the project on the storage of solar energy.

32 Business plan developed for renewable and sustainable energy research.

33 Prototype capacitor of at least 5 whr/kg energy density constructed.

Support the marketing of Australian coals in current advanced technologies for the power and metallurgical industries, with emphasis on increased efficiency and ceconomy and reduced environmental impact. (25%)

34 Current projects on coal reactivity, furnace fouling, coal ash and trace element analysis NO_x and SO_x control progressed.

35 Continued development of facilities to assess the PCI properties of Australian coals to match specific industry needs.

36 A new laser reactor available for the measurement of high temperature, single particle, coal combustion kinetics.

37 Development of capability for evaluating coking coals and blends.

38 Investigation of temperature/pressure gas cleaning in support of advanced power generation technology.

39 Funding found for laboratory-scale entrained flow pressure gasifier.

40 Measurement and control of coal slag viscosity, and specification of fluxing requirements of Australian coals in IGCC systems.

41 Research leadership for the new CRC for Black Coal Utilisation.

42 Pilot-plant investigation of the cleaning of dusty gases by fabric filtration.

43 Investigation of coal pyrolysis at high heating rates and pressures relevant to gasification.

44 Development of new equipment for coal ash fusion temperature determination.

45 Investigation of spontaneous combustion of coal mine spoil.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,346,000
External Revenue	$7,110,000
Total Revenue	$18,456,000
Operating Result	-1,375,000
End of Year Cash Balance	1,419,000

Staff by Functional Classification 1996-97*

Research	133
Total	181

*estimates as at June 1996

12. CSIRO Office of Space Science and Applications and Earth Observation Centre

Objective

To maximise the environmental, social and economic benefits to Australia arising from research and development in space-related science and engineering.

Strategy

Australian contributions to international space programs continue to complement our access to Earth Observation data for high priority programs such as the investigation of climate change and the sustainable management of the nation's natural resources. With stringent financial constraints on the world's space agencies, increased attention is being focused on the contribution of non-space faring nations. In this context, CSIRO's important part in international Earth Observation programs helps maintain Australia's profile in global space and earth science and to achieve access to valuable data for scientific purposes.

- Provide an effective source of information, analysis and advice on global space science and technology.
- Promote co-operation and the development of a common space science and technology infrastructure in Australia.
- Strengthen Earth Observation research, development and demonstration activities.
- Enhance relationships within CSIRO, between CSIRO and international space agencies, and between CSIRO and other space science and technology stakeholders.
- Collaborate with agencies using Earth Observation Data to enhance Australia's space activities and international profile.
- Enhance national competitiveness through the transfer of technology to Australian space industries.
- Promote and champion CSIRO's strengths in space science technology.
- Broker and contribute to the management of complex Earth Observation programs.
- Acquire and allocate resources for space science and technology, including the management of CSIRO's access to research aircraft facilities, within an agreed and open set of priorities and criteria.
- Make the most effective use of the skills and resources available within COSSA.

Specific Objectives & Planned Outcomes

Strengthen the ability of CSIRO's space-related research and development to contribute to the sustainable management of Australia's natural resources. (50%)

1 Reorganised program structure, funding mechanisms and support functions to meet the needs of the Earth Observation Centre.

2 Established Earth Observation Centre project development structure and prioritisation of Working Groups, Science Projects and Implementation Teams.

3 Established initial Earth Observation Centre projects addressing data acquisition, processing and value adding of AVHRR data as outlined in the Simpson Report.

4 Delivery of the prototype Operational Airborne Research Spectrometer.

5 Completion of the study of present and future needs and options for CSIRO's requirements for access to research aircraft.

6 Completion of co-operative agreements between CSIRO and the Bureau of Meteorology, the Australian Institute of Marine Science, and other agencies.

Strengthen the participation by CSIRO and its scientific, technological and industrial collaborators in international space projects and global space programs. (40%)

7 Completion of the year as Chair of the Committee on Earth Observation Satellite (CEOS).

8 Successful conduct of the November 1996 CEOS Plenary.

9 Installation of a CEOS directory node as the Australian contribution to the International Directory Network (IDN) of "co-operating" nodes.

10 Finalisation of the Advanced Along Track Scanning Radiometer (AATSR) Australian/UK Department of Environmental Science Management Plan.

11 Facilitation if Australian contributions to the validation of AATSR products in the Australian region, with special emphasis on the data applications in climate change research and the study of related phenomena in the southern oceans.

12 Completion of the September 1996 specialist aircraft and instrumentation deployment of AirSAR in collaboration with NASA, CSIRO Divisions, and other Australian scientific and industry groups.

Increase awareness of the benefits of CSIRO's achievements and capabilities in space-related research, and provide scientific information to researchers on space-related projects. (10%)

13 Continued timely publication and promotion of CSIRO Space Industry News (SpIN) magazine to communicate CSIRO's and other Australian achievements.

12. CSIRO Office of Space Science and Applications and Earth Observation Centre

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$2,486,000
External Revenue	$995,000
Total Revenue	$3,481,000
Operating Result	-636,000
End of Year Cash Balance	63,000

Staff by Functional Classification 1996-97*

Research	8
Total	14

*estimates as at June 1996

Objective

To generate economic, social and environmental benefits for Australian Industry and the Australian community through our research into insects and their management.

Strategy

There is a widespread awareness in the community that the long term sustainability of the Australian environment, whether rural, industrial or natural, depends on the development of rational management systems, replacement, reduction and remediation of disruptive inputs and an appreciation of the value of Australia's unique biodiversity.

- The Division exploits its uniquely wide range of scientific skills in biological, chemical, physical and mathematical disciplines in three main fields of endeavour; pest control, use of beneficial organisms and study and conservation of the natural environment.
- It seeks to improve existing pest control practices, to develop novel techniques that lessen reliance on chemical methods and to provide rational integrated combination of these systems. It provides soundly based and economically and environmentally acceptable long lasting solutions by exploitation or enhancement of the effects of native and introduced beneficial insects, other invertebrates and insect-associated micro-organisms.
- It also seeks to provide information on biodiversity and degradation in the natural environment through preparation and use of a physical and computer database of the Australian insect fauna and its distribution.
- To help achieve its objectives the Division collaborates with a wide range of industrial partners, universities, state and federal organisations and international and aid organisations.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Novel Management Techniques for Plant and Plant Product Pests - MDP2

Conserving Biodiversity for Australia's Future - MDP18

Minesite Rehabilitation - MDP24

Dryland Farming Systems for Catchment Care - MDP32

Tropical Agricultural Exports - MDP33

CSIRO Aquaculture Initiative (CAI) - MDP34

Rejuvenating the Murray-Darling Basin with Forest Products Industries - MDP35

Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities - MDP36

Specific Objectives & Planned Outcomes

To develop strategies for managing pests and beneficials of primary production that integrate a knowledge of ecology with all available management techniques. (22%)

1 Opportunities identified for new research into major pests of tropical horticulture (fruit flies, diamond backed moth and fruit-spotting bug) and for host plant resistance to sap sucking insects/mites of legumes.

2 Research initiated on the biology of the whiteflies, *Bemisia tabaci*, and methods developed to identify their parasitoids that could be potential biocontrol agents.

3 Toxicity of major soil fumigants to whitefringed weevil larvae determined in three soils of highly contrasting fumigant sorptive capacity.

4 Host-specificity testing for European sarcophagid flies, potential biological control agents for use against mediterranean snails, completed in quarantine.

5 Field studies of the influence of selected earthworm species on pasture production and the burial of surface-applied lime to offset soil acidity in southern Australia.

6 Research into resistance management strategies for transgenic Bt cotton varieties finalised. Implementation facilitated prior to commercial release of the new varieties.

7 Inclusion of the first series of risk assessment studies in an Environmental Impact Statement for genetically modified Heliothis NPVs.

8 A $A3.6M Screw-worm Fly mass rearing facility brought on line in Kluang, Johor, Malaysia. The facility is expected to produce up to 10,000,000 Old World Screw-worm fly, *Chrysomya bezziana* per week.

To deliver knowledge on the biosystematics and ecology of insects and related organisms in order to conserve and sustainably manage natural resources and biodiversity. The Program is responsible for the maintenance and development of the Australian National Insect Collection (ANIC). (21%)

9 A range of information technology based products, including the second edition of the CD-ROM *Insects: a world of diversity*, completion of illustration images for the CD-ROM *Beetles of the World*, publication of CD-ROM providing a guide to the families of freshwater macroinvertebrates, and a PC version of the ANIC Specimen Database.

10 Manuscripts completed for the *Handbook of Australian Butterflies* and the *Guide to the Ants of Australia*

11 Biosystematic research completed on species of the genus *Cricotopus* (Chironomidae), the genera of tortricid tribus Grapholithini, the species of the water-strider subfamily Gerrinae. Papers on the red-legged earth mite, *Halodytes destructor*, finalised for publication.

12 Complete reviews of the Aleyrodidae (whiteflies) and Aphididae (aphids) of Australia, Papua New Guinea and South Pacific Island countries.

13 Appointment of a dedicated part-time curator of the freshwater insect orders Odonata, Plecoptera, Megaloptera, Ephemeroptera and Trichoptera. High level curation of the ANIC collection of the fifth largest family of Australian Lepidoptera, Gelechiidae.

14 An international review workshop conducted on *The Ecology and Control of Hypsipyla Shoot Borer* and the proceedings published.

To develop safe and cost-effective methods of pest and quality management for commodity storage, transport and built environment that meet modern and changing needs for the market and community. (16%)

15 Completion of laboratory and field investigations to determine whether there are opportunities to improve insect control by aeration by utilising the movement of insects during aeration of grain, e.g. by localised treatments near the surface.

16 Thorough data obtained on the movement of three gases (phosphine, carbon monoxide and carbon dioxide) in sealed storages, and their relationship to localised changes in temperature assessed with the aim of improving theoretical understanding, fumigation and worker safety.

17 Technology transfer increased with the PMCAM system, so that some systems for controlling aeration and monitoring phosphine will be adopted and managed by the Program's industrial partners.

18 Advances in research on five commercial non-chemical barriers and three commercial baiting systems for the prevention and control of termite problems in buildings and other structures.

19 Advances in research on foraging behaviour, population dynamics and other aspects of the biology of three termite species in the Canberra region, as the basis for improvements to termite bait technology.

To understand the ecology of weeds and their natural enemies, and to use this knowledge to increase the sustainability of land management systems. (19%)

20 Biological control strategies for weeds of agriculture and pastures including skeleton weed, Paterson's curse, common heliotrope, nodding thistle, Scotch and related thistles, St John's wort, horehound, doublegee, mesquite and sida.

21 Biological control strategies for weeds important in conservation including mimosa, water hyacinth, bitou bush, bridal creeper and Scotch broom.

22 Implementation of collaborative projects to establish biological control of water hyacinth, salvinia and mimosa in South East Asia, Papua New Guinea and several countries in Africa.

To develop biotechnologies and products for managing insects (and other invertebrates) and pesticide residues. (22%)

23 Antibodies developed to distinguish two US heliothines. Collaboration with Abbott laboratories to assess their performance in a field test format.

24 Evaluation of the insecticidal activities of "P11" polypeptides derived from entomopoxviruses and nuclear polyhedrosis viruses.

25 The genes for two novel insecticidal crystal proteins from *Bacillus thuringiensis* cloned and the specific toxicity of the products determined for *Helicoverpa armigera*.

26 Evaluation of various formulations of Metarhizium for locust and grasshopper control to determine their effects on speed of kill and secondary infection.

27 Identification of those portions of the genome of the *Helicoverpa armigera* stunt virus which produce optimal toxicity for *H. armigera* when expressed in transgenic plants.

28 Transgenic lines of *M. domestica*, *B. tryoni* and *L. cuprina* characterised to determine whether or not their transgenes are stably inherited.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$14,091,000
External Revenue	$13,176,000
Total Revenue	$27,267,000
Operating Result	-1,508,000
End of Year Cash Balance	476,000

Staff by Functional Classification 1996-97*

Research	235
Total	311

*estimates as at June 1996

Objective

To underpin the management, conservation and sustainable use of the Australian environment by developing and communicating a thorough understanding of physical processes in the biosphere.

Strategy

In response to an increasing need for integrated, scientifically innovative approaches to complex problems in the Australian physical environment, the Centre will:

- Combine field investigations, laboratory experiments and theoretical analysis.
- Produce quantitative models, measurements, and generalisable understanding; and thence, techniques for environmental management.
- Maximise strategic research benefits by constructing problems and projects interactively with users, including Federal and State agencies.
- Maintain education and bench-to-bench collaboration with users as critical elements in the Centre's communication strategy.

Multi-Divisional Collaboration

The Centre participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Air Quality - MDP30

Specific Objectives & Planned Outcomes

To improve the understanding of energy, matter and momentum transfer between the earth's surface and the atmosphere, with emphasis on the mediating role of vegetation. Particular foci include turbulent wind flows, microclimates, surface energy balances and dispersion in heterogeneous or hilly terrain; and trace gas exchanges between the biosphere and atmosphere. (40%)

1 Analysis of 1995 and 1994 data from the OASIS field experiment program on surface energy balances and trace gas (CO_2, CH_4, N_2O) exchanges in heterogeneous terrain, leading to flux estimates at multiple scales.

2 Development of the Soil-Canopy-Atmosphere Model (SCAM) and comparisons with data from OASIS and other sources.

3 Measurement of methane fluxes from rice paddies using novel techniques applicable to small plots typically found in Asia, and continued measurement of methane and nitrous oxide emissions from grazing sheep and methane emissions from landfill sites.

4 Application of existing and emerging techniques for modelling and measuring flow and dispersion in complex terrain, especially for assessment of local emission and deposition of pollutants and regional wind energy resources.

5 Wind tunnel studies of microclimate processes around windbreaks, particularly of scalar transfers and three-dimensional effects; collaboration with State agencies in field experiments to measure airflow, turbulence and energy balances around a windbreak.

Conduct research on water and solute transport through soils and other porous media, and on water and solute movement into and through plants, and to improve our understanding and predictive capability in relation to the environment; apply this predictive ability to the solution of problems arising in the management of ecosystems and the environment, or in agricultural, horticultural and forestry production. (30%)

6 Modelling of water use by trees and evaluation of tree planting patterns for efficient crop/pasture growth and water table control.

7 Theoretical and practical developments of the TDR system completed and applications investigated.

8 Analysis of water use and extraction patterns from row crops with various rooting depths.

9 Investigation of pyrite oxidation and its reversibility in acid sulphate soils, theoretically and experimentally, to improve our ability to predict future conditions and to provide management options.

Provide an experimentally verified description of those physical processes in fresh and estuarine water bodies which interact with the biological processes affecting water quality and apply this knowledge to improved water quality management. (20%)

10 Data collection and theoretical understanding of mixing and circulation dynamics of rivers and reservoirs pertinent to the management of blue-green algal blooms in these water bodies.

11 Realistic understanding of major physical processes and the effects on sediment chemistry in the exchange of materials between estuarine and freshwater sediments and overlying water.

Communicate results of Division's research to users in the community, industry and government agencies. (10%)

12 Communication strategy developed and implemented.

13 Strengthened interactions with the media/industry.

14 Internet and World Wide Web presence expanded.

14. Centre for Environmental Mechanics

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$2,464,000
External Revenue	$1,369,000
Total Revenue	$3,834,000
Operating Result	345,000
End of Year Cash Balance	-607,000

Staff by Functional Classification 1996-97*

Research	29
Total	45

*estimates as at June 1996

Objective

To improve the international competitiveness of Australian metalliferous and coal mining industries by: (1) developing new exploration technologies and insights into the causes of mineral accumulation and distribution so as to increase the success rate of discovering new economically mineable deposits; and (2) developing new technologies for mine design, stability and safety, rock breakage and ore evaluation so as to increase mine productivity and decrease mining costs.

Strategy

The future profitability and competitiveness of the Australian mining industry will depend on its ability to discover and delineate major ore bodies as quickly and efficiently as possible and to minimise development and production costs. Sustained success for Australian companies in the global mining environment will be dependent on their ability to discover and exploit large, economically significant deposits. The Division aims to meet the current and future technological needs of the Australian mining industry by:

- Establishing and maintaining high level relationships with key companies and industry bodies, particularly those working internationally to provide for joint planning and objective-setting, ensure adequate funding of research activities, and facilitate adoption of research results.
- Continuing the process of aligning the physical resources of the Division to reflect the fundamental steps in the mining process (area selection, area evaluation, deposit delineation, excavation design and engineering, mining technology and equipment and mining environmental management).
- Establishing strategic alliances with selected mining companies, mining equipment manufacturers and financiers to assist the uptake of new technologies by industry through development of reliable products.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Integrated Geological, Geophysical, Mine Design Visualisation - MDP7

Iron Ore Processing - MDP8

Minesite Rehabilitation - MDP24

Processing of Nickel Ores - MDP37

Specific Objectives & Planned Outcomes

To develop more effective concepts and technologies to optimise the exploration industry's capability to identify prospective ground and, accordingly, select tenements with the highest potential for economic mineralisation. (12%)

1 Exploration strategies for world-class nickel deposits; linking Archaean komatiite volcanism and associated nickel deposits and producing exploration concepts for nickel deposits of the Noril'sk and Jinchuan types.

2 Deep lithospheric mapping for diamondiferous kimberlites and lamproites.

3 Models for hydrothermal copper/gold deposits in Australia and the Pacific Rim incorporating resistate indicator minerals, modern ore-forming environments and hydrothermal fluid characterisation.

To produce an integrated geodynamic synthesis of the larger scale rock deformations and geological processes that have formed the Australian continent over geological time and to improve the success rate for exploration companies looking for new world class minerals and energy deposits. (8%)

4 A broad-scale computer-based 3D and 4D synthesis of the geological structure and evolution of the Australian continental plate.

5 Detailed 3D and 4D computer models of the geology of key areas within the continent: Menzies to Norseman in Western Australia, the north-west shelf of Australia and the Lachlan orogen of south-east Australia.

6 New analyses of the structure and mechanics of the continent, incorporating geologically relevant constitutive codes, non-linear dynamics, and relevant ore genesis models.

7 Construction of an integrated tectonics-geophysical analysis package.

8 Development of the AUSTRALIS analytical facility.

To develop more effective methods and technologies to efficiently locate world-class ore deposits, in particular gold, base metals, iron and diamond deposits, in terrain types of strategic importance to Australia and the Australian mineral industry world-wide. (20%)

9 Innovative methods that capitalise on knowledge of geochemical dispersion and landscape evolution across Australia and applicable world-wide in the equatorial and sub-equatorial belts.

10 New exploration methods for deposits concealed beneath the margins of sedimentary basins.

11 New initiatives for exploration to locate buried, high quality iron ore deposits.

12 A new generation of airborne geophysics technology for both mineral and petroleum exploration: MIN-SEARCH, an integrated system comprising magnetics, radiometrics, deep probing EM, gravity gradiometry, clay mineral mapping GIMMS and silicate mapping TIPS; OIL-SEARCH adapting these technologies for petroleum exploration.

13 The World's first satellite system for mapping iron oxides, hydroxyls and carbonates.

14 Advanced exploration geophysics and imaging software (AEGIS).

To dramatically improve exploration technology for Australian conditions. Key areas are electromagnetic (EM) including airborne, and airborne gravity. (13%)

15 Cost-effective systems to map the conductivity structure of the regolith and hard-rock geology.

16 Improved signal/noise performance of airborne electro-magnetic (AEM) systems to detect targets to 300m depth under conductive cover.

17 Improved, easy-to-use tools to rapidly strip the effects of inhomogeneous regolith from large quantities of AEM data and define deep targets.

18 Design and development of a new airborne gravity gradiometer system and its integration with other airborne exploration techniques.

To develop integrated technologies for ore body delineation and rock mass characterisation. (17%)

19 Development and application of advanced scanning photogrammetric technologies for the rapid and automated collection and monitoring of geotechnical and other rock mass data.

20 Visualisation and analysis tools for geophysical technologies developed and applied to ore body delineation and rock mass characterisation within the CMTE.

To improve mine design reliability and hazard assessment. (10%)

21 Monitoring tools and models for the time-dependent behaviour of rock masses, developed, tested and applied.

22 Effective reliability-based design tools for mining excavations developed, tested and applied.

23 Advanced 3D modelling analysis and visualisation techniques developed and applied to mine design.

To improve productivity of existing mining systems. (12%)

24 Production control tools to improve equipment availability and utilisation.

25 Development and commercialisation of innovative rock reinforcement and ground improvement techniques.

26 In partnership with the CMTE, identification of needs and development of technologies which improve equipment productivity through semi-automation.

27 Advanced mathematical modelling techniques developed and applied to mining processes.

To develop technologies for innovative mining systems. (3%)

28 Production control technologies for automated mining systems developed and applied.

29 Non-explosive rock breakage technologies, with particular emphasis on hardrock applications, researched through CMTE.

30 Non-invasive mining technologies developed and enhanced.

To develop design criteria and technologies which minimise the impact of mining on the environment. (3%)

31 Methods for smart disposal of wastes developed and applied.

32 Design criteria for constructed landforms at mine sites developed and applied.

To develop and apply technologies to improve mine occupational health and safety. (1%)

33 New efficient mining methods and equipment which engineer hazards out of mine operations.

34 Monitoring and control technologies which effectively manage hazardous situations developed and demonstrated.

35 Better emergency response methods developed and implemented for mines based on new technologies and equipment.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$15,933,000
External Revenue	$13,427,000
Total Revenue	$29,360,000
Operating Result	737,000
End of Year Cash Balance	1,415,000

Staff by Functional Classification 1996-97*

Research	153
Total	231

*estimates as at June 1996

Objective

To develop a sound scientific basis for the use and conservation of Australia's marine living resources and environment; to provide scientific advice to environmental, industry and resource managers to ensure the ecological and economic sustainability of these resources and enhance the competitiveness of dependent industries.

Strategy

In November 1994 Australia's Ocean Territory (AOT) increased in size to 16.1 million square kms, including an Exclusive Economic Zone of 11 million square kilometers. It is estimated that the AOT has the potential to contribute between $50 and $85 billion a year to Australia's economy within 25 years. The Division has a significant role to play in meeting Australia's obligations to research, develop and protect this Zone. The Division will continue to develop new approaches to the sustainable management of marine living resources and the marine environment, to maximise their economic utilisation and minimise threat from over-exploitation.

- Undertake research to assist with the assessment and management of the impacts on the marine environment of resource exploitation, economic development, climate variability and introduced marine pests.
- Undertake strategic and tactical research in support of the mariculture and fishing industries to help them achieve and maintain their economic competitiveness and the sustainable development of their resource base.
- Undertake research and provide scientific advice on biodiversity, and bioregionalisation to assist in the identification of appropriate marine protected areas.
- Work with industry, government agencies and other scientific institutions to identify research problems, facilitate research, communicate and apply the results and develop commercial opportunities to maximise the benefits to Australia.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Coastal Zone Program - MDP21

Management of Marine Living Resources - MDP23

Climate Variability and Impacts - MDP29

CSIRO Aquaculture Initiative (CAI) - MDP34

Specific Objectives & Planned Outcomes

To understand the ecology and dynamics of Australia's tropical marine resources and to use this knowledge to assist government and industry to manage these resources for ecological and economic sustainability and the maintenance of biodiversity. (24%)

1 Completion of large-scale experiments to assess the impact of trawling on tropical benthic, fish and prawn communities of the Great Barrier Reef. Determination of the recovery time of impacted benthic communities by comparing trawled treatment plots to untrawled control plots.

2 New statistical techniques to estimate mortality and catchability of prawns from Northern Prawn Fishery commercial logbook and survey data.

3 The dynamics of Torres Strait seabed habitats mapped and monitored. A conservation plan for the region to support multiple-use management.

4 Improved understanding of estuarine and inshore clupeoid fishes of Indonesia, Malaysia and Bangladesh. Advice provided to these governments on conservation of the resource.

5 Stock assessments for the Northern Prawn Fishery, Tropical Rock Lobster Fishery, Northern Demersal Trawl Fishery, and Torres Strait Islander traditional fishery. Results provided to resource managers.

6 A complete description of the trawl bycatch of Australia's Northern Prawn Fishery.

To understand the ecology and dynamics of Australia's pelagic, temperate and deepwater fishery resources, and to use this knowledge to assist government and industry to manage these resources for ecological and economic sustainability. (29%)

7 A model of the food web supporting production of orange roughy in the mid-slope ecosystem and, through field surveying, an assessment of the habitat requirements of the main South East Fishery quota species (orange roughy, grenadier and gemfish).

8 Assessment of the stock of school shark through full spatial modelling and a refined catch-and-effort data series.

9 Fish-stock assessment models for the South East Fishery and a fisheries-independent biomass assessment of orange roughy, using a multi-frequency acoustic system.

10 The extent of migration and swimming depth of school sharks determined through archival tagging and analysis of results from recent tagging studies.

11 The present state of the southern bluefin tuna stocks assessed and presented effectively at international meetings for the management of the fishery.

12 Completion of a study of bioregionalisation strategies. Draft bioregionalisations for the Australian Exclusive Economic Zone produced as part of the OR2000 Commonwealth Consortium Marine Protected Areas Project.

13 Research on the spawning dynamics of southern bluefin tuna completed for improving assessments of the parental stocks.

14 Completion of software to visualise and estimate geoposition from data produced by the CSIRO Archival Tag, and use of these data to model the ecophysiology of southern bluefin tuna in the wild.

15 The CSIRO Fish Collection included on the National Registry of Biological Collections; identification handbooks to Australian seafood and south-east Australian trawl fisheries prepared; an interactive database using the CSIRO Fish Photographic Index established to identify Australian fishes.

To develop and promote techniques for the early detection, prediction of impacts, and assessment of risks and costs associated with introduced marine pest species in Australian waters, and to develop methods to limit their spread and minimise their impacts on marine industries and ecosystems. (9%)

16 Completion of the detailed study of introduced marine pest species in Port Phillip Bay.

17 Preliminary specificity trials of the parasite European (green) crab, *Sacullina carcini*, on Australian native crabs, undertaken and evaluated.

18 Field studies initiated on the impacts and demography of the European (green) crab and northern Pacific seastar. International workshops hosted on impacts and control of the crab and the Japanese alga, *Undaria*.

To develop the scientific and technological basis to expand and improve the performance of the mariculture industry. (14%)

19 Investigation of transgenic techniques to develop novel biological tags for penaeid prawns.

20 Examination of trophodynamic pathways in aquaculture ponds and effluent, as well as the assimilation efficiencies of formulated diets, with the use of stable isotopes.

21 A penaeid prawn diet formulated from local resources, that will compete successfully with imported feeds.

22 Genetic markers used to determine the stock structure of commercially fished stocks, delineate pedigrees, and undertake breeding trials of selected aquaculture species.

23 Assessment of the value of supplementary feeding with fresh and preserved unicellular algae to increase and stabilise the growth rate of juvenile oysters.

To determine the principles needed to manage the impact of economic development on the marine environment for ecological sustainability, and to assist government and industry to apply these principles. (9%)

24 Completion of the national mesocosm facility building. Development and implementation of a management plan that will include an advisory committee with external members, a schedule of costs, and a process for allocating time to research projects.

25 Development, testing and application of methods to determine algal bloom dynamics and associated physical and chemical processes in inshore and estuarine systems in south-western Australia.

26 Mapping of the underwater features of the coast from Exmouth Gulf, Western Australia, to the New South Wales/Queensland border completed at a scale of 1:100,000 in a Geographic Information System format.

To develop and apply methods to evaluate strategies for managing Australia's marine living resources and marine environment. (15%)

27 Modelling of nutrient cycling and impacts in Port Phillip Bay completed, the consequences of alternative management scenarios evaluated and the results transferred to relevant management agencies.

28 The evaluation of risk-averse harvest strategies for management of developing fisheries completed.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$13,791,000
External Revenue	$8,274,000
Total Revenue	$22,065,000
Operating Result	-1,401,000
End of Year Cash Balance	2,065,000

Staff by Functional Classification 1996-97*

Research	156
Total	208

*estimates as at June 1996

Objective

To provide the Australian food industry with new processes or technologies for the efficient production of processed foods for the domestic and export markets, and to improve the safety and nutritional quality of food produced in Australia.

Strategy

The food industry has the capacity to continue to substantially increase its exports, particularly of value-added processed foods to expanding markets in Asia. To do so it needs to enhance its competitiveness, address market specifications and provide clean foods of consistent quality. The Division will:

- Acquire knowledge of the chemical, physical, biological and psychophysical attributes of foods and food components, and apply it to new and improved processes and products.
- Develop new technologies for the processing, presentation, storage and transport of foods.
- Help improve the safety and wholesomeness of Australian food.
- Transfer up-to-date technology and information to the food industry and consumers.
- Improve workforce planning to allow changes in scope of R&D programs.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Process and Maintenance Optimisation in Manufacturing - MDP15

Biosensors - MDP27

Smart Manufacturing - MDP28

CSIRO Aquaculture Initiative (CAI) - MDP34

Specific Objectives & Planned Outcomes

Develop commercially viable processes for manufacture of food ingredients, improve efficiency of ingredient manufacturing processes, and determine factors influencing functional properties of food ingredients as a basis for applications development, quality improvement and product marketing (18%)

1 Two low-cost, novel formulations for recombined dairy products.

2 Demonstration of the need for better functional indices in selection of milk powder ingredients for recombined sweetened condensed milk.

3 Completion of a study of milk protein-polysaccharide interactions.

4 Pilot-scale process development with a commercial partner of technologies for isolation of three products containing bioactive proteins and peptides from milk and whey.

5 Study completed of the effects of dietary dairy proteins on colon cancer risk in an animal model (with Division of Human Nutrition).

6 Assessment of commercial processing technologies for manufacture of dairy protein products in Australian factories, with identification of unit processes where quality is lost.

7 Methods for enhancing productivity of plant cell cultures for polysaccharide manufacture.

8 Expansion of the range of food ingredients and additives from plant cell culture by developing an extended range of cell cultures.

Develop processes for efficient manufacture of cheese and cultured food products, improve their quality and flavour, and establish the efficacy of probiotic organisms in foods (13%)

9 Commissioning of state-of-the-art cheesemaking pilot plant for AFISC/CSIRO joint programs.

10 Delivery of an operator advisory system for Cheddar cheese plants.

11 Demonstration of a positive effect on cheese flavour from insertion of lactococcal peptidase into the acidifying organism.

12 Demonstrate enhanced methodology for identifying trace level acidic compounds which are intermediates in Cheddar flavour generation.

13 Establishment of an effective DNA-based method for identification of probiotic lactobacilli.

14 Development of a matrix descriptor of the in-vitro biological properties of probiotic bacteria.

Develop core capacity in processing bay operations, particularly extrusion and preservation technologies, and use these in partnership with customers to define and carry out an industry focussed portfolio of research (13%)

15 Identification of the scope for and benefits of process optimisation and control in bakery lines through a comprehensive feasibility study.

16 Strategic research on extrusion technology in: predicting temperature and pressure profiles in extruders through modelling; using statistical methods in evaluating product quality and the relationships of product quality with processing conditions; material science and transformation studies in the extruder; evaluating the feasibility of using image analysis to characterise product quality.

17 Efficiency of conventional meat processing operations increased using the knowledge gained from Fututech automation.

18 Installation of a commercial prototype semi-automated rib deboning machine in an abattoir.

19 Packaging line for primal cuts installed in an abattoir in conjunction with industry partner.

20 Installation in an abattoir of a hair removal and collection unit using CO_2 technology to provide a clean surface along the hide marking lines.

21 Next generation machines and processes improve hygiene, safety, ergonomics, adaptive control and reduce maintenance costs.

Improve the quality of meat and meat products, especially that exported with high added value (12%)

22 Development of procedures to improve the overall quality and image of Australian beef.

23 Establishment of specific co-product projects with a variety of meat and ingredient companies.

24 Development of new strategic projects to identify heat-stable crosslinked intramuscular collagen; establishment of collaborative links with INRA and new contracts in applied research for Australian collagen processing industries.

25 Development of projects to determine collagen's contribution to meat texture; identification of proteases active during conditioning of meat and fat quality attributes affecting meat quality.

26 Crosslinked edible films to coat meat developed for a major meat processing company.

27 Development of technologies to add value to manufacturing meat.

Develop new and improved technologies for the packaging and distribution of foods for Australian industry (8%)

28 Development of protocols for export of horticultural produce to Asia.

29 Application of oxygen scavenging technology to maintain very low oxygen levels in packaged products prone to oxidation during storage.

30 Commercial evaluation of a technology for the prevention of bitterness in Navel orange juice.

31 Development of procedures and HACCP plans for minimally-processed foods.

32 CSIRO Water Activity kit commercialised.

33 Development of protocols for the in-transit, in-container, cold-disinfestation of citrus fruit.

Enhance the ability of the Australian food processing industry to produce food reliably that is safe, has the required shelf-life, and complies with the safety hygiene and quality specifications of customers in domestic and export markets (17%)

34 Reduction of aflatoxin formation in peanuts by means of competitive non-toxigenic strains of *Aspergillus*.

35 Assessment of the incidence of fungal contamination during all stages of vine fruit drying and processing.

36 Studies on enterohaemorraghic *Escherichia coli* - ecology, isolation methodology, ability to infect animals and mechanisms of dissemination of these organisms throughout the meat chain.

37 Determination of the factors controlling contamination and growth of *E. coli* and *Staphylococcus aureus* on beef carcasses.

38 Use of bioluminescense in detection methods and studies of the behaviour of micro-organisms in meat ecosystems.

39 Determination of the ability of enterohaemorrhagic *E. coli* to survive during production of fermented meats.

40 Determination of the impact of new processing technologies on the microbiological status of beef and sheep meat.

41 Methods for identifying thermophilic bacteria and tracing their origin in milk powders developed.

Determine factors responsible for the sensory quality of foods, and for taints and off-flavours (3%)

42 Determination of the influence on food acceptability of the pungency of ginger.

43 Apparatus to dispense precise mixtures of aromas (olfactometer) commissioned.

44 Prototype chemical sensory array for sweetness detection and biosensor development for water-borne pathogen detection.

45 Determination of the influence of diet and environment on the flavour of crustaceans.

46 Determination of the extent of migration of hazardous chemicals from selected packaging materials into high- fat foodstuffs.

Transfer information and technology to the food industry and consumers (15%)

47 Provision of technical information and advice and promotion of CSIRO's capacity to enhance industry's technological base.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$14,879,000
External Revenue	$10,770,000
Total Revenue	$25,649,000
Operating Result	163,000
End of Year Cash Balance	6,568,000

Staff by Functional Classification 1996-97*

Research	160
Total	226

*estimates as at June 1996

Objective

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.

Strategy

- Develop advanced methods of tree breeding for improving important characteristics.
- Improve silvicultural and operational systems for increased and sustained productivity.
- Determine the effect of growing conditions on wood properties which influence the quality of end products.
- Improve methods for protecting forest resources from fire and to minimise losses from pests and diseases.
- Evaluate and select trees for wood and other economic products and for the amelioration of land degradation.
- Assist the timber industry to improve technologies and develop new practices, processes and products.
- Develop processes for wood and recycled fibre that increases pulp and paper quality.
- Improve utilisation of forest industry residues and recyclable products.
- Improve performance of naturally durable and preservative treated timbers.
- Improve environmental aspects of manufacturing practices and processes.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Conserving Biodiversity for Australia's Future - MDP18

Climate Variability and Impacts - MDP29

Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity - MDP31

Dryland Farming Systems for Catchment Care - MDP32

Rejuvenating the Murray-Darling Basin with Forest Products Industries - MDP35

Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities - MDP36

Specific Objectives & Planned Outcomes

To sample, evaluate, conserve and utilise the genetic resources of trees of actual or potential value for planting in Australia and other countries. Develop and communicate improved methods of choosing trees for specific uses and environments. (16%)

1 Completion of a breeding strategy for *Melaleuca cajuputi*.

2 Breeding strategy for *Casuarina equisetifolia* spp. *equisetifolia*.

3 Completion of a short training course in experimental design and analysis with the Forest Research Institute of Malaysia.

4 Assessment of suitability of 50 potential farm forestry sites in the Deniliquin area of the Murray Darling Basin.

5 Completion of seventh training workshop in Vientiane, Laos on the use of climatic mapping programs for identifying areas suitable for growing particular native and exotic trees.

6 The performance of tree species under difficult site conditions evaluated through glasshouse assessments of boron x salinity interactions on tree nutrition.

7 Publication of four books and manuals.

Provide options for the sustainable management of native forests for wood production. (10%)

8 Implementation of a coupe-scale evaluation of newly-regenerated, coastal mixed-species regrowth forests.

9 A report on stem degrade following thinning damage in pole-age mixed-species forest.

10 A synthesis of the response of sawlog and pulpwood trees to thinning and fertilizer treatments during the initial 4 years after treatment of pole-age mixed-species stands.

11 A prototype computerised coupe harvest planning model that includes a module to describe the economic implications of alternative snig track layout in contrasting forested terrain.

12 Commencement of a major study of the effects of change in fuel mass and structure after prescribed burning on high intensity fire behaviour.

13 Field testing of a quantitative GIS-based methodology for soil survey in heterogenous forested terrain.

14 A preliminary set of indicators of water and nutrient-supplying capacity for forest soils.

15 Development of a methodology for assessing ecologically sustainable management of native forests, that will contribute to the finalisation of Regional Forest Agreements.

16 Determination of baseline level of genetic diversity in unlogged coupes of native forest in Victoria using a range of DNA markers.

Improve methods for optimising the quantity and quality of wood from radiata pine plantations on a sustainable basis by an increased understanding of genetic diversity within the species and the effects of soil, environment and stand management on productivity. Determine design parameters and

management strategies for plantations for disposal of effluent as a sustainable land use practice. (16%)

17 Expansion of the current work on later-aged stand management. Installation and full operation of a 'core' study and establishment of nine satellite sites across the Green Triangle region.

18 Collection of data and refinement of models for the long-term study examining the impact of pine plantations on regional ground water.

19 Completion of Phase I of a study on 'Improving plantation stock production and performance' of radiata pine families with a range of breeding values.

20 Implementation of new collaborative work on 'Improving the productivity of plantations in Tasmania' consisting of consulting, tactical research and strategic research.

21 Completion of the Review of Code Forest Practices (Plantations) in all States.

22 Phase I of the MDP-Wagga Effluent Plantation Project completed and integrated Australian guidelines for effluent-irrigated plantations prepared. An international travelling workshop on Tree Plantations for Recycling Effluent and Biosolids hosted jointly by FFP and New Zealand Land Treatment Collective.

23 Completion of a study on the genetics of wood quality and their relationship with wood properties.

24 Molecular markers used to locate genes in the radiata pine genome controlling *Dothistroma* resistance in fullsib families. Progeny trials used to characterise quantitative trait loci controlling growth at rotation age and to progress understanding on the molecular genetic control of wood density.

Increase the yield and quality of wood from commercial hardwood plantations on an ecologically sustainable basis through tree improvement and the development of more effective sire and stand management techniques. (18%)

25 A genetic linkage map of *E. marginata* constructed and progeny of family lines screened for resistance to *P. cinnamomi*.

26 The compilation of descriptions completed for a major book entitled 'Fungi of South Western Australia'.

27 100 single oospore isolates of each of 3 sets of reciprocal crosses of *P. cinnamomi* established for genetic analysis.

28 The effect of applied treatments on rates of nitrogen mineralisation, growth and nutrient uptake in second rotation *E. globulus* plantations determined.

29 The effect of tree shelter belts on water use in low rainfall cropping zones of south western Australia estimated.

30 Production of sufficient (100 plus) *E. camaldulensis* clones, transformed with a range of gene constructs, which are suitable for planting in trials approved by GMAC.

31 Procedures developed for inoculation of pine seedlings with the edible fungus *Matsutake* and preliminary field experiments established.

32 Establishment of trials and preliminary evaluation of the effect various pruning methods have on the degree of subsequent fungal infection in stems of *E. nitens*.

33 The potential for using concentrations of nitrogen and phosphorus in soil solutions as indicators of nutrient supply for growth of plantation eucalypts evaluated.

34 Application and evaluation of a simple canopy production model as a tool for assessing site productivity.

To assess resources for pulp and papermaking, understand the relationship between wood, fibre, pulp and paper properties, and develop processes for wood and recycled fibre that increase pulp and paper quality with reduced environmental impact. (13%)

35 Exact analytical procedures defined for separation of fibre, ray cells, soft tissue and vessels for SilviScan-2. Automation of the determination of microfibril angle from diffraction patterns.

36 External interaction reviewed and a plan for the operation of SilviScan-1 developed and implemented.

37 Improved calibrations for prediction of pulp yield from NIR spectra and new methodology for predicting whole tree pulp yields from core samples.

38 Robust equations relating wood and fibre properties. Some key fibre properties identified.

39 Improved understanding of options for obtaining high brightness and pulp strength in TCF bleaching using combinations of oxygen 'carriers' and enzymes.

40 Implementation of a study on the physical and chemical changes occurring during the recycling of paper fibre properties. Assessment of the variations likely with the use of a new generation of pulping and bleaching processes and the use of chemical pulps of high yield.

Understand the biology, physiology and interaction of wood attacking organisms to develop realistic bioassay procedures and improved performance of naturally durable and preservative treated timbers. (7%)

41 Field-trials of termite dust and bait toxicants, physical barriers, and termite feeding trials. National workshop on termite controls for building and pest control industries.

42 A test method for durability rating using white and soft rot interactions. 'Durability for Design' project initiated with R&D corporation support.

43 AFS trial of commercial and experimental preservative rods in CCA treated pine stubs. A contract with Jotun in developing wood stabilisers and surface coatings.

44 Preschem supported in commercialisation of inclusion technology in termite control measures. Fundamental and applied work continued on the immobilisation of boron within timber.

45 Negotiations and collaboration with an Australian manufacturer to develop commercial products based upon the patented diffusible chelates technology.

Improve the utilisation of forest industry residues and recyclable products, in producing new composite materials, reformed cellulose fibres and films, improved adhesives, and wood by-products. (9%)

46 A range of products from waste paper and other fibres, including reconstituted hardwood products.

47 Extensive studies, for the recovery of the components of the dissolving system, to establish the commercial viability of the SIRON process.

48 Improved RF, PF, and tannin-based adhesives for reconstituted wood products. Progress with their commercialisation.

49 Pilot scale quantities of activated carbon provided for local and export market evaluation.

Assist the timber industry to improve efficiencies and values in processing Australian hardwood and softwood resources. (9%)

50 Analysis of different methods of collapse amelioration. Final submission to FWPRDC for project on investigation of collapse and internal checking.

51 Economic evaluation of pilot scale drying results from UBC. Submission to FWPRDC to build and test a pilot scale RFV drier.

52 Drying strategies developed for sawn products from a selection of south-eastern NSW eucalypts.

53 Laboratory drying tests conducted with radiata pine at a range of drying conditions to validate WOODRY predictions. Further development of drying modelling with FASTFLO and with the Monte-Carlo technique. Formulation of model for the development of distortion during wood drying.

54 Continuation of projects on the use of East Gippsland hardwoods for high value-added wood products and the use of Queensland hardwoods for fine furniture.

55 Completion of a project on the development of codes and standards for appearance wood products. New grading rules for softwoods and hardwoods developed, evaluation trials at industry level undertaken and a draft standard presented to Standards Australia.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$16,656,000
External Revenue	$9,803,000
Total Revenue	$26,460,000
Operating Result	63,000
End of Year Cash Balance	7,479,000

Staff by Functional Classification 1996-97*

Research	210
Total	287

*estimates as at June 1996

19. Division of Horticulture

Objective

To improve crop quality, the efficiency and sustainability of horticultural production, product specification and postharvest handling for Australian crops of the temperate, subtropical and tropical zones.

Strategy

Horticulture has a GVP of over $3.5b at the farm gate with dramatically improving export performance for some commodities. Expanding markets in S.Asia offer considerable export opportunities, but demand a quality product, consistent production and attention to strict quarantine regulations. Import replacement opportunities also exist. The Division's strategies are to:

- Develop and apply techniques for the selection and breeding of improved horticultural crops.
- Develop new management techniques to improve reliability of production and to reduce costs.
- Develop improved postharvest handling techniques to extend product life and prevent quarantine exclusions.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Novel Management Techniques for Plant and Plant Product Pests - MDP2

Tropical Agricultural Exports - MDP33

Specific Objectives & Planned Outcomes

Develop superior new varieties of horticultural crops to enhance productivity and quality. (42%)

1 Gene constructs for prevention of embryo and endosperm development tested in arabidopsis and tomato, and first gene inserted in West Indian lime.

2 Flavour and alcohol changes assessed in several transgenic tomato lines.

3 Grape berry-specific promoters characterised.

4 Macadamia breeding unit established in collaboration with Australian Macadamia Society, NSW Agriculture and Queensland Department of Primary Industries.

5 Genes associated with ripening grape berries identified.

6 Further polyphenoloxidase (PPO) genes isolated, characterised and protected to improve position in PPO technology.

7 Selected melon F1 hybrids from breeding program evaluated in co-operation with two companies.

8 Selected easy-peel citrus hybrids entered into second stage grower-based evaluation trials.

9 Citrus scion breeding program advanced using new parthenocarpic, pollen sterile, monoembryonic hybrids as parents in new crosses focused on industry priorities.

Develop better crop management systems to enhance productivity and quality. (31%)

10 Effects of nitrogen supply and pre-flowering water supply on vigour of sultana grapevines on own roots and on Ramsey rootstock quantified.

11 Drip and sprinkler irrigation techniques evaluated in a commercial cashew plantation through measurement of plant and soil water relations and yield.

12 Joint naming and release of seedless muscat grape selection with the U.S. Department of Agriculture, and strategies for adoption by the Australian dried fruit industry formalised.

13 Rootstocks to minimise chloride and sodium accumulation in shiraz and chardonnay grape juice and wine identified.

14 Phenological and physiological comparisons between the mango cultivars Kensington and Irwin completed.

Develop improved strategies for postharvest performance based on an identification of factors controlling ripening, senescence, pests, disease and disorders. (27%)

15 Temperature effects on oxygen demand of mushrooms determined and limits for packaging design defined.

16 Physiological responses of sweet cherry varieties to heat assessed with the aim of developing non-chemical disinfestation procedures for export.

17 Influence of combined low O_2, heat and cold disinfestation treatments on apple and pear quality assessed.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$5,873,000
External Revenue	$2,892,000
Total Revenue	$8,765,000
Operating Result	-271,000
End of Year Cash Balance	1,064,000

Staff by Functional Classification 1996-97*

Research	76
Total	98

*estimates as at June 1996

Objective

To provide appropriate research and development to improve human well-being and community health in Australia whilst at the same time enhancing the competitiveness of the Australian food and food-related pharmaceutical industries.

Strategy

The continued interest and expectations by consumers and Government of the importance of nutrition-oriented solutions to health problems in conjunction with the high level of interest by the food and food-related pharmaceutical industries in producing foods and specific nutrients that satisfy those expectations provides the framework for the Division's research and development strategy.

- To interact with the food and food-related pharmaceutical and health care industries to examine and evaluate foods with optimal nutritional characteristics.
- To conduct the appropriate research to understand the basis of nutrition-related disorders particularly those that account for the greatest morbidity and mortality in Australia.
- To interact and collaborate with other CSIRO Divisions as well as research institutions to enhance Australia's skill base in the areas of health, food and the pharmaceutical industries.
- To utilise techniques for improving nutritional knowledge and behaviour in the community and to transmit that information to community health agencies and the food industry.

Specific Objectives & Planned Outcomes

Investigate the protective and cancer-causing factors in food with a view to assisting the food industry to develop foods with enhanced health benefits, and to advise health professionals and Government agencies. (27%)

1 Formulation of a plant-based antioxidant extract with potential health benefits with respect to degenerative disease, for commercialisation by industry partner.

2 Further development and commercialisation of patented "Starplus" technology for the delivery of short chain fatty acids to the large bowel, in order to promote bowel health.

To promote the well-being of the Australian community and food industry through the development of targeted nutrition intervention and food policy strategies. (28%)

3 Development of extensive food consumption and consumer behaviour databases for use by food industry and health groups for planning and evaluating nutrition strategies in Australian and Asian communities.

4 Identification of the nutritional needs of selected population groups and the assessment of the efficacy of food-based strategies to address these.

To assist the Australian food industry and the food-based pharmaceutical industry by identifying foods, food components and food-based pharmaceuticals that have the potential to prevent or retard the development of degenerative diseases. (20%)

5 Determination of the bioavailability of food constituents such as isoflavons, phenolic compounds and vitamins, and determination of their mechanism of action in relation to reduction in disease risk.

6 Determination of the protective effect of plant and fish oils in cardiovascular disease, and investigation of their mechanism of action.

To establish a rational approach for the design of new growth factors and formulations specifically designed to treat surface wounds, gut disease and polytrauma, to improve animal production and to support the growth of cells in culture. (25%)

7 Commercialisation of whey growth factor extracts through GroPep Pty. Ltd. to the Australian dairy industry.

8 Recombinant growth factors developed to target specific human health and agricultural applications.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$5,860,000
External Revenue	$2,992,000
Total Revenue	$8,851,000
Operating Result	37,000
End of Year Cash Balance	2,145,000

Staff by Functional Classification 1996-97*

Research	43
Total	111

*estimates as at June 1996

21. Division of Information Technology

Objective

To contribute to the international competitiveness of Australian industries by improving the effectiveness of their utilisation of advanced information technologies, systems and services.

Strategy

The software and related services sector is the fastest growing part of the information technology industry because of its role in underpinning the competitiveness of enterprises across the whole economy and the national information infrastructure. Improving the productivity, quality and effective use of software technologies and systems are key objectives for Australian business enterprises and other organisations. The Division will:

- Focus research on the demonstration and development of advanced software technologies and information systems particularly for the following industries: media and information services, manufacturing, commercial services, transportation, and mineral exploration and mining.
- Form strategic relationships with other research and industrial groups, and participate in major research centres in information technology.
- Participate in industrial consortia addressing significant commercial opportunities for advanced information technologies, systems and services.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Integrated Geological, Geophysical, Mine Design Visualisation - MDP7

Process and Maintenance Optimisation in Manufacturing - MDP15

Urban Water Systems - MDP16

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

To develop system architectures, tools and techniques for information systems to support complex decision-making processes. (24%)

1 An evaluation of the applicability of data mining technologies through pilot studies, primarily in the commercial services sector.

2 Design and assessment of a networked server for very large spatial databases in the public utilities sector.

3 Demonstration of a decision support system applying multiple hydrological models in planning of urban water systems.

4 Development of a high-performance traffic and road network simulation package for use in the design and operation of the next generation of traffic management systems.

To develop architectures, tools and techniques which enhance advanced buisness processes encompassing electronic commerce, enterprise information and knowledge management and planning and operational advisory systems. (27%)

5 Definition of requirements for electronic document archiving within a Government Public Records Office.

6 Development and demonstration of techniques which support the construction, maintenance and distribution of resource descriptions in Internet-based information systems.

7 Design and demonstration of consumer-to-consumer trading pilots incorporating technologies for finding, buying and selling across global networks for electronic commerce.

8 Delivery and acceptance of a spare parts assessment and allocation system for a defence application.

9 Development of advanced systems for training of air traffic controllers.

To develop architectures, methodologies, tools and demonstrations for advanced applications using image-based modelling, visualisation and interactive multi-media user interfaces and systems. (31%)

10 Development of a technology framework for on-demand access, processing and delivery of earth observation data and products from distributed data archives.

11 Development of techniques for wavelet/fractal based sparse data interpolation and geophysical data processing.

12 Demonstration, with collaborators in the mining industry, of a system for displaying and manipulating in-mine geophysical and geological data in three dimensions.

13 Demonstration of an on-line interactive system for film and television researchers to remotely access and navigate through biographical material in multiple media forms.

14 Demonstration of a system for browsing, annotating, and segmenting digital broadcast footage with the subsequent generation of an on-line interactive application for non-linear access to the broadcast.

15 Commercialisation of an interactive system for ore-grade geostatics through collaboration with mining industry service companies.

To develop, apply and validate advanced specification, design, implementation, and verification methodologies which improve the productivity and quality of software. (13%)

16 Consolidation of the Outreach Program as part of the CSIRO Software Engineering Initiative to improve the productivity and quality of applications software developed in CSIRO and by industry partners.

17 Establishment of an industry and CSIRO consortium trialling and validating software engineering methods, technologies and tools.

To promote and support effective use of high-performance computing facilities in CSIRO. (5%)

18 Management of the CSIRO Supercomputing Facility and provision of support services that satisfy the community of scientific and engineering users.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$8,239,000
External Revenue	$3,804,000
Total Revenue	$12,043,000
Operating Result	-953,000
End of Year Cash Balance	71,000

Staff by Functional Classification 1996-97*

Research	90
Total	126

*estimates as at June 1996

22. Division of Manufacturing Technology

Objective

To develop and exploit new and improved products and processes which will increase Australia's competitiveness in selected areas of manufacturing in the metals and related industries, particularly those that are export oriented.

Strategy

- Conduct research and development in advanced manufacturing technologies by the application of skills in electronic, materials and mechanical engineering and computer science in accordance with CSIRO and Division priorities. Collaborate with other CSIRO Divisions to supplement core skills.
- Collaborate with universities and industry across a range of basic, applied and commercial activities by active participation in Cooperative Research Centres.
- Increase the transfer of technologies from the Division's research to industry by establishing business plans for the Division as a whole and for key research programs, and improving interaction with client companies.
- Maintain effective links with manufacturing industry by participation in specialist industry centres, such as the Australian Automotive Technology Centre, and in industry and professional associations.
- Taking a leading role in the international research programs on Intelligent Manufacturing Systems.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Magnesium Alloys - MDP9

Magnesium Production - MDP10

Process and Maintenance Optimisation in Manufacturing - MDP15

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

Develop diecasting processes for non-ferrous metals and alloys, and generic elements of casting and solidification technology. (24%)

1 Investigation of advanced thermal control systems for low pressure diecasting and squeeze casting dies.

2 Investigation of influence of operating parameters on the structure and properties of low pressure diecast aluminium and squeeze cast alloys.

3 Development and use of computer modelling packages for the design of die casting tools and light alloy castings.

4 Further development of iron-chromium-boron alloys for high temperature tool and die applications.

5 Cooperative research under the auspices of the CRC for Alloy and Solidification Technology.

Develop high productivity processes and consumables in arc welding technology. (15%)

6 Development of core formulations aimed at the commercialisation of rutile-flux wires with improved mechanical properties, a barium-free self-shielded wire, and improved basic-flux and metal-cored wires for use with pulse welding.

7 Development of a robotic cell integrated with a CNC work station for high current plasma arc welding.

8 Extension of the high current GTA welding process technology for out-of-position welding in the joining of aluminium plate in shipbuilding applications.

9 Development of a tandem-head laser based welding prototype.

10 Design and simulation of a robotic arc welding cell for the fabrication of large marine and automotive components.

11 Development of a model for distortion in welding process and of means to ameliorate distortion problems.

12 Cooperative R&D undertaken within the framework of the Materials Welding and Joining CRC.

Develop new processes to enhance the properties of engineering surfaces. (9%)

13 Development of improved arc-based hard surfacing technology.

14 Investigation of surface treatments and scale-formation on the wear of hot forging dies.

15 Development of plasma transferred arc surfacing technology for aluminium alloys.

Develop the technology of electrically generated plasmas. (16%)

16 Support provided for R & D based on laboratory studies and mathematical models of the PLASCON™ process to enable development of a commercial pilot plant for the destruction of ozone depleting substances, such as Halons and CFCs.

17 Improved performance of PLASCON™.

18 A facility to demonstrate the feasibility of directly making seamless thin walled steel tube from the melt.

19 Completion of a study of the arc wire spray process to specify the requirements for improved process control strategies with a view to obtaining better spray characteristics.

Develop vision sensing and real-time system technologies for applications in manufacturing, food processing, service infrastructure and mining industries. (22%)

20 Completion of the feasibility prototype vision system to detect and identify aircraft landing on a runway in Melbourne airport and finalisation of the contractual agreement with FAC and Telstra to develop prototype identification system.

21 Development of a commercial prototype system to detect and identify aircraft landing on all runways at Melbourne airport and evaluation of the system under operating conditions.

22 Completion of contracts with the NSW Roads and Traffic Authority (RTA) and the development of a feasibility prototype system to detect cracks on road pavements.

23 Development of circuitry and software to support rapid configuration of vision processors for industrial applications, including food processing and grading.

24 Completion of a business study with DIST under the Technology Access Program to assess the commercial and technological opportunities for automation in the inspection, sorting and processing on minimally processed food items.

25 Development of an international project under the Intelligent Manufacturing Systems for automated sorting, grading and processing of food items.

26 Development and trial of improved techniques for integration and control of complex mechatronic systems for manufacturing and remote inspection tasks.

27 Development of prototype modules for integration into CNC machine tools for improved control and condition monitoring during plasma profile cutting, including bevel cutting.

28 Further development of the dragline controller and sensing technologies and demonstration on a full scale production machine.

29 Design of a simulator for training dragline operators, identifying the characteristics required of system modules and, where possible, sources of supply.

30 Development of generic machine vision and electro-hydraulic control technology for underground mine automation.

31 Development of a prototype instrument to automatically identify wear debris from oil filtergrams and its trial in a range of applications.

32 Full-scale laboratory investigation of the potential and key operating processes of a novel mechanism for rock cutting.

33 Initial development and evaluation of a novel hybrid test/modelling methodology to identify the structural condition of large machine elements.

Develop integration architectures, methodologies and associated software suitable for integrating business and manufacturing activities in small and medium sized enterprises. (4%)

34 Enterprise Integration projects developed for the CRC for Intelligent Manufacturing Systems and Technologies and the international research program on Intelligent Manufacturing Systems (IMS).

35 A new Generic Enterprise Integration Architecture concept developed within the Smart Manufacturing priority program.

36 Research programs for global manufacturing (Globeman) formulated with Australian and international partners within the framework of the IMS program.

Develop generic production management methodologies and software tools for integrated manufacturing decision support systems. (5%)

37 Research program development for Holonic manufacturing systems within the framework of the international IMS program.

38 Integrated software development for optimising sheet metal fabrication for the CRC for Intelligent Manufacturing Systems and Technology.

39 Development of concept for research program on cooperative scheduling.

40 Development of diagnostics and maintenance tools as part of the Process and Maintenance Optimisation in Manufacturing MDP.

Develop and commercialise software in the field of product design and assembly. (5%)

41 Assembly Planning software completed and tested for commercialisation at several sites.

42 Development of a method and software tools to speed up product design phase. Design of concepts for parts planning software for the CRC for Intelligent Manufacturing Systems and Technologies.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$13,744,000
External Revenue	$9,355,000
Total Revenue	$23,099,000
Operating Result	561,000
End of Year Cash Balance	-815,000

Staff by Functional Classification 1996-97*

Research	148
Total	196

*estimates as at June 1996

23. Division of Materials Science and Technology

Objective

To develop and exploit advanced high value materials and associated technology to support the growth of an internationally competitive Australian manufacturing sector.

Strategy

The rapidly increasing importance of Elaborately Transformed Manufactures as a basis for novel prôducts in Australia's export performance is creating new opportunities for advanced materials and related technologies.

- Establish and maintain effective linkages with key companies and sectors of manufacturing industry.
- Develop improved materials (alloys, ceramics, composites and membranes) and more efficient materials processing techniques to add value to Australian raw materials and to increase the world competitiveness of Australian made products.
- Apply expertise in optical materials, X-ray and laser methods, and computational capabilities, to construct prototype equipment for materials inspection and remote sensing.
- Apply advanced electron-beam pattern generating expertise to create optically variable devices for the security industry, construct masks and other devices for the electronics industry and offer a machinery capability for parts and devices at the micro and nano size levels.
- Maintain an appropriate balance between technological development and strategic research.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Magnesium Alloys - MDP9

Magnesium Production - MDP10

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

To apply fundamental skills in materials and corrosion science, materials processing and coatings technology to the development of improved materials and methods of production for Australian industry. (19%)

1 Completion of a study of minor element site occupancies in duplex titanium aluminides. Preparation of kilogram scale ingots of titanium aluminides and other intermetallic alloys using clean melting facilities developed in-house.

2 Completion of phase 1 of the development of intermetallic alloys for use as interconnects and/or interconnect coatings in solid oxide fuel cells.

3 Establishment of data collection and control instrumentation for the continuous strip casting facility and completion of phase 2 of the computer model, including incorporation of the solidification process.

4 Assessment of creep performance of AZ91E alloys with and without trace additions. Development of a creep resistant magnesium alloy development project in conjunction with a commercial partner.

5 Establishment of competitive rare earth coatings technology for aluminium alloys, and zinc or zincalume-coated steel, and development of non-aerospace aluminium coating technology in collaboration with the commercial partner.

6 Completion of technology transfer relating to the manufacture of commercial anti-corrosion coatings for copper water pipes with the commercial partners.

7 Completion of technology transfer relating to the production of commercial lead alloy high performance crankshaft bearings with the commercial partner.

8 Fabrication of different types of electroformed copper and nickel prototype tools for the production of test parts from stereolithography patterns, in conjunction with other CSIRO Divisions and commercial partners.

To develop novel advanced ceramics with improved properties, and new ceramic components or devices, and to improve manufacturing opportunities for Australian industry through the production and use of advanced ceramics and refractories. (20%)

9 Development of a commercially viable manufacturing process, in conjunction with industrial collaborator, for production of improved refractory products based on controlled microcrack toughened materials.

10 Development of advanced refractory castables for the minerals, metals and petrochemical industries.

11 Fabrication and test evaluation of non-consumable anodes for improved smelting operations as part of MDP project on inert anodes with the Division of Minerals.

12 Identification and implementation of improvements in near nett-shape forming of manufactured ceramic components.

13 Continued support and expansion of refractory in-scarce performance for Australian mining and manufacturing companies in collaboration with other Divisions.

To develop solid oxide fuel cells for electricity generation. (11%)

14 Evaluation of cell stacks and systems in the 3-5 kW capacity range. Continued support for the technological and manufacturing capabilities of Ceramic Fuel Cells Ltd.

To develop, with appropriate partners, advanced scientific and medical equipment which will lead to the establishment of new business and strengthen existing businesses, in the manufacturing industry sector. (19%)

15 Development of atom optics for application in gravity gradiometer.

16 Completion of multi-purpose airborne imaging spectrometer for use in mineral exploration, environmental monitoring and defence applications.

17 Completion of prototype Operational Airborne Remote Sensor for Division of Exploration and Mining.

18 Construction of a prototype phase contrast-x-ray imaging system for the examination of weekly absorbing materials such as soft tissue and contaminated food products.

To apply chemical and chemical engineering skills to the synthesis, processing and utilisation of advanced materials, particularly those of Australian origin or of importance for Australian manufacturing industry. (9%)

19 Initiation of a research program on the production of synthetic nuclei for cultured pearls.

20 Development of lithium ion rechargeable battery technology for traction application.

21 Initiation of the second stage of development of the CSIRO process for extraction of titania from ilmenite.

To develop techniques to optimise packaging and to develop environmentally benign packaging systems. (6%)

22 Development of new biodegradable packaging for commercial partners.

23 Development of novel low cost membranes for packaging of food products for commercial partners.

To design and fabricate, using electron lithography techniques, innovative products and processes based on the physical properties of arrays of microscopic surface relief structures for industrial optical, electrical and mechanical applications. (16%)

24 Design and fabrication of EXELGRAM Optically Variable Device (OVD) master plates for optical security and anti-counterfeiting applications in support of the requirements of CSIRO's international licensees.

25 Further development of the EXELGRAM and OVD technology base for a wider range of optical security applications and customer requirements.

26 Development of OVD simulation software for design bureau applications in Europe and elsewhere.

27 Development of a design and fabrication capability for Surface Acoustic Wave (SAW) devices for very high frequency filtering and microwave applications.

28 Development of a fabrication and prototyping capability for specialized opto-electronic devices that enhances and complements existing Australian opto-electronic technology centres.

29 In collaboration with Australian industry, development of injection moulding applications of novel microstructure patterns generated by electron beam lithography techniques.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$12,264,000
External Revenue	$4,975,000
Total Revenue	$17,239,000
Operating Result	1,231,000
End of Year Cash Balance	582,000

Staff by Functional Classification 1996-97*

Research	97
Total	148

*estimates as at June 1996

24. Division of Mathematics and Statistics

Objective

To develop mathematical and statistical products and services which will be employed for the benefit of Australia and/or Australian enterprises. To continually enhance the knowledge base from which these products and services have been created to ensure we are able to meet the longer-term needs of our customers and Australia.

Strategy

- Engage in mathematical and statistical research, working directly with Australian enterprises on problems of immediate tactical importance to them and identifying their strategic research needs.
- Concentrate on increasing resources for longer-term projects. External funding for these is being sought through industrial partnerships, joint ventures and other channels.
- Carry out regular marketing to identify the mathematical and statistical research needed to improve the competitive position of Australian industries. Collaborative projects with other CSIRO Divisions will be actively sought.
- Enlist the collaboration of universities and other research groups.
- Communicate activities by means of technical reports, scientific publications, workshops, industry news-sheets, targeted courses, software products, media releases and ongoing interaction with stakeholders.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Heavy Mineral Processing - MDP6

Process and Maintenance Optimisation in Manufacturing - MDP15

Urban Water Systems - MDP16

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

To formulate mathematical models and develop computational algorithms and functional software for industrial applications, and to deliver the benefits of this research to users. (27%)

1 Development of mathematical models to help understand and improve specific processes and products. Applications will include electromagnetic effects in metal casting, operation of coke ovens, fabrication of fibre cement sheets, metal rolling and coating, operation of bio-sensors, food extrusion and continuum models for granular flow.

2 Continued investment in Project Fastflo (New Computational Fluid Dynamics Algorithms for Industrial Applications), particularly implementation as a scientific partial differential equation solver on PCs. Development of international licensing procedures for commercialisation of Fastflo. Application of Fastflo to collaborative research projects.

3 Development of models and software for specific applications involving fluid flow: pulsating combustion, heat transfer in coke ovens, the aeration step in the Becher process, carbothermic smelting, and filling of moulds with molten metal.

4 Optimisation algorithms and software to improve specific processes including scheduling of airline crews, rostering of service workers and meat processing.

5 Application of simulation concepts and software in a wide variety of industries to understand and improve processes, including mineral processing plants, service bureaux and factory layouts.

6 Continued development of particle-based computational algorithms for flow of granular materials, including collaboration with other CSIRO Divisions and marketing to identify prospective industrial customers.

To develop and apply the capability to make efficient and effective use of data and measurement in support of management and decisions by Australian enterprises. (28%)

7 Collaboration with groups having complementary skills and knowledge in modern methods for studying large complex datasets, working with disparate data sources, visualisation and knowledge-based systems.

8 Statistical models used to further compress a large spatio-temporal database.

To improve the competitiveness of the Australian small-to-medium enterprises (SMEs) sector by developing, providing, and facilitating access to appropriate mathematical and statistical services, tools and techniques. (9%)

9 Analysis of data from market survey about the business requirements of SMEs.

10 Modification of strategic plan in the light of this analysis.

11 Development and implementation of an operational plan on the above analysis.

To enhance the competitiveness of Australian enterprises, particularly the computer software and service industries, by improving their software quality and productivity. (6%)

12 A framework for an extension service (inside CSIRO in the first instance) in software quality management, based on the key theme of process improvement.

13 Establishment of research projects on the software development process and associated measurement issues (software metrics), in collaboration with AT&T Laboratories and other groups.

To develop and apply methods for the analysis and integration of temporal and spatial data to provide information for environmental management. (9%)

14 Case studies undertaken with key environmental agencies to demonstrate the value of remotely sensed data, integrated with other relevant data, for providing information to resource managers.

15 Methods for calibrating AVHRR data.

16 Integration of remotely sensed and terrain data to predict areas at risk from salinity.

17 Methods for assessing, representing and combining the uncertainty in the data layers of a geographic information system.

To meet and anticipate the needs of Australian enterprises by developing and applying algorithms for image filtering, segmentation and characterisation. (10%)

18 Faster algorithms for filtering and segmentation of two dimensional grey scale images.

19 Three-dimensional reconstruction algorithms suitable for stereoscopic images.

20 Advanced filtering, segmentation and characterisation algorithms developed for two dimensional colour images and applied to biomedical applications.

21 Advanced algorithms developed for accurately identifying mineral mixtures from shortwave infrared spectra recorded by field portable and airborne spectrometers.

22 An improved software environment for developing image analysis algorithms.

To provide an IT infrastructure that facilitates innovation and wide area collaboration, and at the same time ensure stable and secure environments for the Division's activities. (11%)

23 An agreement with Divisional management for service levels to be provided on the Divisional servers.

24 Bi-monthly project plans that schedule changes to hardware, operating systems and applications software according to available resources.

25 A plan for the upgrade of existing 10 megabit local area networks.

26 Procedures introduced for updating and reviewing the IT strategic plans, operational plans, disaster recovery plans, and security poilicies, and review virus protection, firewall security, PGP security, and password aging.

27 A new integrated file backup system introduced to backup UNIX files and Windows NT files, and a review of arrangements for long term archiving of valuable files possibly to CD-ROM.

28 Introduction of coordinate management systems for software installation within the Division that utilise the wide area network, and increase the uniformity of the IT environment at each of our sites.

29 Introduction of a service providing access to PC applications (such as Microsoft Office) for users of UNIX workstations and X terminals.

30 Plan for remote access to our IT facilities at speeds greater than 28.8K using either ISDN or cable modems.

31 An increase in the reliability of both voice and data networks by providing fallback mechanisms - in particular that the Macquarie University site does not lose voice service when there is a problem with the microwave system.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$7,876,000
External Revenue	$2,610,000
Total Revenue	$10,485,000
Operating Result	-1,202,000
End of Year Cash Balance	1,071,000

Staff by Functional Classification 1996-97*

Research	66
Total	98

*estimates as at June 1996

25. Division of Minerals

Objective

To deliver R & D outcomes to the Australian mineral and metal production industries that will benefit their efficiency, product quality and value-adding prospects.

Strategy

The Division's strategy is based on the need to expand the scope and volume of business in order to generate the resources needed to deliver useful outcomes. This will be done by:

Business-Like Behaviour:

- Tailor approach to suit the needs and value-propositions of each type of customer; governments, large mineral houses, small-medium mineral houses and consulting/service providers.
- Use project portfolio analysis as the tool for managing the science and the market.
- Develop an effective team approach.

Attuned to Industry Needs:

- Understand the industry eg complement their well organised and sophisticated use of technology.
- Work to their needs eg focus on Clean and Green Technologies, Radical and Intense Processing, Smart Sensors and Remote Control.
- Have a structure that delivers eg three interacting segments delivering to 15 business opportunities.

Underpinned by Excellent Science

- Bring market plans and science plans together to produce the research program.
- Maintain critical mass in underlying disciplinary strengths: chemistry, engineering and electronics in mineral processing, hydro-metallurgy, pyro-metallurgy.
- Maintain sophisticated, leading-edge equipment through a capital procurement program.
- Human Resources program that recruits, supports and retains excellent people.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4

Heavy Mineral Processing - MDP6

Iron Ore Processing - MDP8

Magnesium Production - MDP10

Processing of Nickel Ores - MDP37

Specific Objectives & Planned Outcomes

To serve the Australian mineral processing industry by generating R & D solutions that will benefit its efficiency, product quality and value-adding prospects through client-focused multi-disciplinary research and development. (36%)

1 Fine Particle Beneficiation: Development of a new flotation process for lowering the impurity content of nickel concentrates.

2 Iron Ore Processing: Assessment of the kind and amount of value-added processing feasible for selected Australian iron ores.

3 Process Engineering: Establishment of the technical feasibility of dustless combustion processes.

4 Process Mineralogy: Development of an enhanced capability to determine, by QEM*SEM, the mineralogy of base and precious metal ores and concentrates.

5 Process Instrumentation: Development and installation of on-belt microwave moisture gauges for iron ore and coal.

To provide solutions to the problems of making new and/or improved metal oxides and other compounds from minerals, more cheaply. (35%)

6 Novel Battery Technologies: Establishment of the best additives for enhancing positive-plate performance in lead/acid batteries.

7 Titania Production: Commissioning of a plant for removing the radioactivity from synthetic rutile.

8 Industrial Minerals Processing: Commissioning of a plant for manufacture of caustic magnesia ("Enviromag").

9 Alumina Production: Demonstration on a full scale plant of CSIRO technology for improved thickener performance.

10 Processing Gold Ores: Establishment of options for reducing costs in gold carbon-in-pulp plants using highly saline water (as part of the A J Parker CRC for Hydrometallurgy).

To promote sustainable growth in the Australian minerals industry by providing solutions to technical and environmental problems in the production and refining of metals, in order to improve efficiency, product quality, value-adding prospects and environmental impact, through client- focused, multi-disciplinary research which draws on an intimate knowledge of the industy. (29%)

11 Aluminium Production: Determination of the technical feasibility of novel carbothermic reduction processes for aluminium and smelting wastes.

12 Magnesium Technology: Development of a model describing the flows of material in the magnesium electrolytic cell.

13 Melt Chemistry: Establishment of the fundamentals in an on-going study of the reactions between slags and refractories (as part of the G K Williams CRC for Extractive Metallurgy).

14 Non-Ferrous Metal Production: Optimization of flash furnace operation through development of improved models.

15 Ferrous Metal Production: Optimization of HIsmelt pilot plant through physical and numerical modelling.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$19,732,000
External Revenue	$13,150,000
Total Revenue	$32,882,000
Operating Result	-6,484,000
End of Year Cash Balance	-1,901,000

Staff by Functional Classification 1996-97*

Research	206
Total	313

*estimates as at June 1996

26. Division of Oceanography

Objective

To increase and apply scientific knowledge required for the environmentally sustainable development of Australia's regional oceans, seas and estuaries, and to increase our understanding of, and quantify, the ocean's role in climate.

Strategy

National needs for physical and chemical marine expertise are now very diverse with Australia's Exclusive Economic Zone having come into force in 1994. These needs are best met by integration of core research capability into programs defined by the requirements of users.

A major government requirement is advice for marine environmental protection policy. The coastal zone is an area of particular focus. Offshore industrial development requires estimates of risk of environmental degradation and accurate knowledge of environmental extremes. Synoptic and climatic knowledge of ocean thermal and current structure is needed to assess and predict the sensitivity of the Australian climate to changes in its surrounding oceans. Marine chemistry contributes to fisheries, mariculture and the exploitation of marine resources and byproducts. Marine technology aids local industrial capability and links with the world in areas such as climate research and remote sensing.

Our strategy consists of the following elements:

- Undertake strategic research in ocean observations, ocean dynamics, numerical modelling, organic and inorganic chemical analysis and marine technology, and the integration and application of these disciplines in selected projects of defined environmental, industrial and social relevance.
- Provide direct marine research service and scientific advice to industry, and to federal and state bodies, on issues of environmental management and industrial development; and develop marine products in collaboration with industry.
- Enhance the efficiency and impact of Divisional research through the use of special purpose grants and collaborative links with Cooperative Research Centres, other CSIRO Divisions, national agencies, universities, and with internationally coordinated research programs.
- Promote the Division's work to government, industry, other stakeholders and the general public through a range of marketing and communication mechanisms.
- Operate the RV *Franklin* and maintain its capability as a state-of-the-art National Facility for the benefit of Divisional research and Australian marine science.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Coastal Zone Program - MDP21

Management of Marine Living Resources - MDP23

Climate Variability and Impacts - MDP29

CSIRO Aquaculture Initiative (CAI) - MDP34

Specific Objectives & Planned Outcomes

Describe and quantify processes in the oceans and incorporate them in predictive models of climate variability for the Australian region (el Nino Southern Oscillation and Indian Ocean related effects in particular) and of "greenhouse" induced climate change. (45%)

1 A global ocean model including assimilation of sub-surface thermal data for the study of problems related to Australia's climate variability.

2 Determination of South Pacific meridional heat and freshwater fluxes from completion of analysis of WOCE 30°S hydrographic section and by inclusion of current meter measurements.

3 Determination of the source of variability in the Southwest Pacific deep western boundary current by comparison of WOCE current meter observations and global models.

4 A consistent method for including vertical mixing processes in density-layered ocean models.

5 A first step in combining data sets to estimate net air-sea exchange of CO_2 by intercomparing ocean CO_2 measurements with overseas laboratories.

6 A better constraint on net air-sea flux estimates for CO_2 through a combination of Australian, French and Japanese data sets from the Southern Ocean.

7 The relative importance of ENSO and non-ENSO variations in thermal structure of the Indian Ocean (Antarctic CRC).

8 Publication of a major review article on the achievements of the multi-national Coupled Ocean Atmosphere Response Experiment.

9 Improved model of the effects of eddies in ocean climate models.

10 Estimates of meridional eddy heat and momentum fluxes in an eddy-resolving primitive equation model in a region south of Australia (Antarctic CRC).

11 Completion of the sixth occupation of repeat hydrographic section from Tasmania to Antarctica across the Southern Ocean.

12 Assimilation of satellite altimetry data in a Southern Ocean primitive equation model (Antarctic CRC).

Describe and predict the physical and environmental state of Australia's regional seas including its EEZ and estuaries by modelling and measurement, for applications to offshore engineering, fisheries management, pollution dispersal, and search and rescue. (27%)

13 Completion of an efficient three-dimensional hydrodynamic model suitable for incorporation into computer-based tools for the management of coastal marine ecosystems.

14 Completion of work associated with the Port Phillip Bay Environmental Study, including management scenario modelling and reporting.

15 Development of a 3-D data analysis scheme for the EEZ region using surface satellite data to infer subsurface patterns.

16 Development and implementation of a full data assimilation model for the Coral/Tasman Sea portion of the EEZ region.

17 Collection of research vessel and moored instrument data around Tasmania to test hypotheses on the ocean circulation developed from satellite and drifter data.

18 Assessment of the role of coastal processes off Western Australia on recruitment to a number of WA commercial fisheries.

19 Estimation of interannual variations of the effective spawning radius of Tiger prawns in Albatross Bay, Gulf of Carpentaria, for use in improved stock assessment and recruitment forecasting.

20 Estimation, from consideration of ocean currents and hypothesized larval behaviours, of the appropriate stock boundaries for management of Southern Rock Lobster.

21 Determination of the fates of sediment plumes from the Sepik, Fly and other PNG rivers as part of the Australia/USA project TROPICS.

Increase understanding of chemical processes in the marine environment, particularly those which influence the carbon cycle and phytoplankton production, and determine the sources, distributions and fates of natural and pollutant chemicals, so as to provide advice for environmental managers and assist the sustainable development of marine resources and products. (28%)

22 Evaluation of factors controlling the carbon cycle in the western Equatorial Pacific (JGOFS).

23 Initiation of a study of the Huon Estuary involving research into water movements and chemical processes affecting water quality to assist managers seeking environmental sustainability of mariculture in the estuary.

24 Integration of chemical data from the Derwent Estuary with physical transport models.

25 Development of chemical modules to enable prediction of the sources, fates and chemical transformations of environmentally important compounds in natural waters.

26 Development of fingerprinting techniques for hydrocarbons to assess their fate, persistence and toxicity in marine systems with particular reference to the *Iron Baron* oil spill.

27 Investigation of the use of ion-selective electrodes to determine the concentrations of free metal ions (the biologically important fraction) in natural waters.

28 Determination of the influence of different essential polyunsaturated fatty acids on growth rates of juvenile abalone.

29 Commissioning of the isotope ratio mass spectrometry facility to determine origins of hydrocarbons, to distinguish terrestrial and marine organic matter, and to assess carbon dioxide uptake by the oceans.

30 Development of improved techniques for measuring human faecal pollution with application to studies of stormwater and sewage input to the Derwent and other estuaries.

31 Identification of fatty acid and lipid classes in aquaculture diets for golden snapper to determine why some diets work better than others and to improve fish growth and survival.

32 Refinement of a laboratory purification process for adding value to Australian marine oils enriched in polyunsaturated fatty acids.

33 Development of a comprehensive data base on the nutritional (oil) composition of principal Australian seafood.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$5,961,000
External Revenue	$2,783,000
Total Revenue	$8,743,000
Operating Result	-518,000
End of Year Cash Balance	2,356,000

Staff by Functional Classification 1996-97*

Research	66
Total	106

*estimates as at June 1996

27. Division of Petroleum Resources

Objective

To add value to Australia's oil and gas industry by working with industry to develop technology, locate strategic resources, develop the required understanding of Australia's reservoirs and enable efficient recovery of the resources they hold.

Strategy

Maintenance of Australia's high level of self-sufficiency in oil and gas is dependent on developing and extending the life of new and existing resources. As a participant in the Australian Petroleum Cooperative Research Centre the Division will:

- Develop long term research plans to achieve research directions, funding strategies and discipline base requirements consistent with CSIRO and industry priorities.
- Build on established relationships with industry to maintain guidance for strategic research directions.
- Develop discipline-based research activities consistent with the requirements of the Division.
- Continue to make technology available to industry for assessment and use.

Specific Objectives & Planned Outcomes

Generation and improvement of concepts using geochemical and petrological sciences to determine source rock potential, migration pathways and reservoir charge. (45%)

1 Demonstration of isotope stratigraphy and fluid chemistry technologies applied to basin evolution in a multi-client workshop.

2 Establishment of laser micro pyrolysis as a viable technique for fluid inclusion analysis associated with the evaluation of reservoired petroleum.

3 Continue marketing and development of oil migration technology to create an international market through licensing arrangements with service companies in a two year time period.

4 Completion of Phase 1 of collaborative research with AGSO in applying grains with oil inclusion (GOI) to determine fill-spill histories of reservoirs.

Development of tools for characterising and interpolating reservoir heterogeneity for use in oil and gas reservoir development and management. (16%)

5 Further studies of reservoir characterisation and production conducted to determine optimum levels of characterisation required in Australian reservoirs.

6 Development of a procedure for laboratory measurements of residual saturation that accounts for heterogeneity.

7 Construction of 2-phase 3D network models and report on simulations of water and gas flooding in reservoir models.

8 Software developed to analyse mud loss data collected by drillers to identify hydraulically active fault or fracture zones down the well.

9 Methods of fault seal detection examined, including the use of hydrodynamics.

Development and assessment of technology to reduce drilling costs and increase productivity for wells drilled in the oil and gas industry. (31%)

10 Completion of negotiations to secure industry funding for a major new research initiative to reduce drilling tests by modelling the drilling processes and capturing field experience.

11 Improved understanding of the effects of change in permeability due to physico-chemical interactions on mud pressure penetration into the wellbore wall.

12 Continued application of wellbore stability analysis to industry needs and incorporation of feedback from petroleum companies.

13 Further experimental studies and numerical modelling to predict the propagation behaviour of multiple fractures in vertical, deviated and horizontal wells.

Development of a fundamental understanding, and verification by field and laboratory investigation, of a range of stimulation technologies for use in the oil and gas and coalbed methane industries. (8%)

14 Identification of critical generic processes affecting recovery of gas from coal based field studies.

15 Specification of needs for further development of software to model the processes involved in gas recovery.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$5,541,000
External Revenue	$4,596,000
Total Revenue	$10,137,000
Operating Result	85,000
End of Year Cash Balance	-1,919,000

Staff by Functional Classification 1996-97*

Research	48
Total	73

*estimates as at June 1996

Objective

To apply strategic research in the plant sciences to promote profitable and sustainable agri-food and fibre industries, develop novel plant products and improve natural resource management.

Strategy

The agricultural sector is part of a total agribusiness enterprise in Australia that generates $22 billion worth of primary products and $37 billion turnover in the foods and beverages manufacturing industries. These industries have unprecedented opportunities for growth and delivery of high quality products into domestic and export markets, especially in the economic growth centres of Asia. Environmental issues need to be considered in tandem with economics of production.

At the same time as new opportunities for agricultural production are appearing, we are confronted with a serious diminuation of our productive capacity in the form of erosion, spreading salinisation and increasing soil acidity, exacerbated by persistent drought in much of eastern Australia.

Environmental issues need to be considered in tandem with economics of production. It is essential that we understand the structure and dynamics of our agro-ecosystems so that we can achieve sustainability from our production units.

Our agriculture and natural resource management must be based on the best possible biological research. Powerful new methods of biological enquiry, especially genetic engineering, now allow us to address product quality features as well as efficiency in production systems.

National programs of economic and structural reform are improving Australia's competitive position, and Australian companies both large and small are developing recognition of the importance of research for their future viability.

In this context the Division will:

- apply a range of basic and applied plant research to the Australian agribusiness system and native ecosystem management
- participate in multi-disciplinary programs with other research institutes and industry for economic and community benefit
- implement a communication and technology transfer plan aimed at ensuring that we meet end-user needs and that research outcomes are adopted.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1

Novel Management Techniques for Plant and Plant Product Pests - MDP2

Climate Change - MDP17

Conserving Biodiversity for Australia's Future - MDP18

Biosensors - MDP27

Climate Variability and Impacts - MDP29

Dryland Farming Systems for Catchment Care - MDP32

Tropical Agricultural Exports - MDP33

CSIRO Aquaculture Initiative (CAI) - MDP34

Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities - MDP36

Specific Objectives & Planned Outcomes

To diversify the range of crops and to improve the performance of rainfed crops and pastures in southern Australia. (14%)

1 Release of new lines of wheat to State wheat breeders for independent assessment.

2 Risk analysis for nitrogen application using long-term weather data and a wheat crop model tailored for the mediterranean environment of Western Australia.

3 Transfer of F2 and backcross seed from crosses between two low-erucic acid, low-glucosinolate, CSIRO Indian mustard lines and ten low-erucic high yielding lines from Agriculture Victoria, to the Indian mustard breeder at Horsham.

4 Determination of whether increased phosphorus solubilisation from poorly available soil pools by plants grown at elevated CO_2 concentrations contributes to increased C gain via improved plant nutrition.

To transform agri-business enterprises for food and fibre into highly profitable and stable production systems through the development of new ways of managing physical, biological, financial and managerial resources. (14%)

5 Field testing of a novel inhibitor of nitrification and assessment of its effect on efficiency of nitrogen recovery by crops.

6 In-depth training provided to an experienced extension officer on secondment from NSW Agriculture in the application of the GrassGro decision support system to the grazing industry. A series of case studies on applications of GrassGro in actual advisory situations developed and prepared for publication with NSW Agriculture extension officers in Yass and Goulburn.

7 Development and validation of a new procedure, based on the use of beeswax as an alkane marker, to estimate supplement intake cheaply and accurately in animals grazing in sheep-meat production systems.

8 Establishment of whether wheat from southern Australia containing high grain protein percentages is of comparable dough and protein quality to grain from traditional prime-hard regions.

To develop economically viable and ecologically sustainable systems of cotton production for Australia. (10%)

9 Quantification of the value of selected refugia for management of INGARD cotton varieties in commercial sale field trials of transgenic cottons, and development of sustainable management strategies for their deployment by the cotton industry.

10 Assessment of a diverse range of commercial legume crops for nitrogen fixation and as components of rotations throughout the cotton-growing areas.

11 Finalisation of development of operational CERCOT model through calibration of carbon, nitrogen and water stress functions, and addition of locally validated soil sub-model.

12 Commercialisation of replacements for cotton varieties Siokra S324 and CS189+, and further evaluation of broadly adapted, higher-yielding replacements for Sicala V2 and Siokra V15.

To provide a basis for biological conservation, management and use of the Australian flora and vegetation. (12%)

13 Publication of EUCLID - an interactive 'key' and images on CD-ROM for 350 eucalypt species in south-eastern Australia.

14 Determination of the generic limits and evolutionary and phylogenetic relationships of Australian Rhamnaceae.

15 Completion of continental scale assessment of extent of geographic patterning of genetic structure in *Linum marginale-Melampsora lini* host-pathogen association.

16 Analysis of variation in mating systems in small and large populations of the rare species *Rutidosis leptorrynchoides*.

To create novel germplasm for increasing the market value of grain products. (17%)

17 Characterisation of starch produced by wheat transformed with antisense constructs to starch branching enzymes.

18 Completion of the disease resistance-like gene at the Cre 3 locus conferring resistance to cereal cyst nematode.

19 Assessment of preliminary experiments to establish a simple dough system comprising defined protein, starch and lipids.

20 Completion of characterisation of a recombinant antibody produced using the mRNA from a glutenin-monoclonal antibody producing hybridoma.

To determine patterns of gene expression in plant growth and development, develop novel genetic technologies for manipulating gene expression and to use the knowledge so gained to improve plant characteristics to enhance crop production. (13%)

21 Isolation of a fertilisation-independent seed gene (*fis* 2).

22 Testing of transgenic cotton plants with altered levels of Adh for waterlogging tolerance.

23 Analysis of the expression of transgenes driven by the amylase gene promoter in transformed barley.

24 Development of methods for determination of levels of early intermediates in the GA biosynthetic pathway in *Arabidopsis*.

To enhance plant performance and product quality through gene technology. (20%)

25 Production of transgenic potatoes with resistance genes for both potato leaf roll virus and potato virus Y.

26 Development and evaluation of white clover lines containing a novel carbohydrate aimed at enhancing digestibility.

27 Determination of the molecular basis of specificity of rust resistance genes in flax.

28 Generation of transgenic lucerne with altered lignin composition.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$22,875,000
External Revenue	$12,313,000
Total Revenue	$35,188,000
Operating Result	-966,000
End of Year Cash Balance	3,382,000

Staff by Functional Classification 1996-97*

Research	337
Total	433

*estimates as at June 1996

Objective

To extend and apply the knowledge and techniques of radio and imaging systems for the benefit of Australian industry and the Australian community.

Strategy

- Conduct research into generic technologies appropriate to telecommunications and image processing systems.
- Recognise emerging trends in services relevant to the Division's strengths and adapt its technology research to meet the future needs.
- Use large scale Demonstrator projects to address industry needs at the systems level.
- Collaborate with industry, universities, Government business enterprises and organisations such as DSTO, and foster the formation of research partnerships, drawing on wider CSIRO expertise where appropriate.
- Maximise the exploitation of the Division's research through partnerships giving access to international markets.
- Provide small-to-medium enterprises (SMEs) with ready access to the Division's capabilities.

Specific Objectives & Planned Outcomes

To develop and apply electronics and communications technologies in conjunction with telecommunications equipment manufacturers and providers of telecommunications services. (16%)

1 Development of broadband telecommunications networking using an in-house experimental ATM-based network linked to external networks. This network will be used to demonstrate to industry the application of quality of service (QoS) parameters, only available with ATM, to collaborative multi-media services, such as geophysical imaging, multi-media authoring and delivery of entertainment services. A demonstration scenario based on a small office, home office concept will be developed.

2 Investigations into the measurement and characterisation of traffic on broadband telecommunications networks. This work will develop traffic prediction and congestion control algorithms for use in the negotiation of quality of service parameters by new multi-media applications which will run on the broadband networks of the future.

3 Investigations into the signalling and messaging required to provide mobile and radio access to ATM networks while maintaining seamless connectivity. The provision of error resilience in multi-media applications and scalability in applications to accommodate reduced data rates will also be investigated.

4 Development of an enhanced personal, intelligent communications system as a demonstrator for the next generation of personal communications services (PCS). This system will be used for propagation experiments to enable improved cell planning and for the development of new services to be used over PCS.

To develop advanced wireless and untethered communications systems for mobile and portable computing networks, telecommunications customer access and other short-haul network links, and investigate enhanced applications for wireless access computing. (10%)

5 Demonstration of the quality of service achievable on a high speed wireless local area network through the use of a prototype and the development of the appropriate network interfaces.

6 Demonstration of key radiofrequency components and antenna components for high bit rate wireless applications such as WCAN (wireless customer access network) at 28 and 42 GHz.

7 Development of subsystems for a range of microwave radios up to 38 GHz for cellular telephone infrastructure.

8 Development of a demonstrator for high power, linear microwave amplifiers.

9 Demonstration of prototype, hybrid MMIC-based 42 GHz transceivers for low-cost broadband wireless customer access systems, including a version in which the MMIC chips are mounted using flip-chip techniques, and a second version incorporating and patented bidirectional amplifier technology.

To develop advanced GaAs based semiconductor devices and microwave monolithic integrated circuits (MMICs) for application in communications and defence systems. (24%)

10 Design rules established for a range of MMICs up to 100 GHz on 50 mm wafers using passivated 0.15 micron quantum-well doped high electron mobility transistors (HEMTs).

11 Demonstration of optical detectors up to 20 GHz.

12 A new electron beam lithography system for 50 mm wafers built and commissioned.

13 Design fabrication and testing of a range of MMIC devices in frequency bands from 0.5 - 120 GHz, including bidirectional amplifiers, Schottky diode and HEMT-based up/down converters and wide-band low-noise and medium power conventional amplifiers.

14 Commissioning of a unique on-wafer measuring system that will permit the accurate wafer level characterisation of HEMTs and MMICs at cryogenic temperatures between 0.5 and 50 GHz.

15 Demonstration of hybrid integration, using flip-chip techniques, of a planar antenna, an MMIC amplifier, and an MMIC mixer, to produce the basic element of an array receiver working near 100GHz.

To develop and apply expertise in ultrasound, information technology and medical imaging to enhance the cost effective delivery of health services, and to advance industry's capabilities in underwater imaging. (15%)

16 Full scale engineering design of high resolution mine imaging system completed in conjunction with industry.

17 An evaluation and report to industry on methods to quantitatively measure blood flow in vessels.

18 Development of a clinical application of knowledge-based interpretation of X-ray and CT images of the chest.

19 Edited proceedings of the World Federation for Ultrasound in Medicine and Biology (WFUMB) Symposium on Non-Thermal Bioeffects of Diagnostic Ultrasound.

To apply advanced signal processing technologies in the following areas : telecommunications, the security industry, digital electronics and sensing technologies for the communications and mining industry. (16%)

20 Applications of the principles of content-based image processing to a number of areas including real-time face recognition and rapid browsing through large image databases.

21 High ratio compression of still images.

22 Low bit-rate audio and video encoder for mobile and PSTN channels.

23 Investigation of the use of digital processing solutions in the implementation of improved safety instrumentation for the mining industry.

24 Application of radio imaging technology and software to mine planning and mine operations.

To develop robust and adaptive methods for telecommunications and control, as part of the activities of the Cooperative Research Centre for Robust and Adaptive Systems. (4%)

25 Real-time speech coding demonstrator for voice archiving applications.

26 Application of the principles of synergetic computation to the development of fast methods of pose estimation for a human head or other objects.

To develop techniques for the design and manufacture of antennas and passive microwave/millimetre-wave devices for communications systems. (15%)

27 Design and manufacture of focal feed system for Nançay radiotelescope completed.

28 Computer software with improved accuracy developed for modelling of reflector and feed arrays for satellite antennas.

29 A dual-band feed system designed, built and tested for Georgia Institute of Technology.

30 Antenna elements for integrating with millimetre-wave components for WCAN (wireless customer access network) and WLAN (wireless local area network).

31 A demonstration antenna designed and tested for accessing different services in multi- frequency bands.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$13,652,000
External Revenue	$5,237,000
Total Revenue	$18,889,000
Operating Result	-606,000
End of Year Cash Balance	1,055,000

Staff by Functional Classification 1996-97*

Research	130
Total	216

*estimates as at June 1996

Objective

To ensure the most efficient and cost effective use of the RV *Franklin* as a multi-purpose research platform for the Australian marine science community, Government and marine-related industry.

Strategy

- Anticipate national needs within the capability of the vessel, ensure cost effective deployment, and provide competent scientific engineering support and financial management in consultation with, and by participation on, Steering and Users Committees of the vessel.
- Maintain and continually upgrade the technical capabilities of the scientific instruments and systems installed in the vessel.
- Ensure an ongoing program of refurbishment and preventative maintenance in collaboration with the operating contractor (Howard Smith Industries Pty Limited).
- Support the research usage of the vessel through the provision of efficient and quality-controlled standard chemical analysis, calibration, hydrology and data product services.
- Promote collaboration and interaction with other research vessel operators both nationally and internationally.

Multi-Divisional Collaboration

The Facility participates in the following Multi-Divisional Program:

Climate Change - MDP17

Specific Objectives & Planned Outcomes

To fully utilise CSIRO's share of available shiptime (79 days or 43% of the total) in 1996-97. (100%)

1 Further investigations into Freshwater and Heat budgets in the tropical Indian Ocean.

2 Moored measurements and CTD sections of the flow of the Deep and Bottom Water into the West Australian Basin of the Indian Ocean.

3 Study of Coastal, Shelf and Continental Slope Currents around Tasmania.

4 Study of the fates of sediment plumes from the Sepik, Fly and other Papua New Guinea rivers as part of a major international experiment studying Tropical River - Ocean Processes in Coastal Settings.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$4,194,000
External Revenue	$535,000
Total Revenue	$4,729,000
Operating Result	-514,000
End of Year Cash Balance	432,000

Staff by Functional Classification 1996-97*

Research	0
Total	10

*estimates as at June 1996

31. Division of Soils

Objective

To benefit the nation through research and the development of technologies which contribute to profitable and ecologically sustainable use of Australia's soil and land resources.

Strategy

As the rural industries begin a recovery from both recession and one of the most damaging droughts on record, the soil resource will be exploited further as farming enterprises seek to recoup losses. This will increase the need for radical rural adjustment and the need for information on better land management. In response to an increasingly environmentally aware urban population, government and industry will seek to implement environmentally sound practices as reflected in ability to satisfy environmental quality assurance, in the rural mining, manufacturing and service industries, particularly with respect to disposal of wastes and pollutants. The provision of information to assist ecologically sustainable development will be achieved by:

- Developing our national base of knowledge on soil properties, processes and distribution.
- Identifying and solving problems for industry and the community using soil science knowledge and related technology.
- Providing national and international leadership and direction in soil science research and technology development.
- Contributing to policy development relevant to soils and land use management.
- Promoting the development of soil science professionals.
- Improving public awareness of the importance of soils as part of our ecosystems and national resource base.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Conserving Biodiversity for Australia's Future - MDP18

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity - MDP31

Dryland Farming Systems for Catchment Care - MDP32

Tropical Agricultural Exports - MDP33

Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities - MDP36

Specific Objectives & Planned Outcomes

To develop integrated, efficient and ecologically sustainable soil management systems for improved rural production and product quality and to identify soil indicators of sustainability. (32%)

1 Identification of major causal factors of sugarcane yield decline and development of appropriate management strategies to return to an increasing yield trend.

2 Description, quantification and modelling of C and N pools in soils, and the development of management systems to protect soil organic matter and increase productivity of crops and pastures.

3 Assessment of the effects of land management on soil health and the diversity of soil biota, thereby developing the use of specific soil biota to enhance soil processes for optimum plant growth.

4 Evaluation of management practices, environmental conditions and biocontrol agents for controlling soil-borne root diseases in dryland farming and nursery production.

5 Provision of a predictive approach to soil degradation caused by sodicity and acidity, and to develop management options to minimise the effects of these processes.

To develop methods for measurement, prediction and effective management of the impacts of agricultural, urban, mining, industrial and tourist activities on landscapes and ecosystems, and to provide strategies for the sustainable rehabilitation of degraded landscapes, disposal of organic wastes, and continued production of clean foods. (23%)

6 Evaluation of the sustainability of land applications of sewage wastes from knowledge of leaching and runoff of nutrients, salts and heavy metals, and provision of guidelines for maximising the effectiveness of waste re-use schemes.

7 Identification of key processes essential to design of rehabilitated, post-mining landscapes that are in dynamic equilibrium with regional environments.

8 Identification and characterisation of potentially useful clays which can selectively absorb heavy metals and organic contaminants, and development of techniques to modify the surface properties to enhance their absorption properties.

9 Identification of key factors which affect the mobility of toxic metals and organic contaminants in soils and their uptake by crops, development of amelioration strategies, and production of management guidelines.

To enhance sustainable land management and agricultural productivity, by improved methods

of soil resource assessment, soil classification, prediction of degradation risk and knowledge of the relationships between soil properties, geomorphology and landscape behaviour. (26%)

10 Development of new methods of land and soil resource assessment using digital terrain modelling, radiometric imagery, remote sensing and conventional soil descriptions for use by state agencies and land managers.

11 Generation of a modern, national soil database and a soil information system for the Murray Darling Basin which links spatial soil distribution patterns to database information and interpretive guidelines for policy makers and land managers.

12 Development of models and pedo-transfer tools to integrate knowledge of soil physical/chemical behaviour within landscape/catchment frameworks to assist in the minimisation of land degradation and development of sustainable dryland farming systems.

13 Development and application of standard methods for land evaluation through the support and management of the Australian Collaborative Land Evaluation Program.

14 Evaluation of the distribution of coastal acid sulphate soils and the development of management strategies for conservation, tourism and other land uses.

To provide research management, strategic planning, resource management, business development, technical support services and communications for our clients and the Division. (20%)

15 Full implementation of Financial Recovery Plan in accord with the Divisional Strategic and Business plans.

16 Finalisation of the skills audit and completion of the Divisional Human Resources Plan designed to provide staff training, improved recruitment and succession planning in accord with Strategic and Business Plans.

17 Development and implementation of a new set of financial procedures to address issues raised by the Divisional Executive Committee and the Risk Management audit.

18 Development of a refurbishment and capital works plan and budget for Canberra and Perth laboratories.

19 Completion of national quality assurance and NATA accreditation for Adelaide ACU unit, and rationalisation of technical support services across the Division.

20 Review of administrative services and site operations at Davies Laboratory Townsville completed.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,669,000
External Revenue	$4,198,000
Total Revenue	$15,867,000
Operating Result	-768,000
End of Year Cash Balance	-191,000

Staff by Functional Classification 1996-97*

Research	112
Total	181

*estimates as at June 1996

32. Division of Tropical Animal Production

Objective

To research and develop technologies that enhance the competitiveness and sustainability of Australia's tropical animal industries.

Strategy

In order for the livestock industries of northern Australia to capture a long term share of the expanding markets of Asia, the industries will need to improve international competitiveness in the face of decreasing prices for primary products, address market specifications for primary as well as value-added products, provide clean products of consistent quality, and achieve this using sustainable management systems. To assist, the Division will:

- Understand the business environment appropriate to our mission.
- Identify appropriate customers.
- Work with our customers to identify needs and opportunities, and to define our research portfolio.
- Ensure we have the skills, structures, and support for project outcomes to be delivered on time and in budget.
- Support the delivery of research outcomes through using best practice in commercialisation, communication, finance, human resources, and planning.
- Provide a stimulating environment for creative research.
- Use flexible forms of work organisation to deliver program and project outcomes.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Fibre Utilisation - MDP3

Tropical Agricultural Exports - MDP33

CSIRO Aquaculture Initiative (CAI) - MDP34

Specific Objectives & Planned Outcomes

Produce non-living vaccines against ticks, the tick fever organisms, Babesia spp. and *Anaplasma marginale*, buffalo flies, the larvae of sheep blowfly and maintain chemical control of ticks and buffalo flies. Assess prawn viral disease status. (28%)

1 Provision of technical backup and evaluation capability to Biotech Australia to facilitate the commercialisation of an improved *Boophilus microplus* (tick) vaccine.

2 Through the Actest service, evaluation of new acaricides and insecticides for *Boophilus microplus* and *Haematobia irritans* (Buffalo fly) control.

3 Improvement of diagnostic methods for acaricide resistance developed and incorporated into strategies applicable to the northern cattle industry.

4 Evaluation of the potential of expression library immunisation for the identification of Anaplasma antigens.

5 Characterisation of the cytokine profiles of Babesia and Anaplasma infections with the aim of developing a predictive measure of immunity.

6 Completion of evaluation of the recombinant *Babesia bovis* antigens prior to potential commercialisation.

7 Characterisations of two further *Lucilia cuprina* (sheep blowfly) antigens in sufficient detail for the antigens to be expressed as recombinant proteins.

8 Assessment of the potential for the existing four recombinant *Lucilia cuprina* antigens to act additively or synergistically as a vaccine.

9 Identification and characterisation of the genes for two antigens in screwworm fly homologous to those of *Lucilia cuprina*.

10 Initiation of studies on the nature and diagnosis of viral disease present in the Australian prawn industry, in collaboration with other institutions.

Develop advanced selection and crossbreeding technologies for beef cattle in the tropics and subtropics to improve product quality and the efficiency with which it is produced. (14%)

11 Evaluation of the progeny from the mating of 1000 Brahman females with sires of 9 breeds as part of the cross breeding programs for the Cattle and Beef Industry CRC.

12 Slaughter of representatives of first and second calf crops of the CRC's straight-breeding program to complete data collection on the straightbred and crossbreed groups of animals, and ongoing production of further straight bred calves on collaborators' properties.

13 Further analysis of three generations of data derived from Belmont selection line experiments.

14 An analysis of Australian/South African data set to estimate magnitude of sire x environment interactions in diverse geographic regions.

15 Continuation of comparative evaluation of reproduction, growth, survival, resistance to environmental stresses, "easy-care" characteristics and meat and carcase attributes of a range of straightbreds and 2-, 3- and 4-way crossbreds as part of MRC project CS183A.

16 Assess the likelihood that a major gene for worm resistance occurs in the Belmont Adaptaur.

17 Complete development and relevant decision support software to aid producers in making educated decisions about cross-breeding systems to target specific markets.

18 Continuation of testing of the action of the major gene for tick resistance from the Belmont Adaptaur in five other genetic backgrounds.

Develop molecular genetic techniques for improved tropical animal breeding. (18%)

19 Completion of screening for genetic markers for growth, conformation, tenderness, meat and fat colour evaluated in Charolais and Brahman research herd and commercial herds.

20 Evaluation of selected genetic markers for tenderness, yield, meat and fat colour, growth and conformation in industry herds and assessment of commercial value.

21 Evaluation of candidate gene markers for tenderness in industry herds; development of diagnostic marker systems where appropriate.

22 DNA fingerprinting technology developed and applied for pedigree determination in *Penaes japonicus*.

23 A further twenty microsatellite markers isolated from the prawn, *Penaes japonicus*.

24 Computer software developed for gene identification and gene tagging with markers.

25 Assessment of scope for genetic selection for hide and leather quality.

Develop reproductive technologies to increase the reproductive potential of male and female cattle, increase the rate of livestock improvement and selectively suppress fertility of male and female cattle. (8%)

26 New protocols that improve the efficiency of oestrus synchronisation and superovulation.

27 Demonstration of the feasibility of the use of LHRH agonists to reverse immunocastration.

28 Determination of the benefits of immunospaying in enhancing carcass quality of young cattle.

29 Establishment of feasibility of extended survival of epididymal sperm at body temperatures.

30 Establishment of feasibility of sperm separation method using male-enhanced antigen.

Improve the efficiency of production, the quality and the composition of carcase and by-products. (12%)

31 Completion of analysis of growth response of cattle to a B2-adrenoceptor vaccine in 3 trials, and identification of research needed to make the vaccine attractive to a commercial partner.

32 Further refinement of a strategy shown to achieve sustained growth promotion of steers through alternative use of growth promoting agents with different mechanisms of action. Assessment of impacts on carcase quality.

33 Assessment of the influence of age and growth rate on two biochemical markers for meat quality.

Improve nutrition of northern cattle and sheep by increasing energy and protein digestion through dietary and microbial manipulations. (13%)

34 Establishment of 'proof of concept' that a mixture of recombinant bacterial strains benefit fibre digestion in mixed rumen culture.

35 Assessment of persistence of the unmodified and modified microbes in ruminants, and of the effects on digestion in the rumen.

36 Introduction of recombinant cellulose genes into rumen bacteria in stable form and the analysis of the expression and secretion of recombinant enzymes in rumen bacteria.

37 Determination of the ecology of rumen micro-organisms tolerant of tannins in shrub legumes.

38 Establishment of conditions under which practical chemical treatments improve digestibility of low quality lignocellulosic materials.

39 Characterisation of highly fibrolytic microorganisms enriched from exotic ruminants.

Generalise and extend existing therapeutic and vaccine technologies through the development of new systems for targeted delivery of antigens. (6%)

40 Establishment of the feasibility of producing a T-cell response to a nominated antigen using VLP technology.

41 Completion of construction of an infectious, replicating BEFV vaccine vector.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$7,818,000
External Revenue	$4,760,000
Total Revenue	$12,578,000
Operating Result	53,000
End of Year Cash Balance	2,715,000

Staff by Functional Classification 1996-97*

Research	72
Total	134

*estimates as at June 1996

33. Division of Tropical Crops and Pastures

Objective

To increase the competitiveness of the beef, grains, and sugar industries of northern Australia by improving product quality and the efficiency and sustainability of production.

Strategy

The major problems facing agricultural industries in northern Australia are nutritional limitations to livestock production, environmental and genetic constraints to crop production, and environmental effects of agricultural production. In its research on such problems the Division collaborates extensively with other CSIRO Divisions and organisations, and has a significant role in the CRCs for Sustainable Sugar Production, Tropical Plant Pathology and Sustainable Development of Tropical Savannas.

The Division is also responding to changes in the R&D environment and to the client base. In particular the Aboriginal community, which occupies over 25% of northern Australia, has identified critical land use issues which may be addressed by CSIRO.

Strategies which will be emphasised in the next planning period include:

- Improve our knowledge of market needs and opportunities.
- Broaden the sources and scope of our advice from stakeholders to include environmentalists and relevant Government Agencies.
- Strengthen our international linkages to improve R&D capacity, to utilise physical and intellectual resources more effectively, and to support Australia's international objectives.
- Increase our emphasis on R&D to influence resource use planning at the catchment, local authority and regional level, and other "public good" matters associated with rural production and environmental management.
- Invest R&D resources only in areas that have a significant basic-strategic research content and ensure that research is focussed on outcomes of importance to our stakeholders and customers.
- Foster a whole-of-system approach to design and conduct of R&D that takes account of implications on production systems, including physical, social, economic and environmental aspects.
- Continue the Division's emphasis on the application of molecular biology to plant and animal production, and sustainable use issues in northern Australia.
- Adopt appropriate quality monitoring and continuous improvement procedures in all aspects of research management and administration at the Divisional, Program and Project levels.
- Develop new mechanisms to improve quality, relevance and adoption of technology by industry.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Fibre Utilisation - MDP3

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Dryland Farming Systems for Catchment Care - MDP32

Tropical Agricultural Exports - MDP33

Specific Objectives & Planned Outcomes

More profitable and sustainable livestock production through improved nutrition. (35%)

1 Registration of Plant Breeders Rights (PBR) of two new cultivars of *Stylosanthes* which are adapted to clay soils, and commercial seed production commenced under licence.

2 Determination of whether the 2Mb and 1.2Mb chromosomes of the causal agent of anthracnose disease of *Stylosanthes* are able to introgress selectively into other biotypes.

3 Establishment of collaboration with international agencies (in India, China, Columbia and Brazil) as a strategy to protect *Stylosanthes* cultivars from anthracnose disease, with ACIAR support.

4 Assessment of the relative capability of rumen microflora derived from wild South African herbivores and domesticated livestock to digest tanniniferous browse species.

5 Introduction of cellulase and xylanase cassettes into rumen bacteria which are either fibrolytic and/or persistent in high numbers in the rumen.

6 Characterisation of the enzymic properties and DNA sequences of fibre-degrading enzymes derived from the fungus *Piromyces mae* from kangaroo gut.

More profitable and sustainable cropping industries producing a range of marketable products. (35%)

7 An international symposium, hosted by the Division, on the potential research, development and extension opportunities to meet future challenges facing the Australian sugar industry and other intensive cropping systems.

8 Determination of the relationship between relative humidity and rainfall with levels of exogenous polysaccharide synthesis (the causal agent of sugar floc) on sugarcane.

9 Assessment of a green fluorescence marker gene for *in vivo* detection of the expression of the transposed spinach SPS gene of transgenic sugarcane plants.

10 Confirmation of the association between chromosome molecular markers and traits for three important production- and quality-related characteristics in grain sorghum, ie. midge resistance, rust resistance and staygreen.

11 Improvement of the resistance of canola to *Sclerotinia* by genetic transformation with antifungal genes isolated from Australian native plants.

12 Consolidation of PBR information for high yielding tropical soybeans, and establishment of trials of selected lines in collaboration with NSWA, QDPI, Queensland Graingrowers Association and private industry, preparatory to release in mid-1997.

Adoption of land management practices that are economically and environmentally sustainable. (30%)

13 Development through collaboration with Aboriginal partners, of a portfolio of activities which support their long-term land use plans.

14 Workshops conducted to identify key issues and information needs of principal stakeholders concerned with regional planning in the rangelands.

15 Implementation of a catchment scale (10,000 ha) evaluation of the ecological, economic and social impacts of woody weed invasion processes and control strategies in tropical savannas.

16 Integration of plant-animal interactions across a range of spatial scales into a conceptual model of tropical savanna degradation in domestic livestock grazing systems.

17 Release of a new *Urochloa* cultivar for use in the rehabilitation of coal mine-spoil in central Queensland.

18 Evaluation of different types of remotely sensed data for their capabilities in detecting land use, and for assessing change in the coastal region of northern Queensland.

19 Utilisation of past experiments on legume-cereal rotations to develop and test APSIM (cropping systems software) capability to simulate cropping systems, and then apply APSIM in exploring prospects for including grain and pasture legumes in cropping systems of northern Australia.

20 Development of an analytical framework for the evaluation of resource use issues related to an Integrated Catchment Management activity in the Herbert River catchment.

Organise and manage Divisional resources to facilitate effective research, enhance individual performance and promote adoption of the products of research.

21 Integration of Divisional and Corporate information and communication services to improve interaction with customers and enhance the visibility and value of CSIRO.

22 Implementation of the outcomes of a workforce planning process to identify key areas for investment in staff development and recruitment.

23 Implementation of recommendations from the Workforce Stress survey.

24 Selection of a commercial partner to exploit the glycine betaine seed treatment patent including the establishment of a major field program with cotton.

25 Finalisation of plans for the replacement of the inadequate facilities at the Cunningham Laboratory.

26 The role and effectiveness of research stations reviewed in the context of a new Division, future CSIRO needs, and outcomes of the Queensland Government review of its facilities.

27 Development of plans and acquisition of funds for the provision of a specialist glasshouse at the Davies Laboratory to support work on sugarcane.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,962,000
External Revenue	$6,237,000
Total Revenue	$18,199,000
Operating Result	-310,000
End of Year Cash Balance	2,647,000

Staff by Functional Classification 1996-97*

Research	145
Total	197

*estimates as at June 1996

34. Division of Water Resources

Objective

To improve our understanding of water's role in the environment so that we provide managers with a sound basis for developing practical and cost effective ways to resolve water resource problems. To operate within an environment shaped to nurture innovation, anticipate future research opportunities, and respond to community and industry needs.

Strategy

The sheer size of Australia and its often difficult terrain makes the solving of water resources problems a complicated process. In this environment, maintaining the quality and quantity of urban, rural, and industrial water supplies requires a variety of scientific disciplines.

The Division investigates all aspects of the hydrological cycle, ranging from rainfall to groundwater, and seeks to maintain a balanced contribution into theoretical aspects of water resources research with practical involvement with its water industry partners.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Urban Water Systems - MDP16

Climate Change - MDP17

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Dryland Farming Systems for Catchment Care - MDP32

Specific Objectives & Planned Outcomes

Develop a sound technical basis for better managing our groundwater resources and surface water /groundwater interactions, and for evaluating and remediating contaminated soil and groundwater. (28%)

1 Commercialisation of technologies for contaminated site assessment and remediation in part through demonstration programs in Australia and overseas (South East Asia, Germany and the USA).

2 Development of guidelines for more effective ways of protecting groundwater quality and assessing aquifer vulnerability to pollution.

3 Continued development of the Centre for Groundwater Studies with linkages established in China and SE Asia for joint R&D projects, and educational and training courses.

4 Establishment of projects for development of techniques at large scales for aquifer storage, recovery and reuse of potable water and wastewater.

Undertake the research into aquatic ecosystems necessary for sound management by agencies and community groups. (29%)

5 Development of a Decision Support System commenced for planning allocation of water for environmental flows.

6 Dissemination of results that show, for part of Australia, that sub-soils are major sources of phosphorus contamination of waterbodies.

7 Completion of analysis of flow and nutrient loads in the Herbert River, Queensland.

8 Development of commercial *E. coli* meters commenced.

9 Completion of investigations into the role of carp in disturbing sediments and releasing nutrients into the water column.

10 Completion of studies into the role of genetic and environmental factors in causing releases of toxins from cyanobacteria.

11 Commencement of a foodweb project, starting with transmission of algal toxins into the foodweb.

12 Study of the effect of pesticides from irrigation tailwaters on ecology of billabongs.

13 Advice given to government departments on likely techniques for remediation of nutrients in estuarine sediments.

Develop practical tools to manage dryland salinity and other water driven degradation problems through research on the role of vegetation, soils, climate, land-uses and groundwater on water and salt movement across catchments. (19%)

14 Management of large and small scale saline disposal basins maximised for their usefulness for salt storage.

15 Risk analysis for dryland salinity development in the Loddon-Campaspe and Liverpool Plain catchments of the Murray-Darling Basin developed.

16 Efficient operational tools for monitoring water quality from airborne data developed, packaged and tested.

17 Evaluation of novel groundwater dating tools.

Develop land and water use strategies to improve resource management in irrigated areas, thus reducing salinisation, increasing productivity and maintaining river quality. (12%)

18 Waterlogging and salinity effects on yields incorporated and tested in selected models of irrigated crops subject to shallow watertables.

19 Water balance components of irrigated perennial pasture subject to shallow watertables measured and incorporated in models.

20 Guidelines developed for the prevention and control of muddy water in rice which do not significantly increase recharge of the watertable and which minimise the need for surface drainage of turbid water.

21 Management techniques developed to increase rice water use efficiency.

22 Water-monitoring procedures developed and contribution made to policy development for the Coleambally Irrigation Area which are acceptable to the community and which assist farmers to make informed water management decisions.

23 Tools developed and adopted to assist irrigators and irrigation area managers make economically and environmentally sound decisions to manage net recharge and salinisation at farm, sub-regional and at the regional scale.

24 An area wide approach to salt management developed in the Murrumbidgee Irrigation Area.

25 New techniques developed for management of effluent irrigation especially in situations with slowly permeable soils and shallow watertables.

26 Guidelines and economic analysis developed to minimise the volume of water and quantity of salt discharged from subsurface drains used to protect and remediate horticultural land.

Develop and evaluate decision making approaches based on hydrology and socio- economic sciences and apply these to the resource and environmental issues faced by scientists, managers and users of urban and rural water and land. (12%)

27 Application of an institutional and community process model for the allocation of near-urban land and water on the Swan Coastal Plain to the Gingin area, with special reference to the evaluation of procedural justice.

28 Implementation processes documented for Integrated Catchment Management in the Herbert River Catchment, Queensland and impacts monitored leading to recommendations on informational needs and an evaluation methodology.

29 Irrigator, agency and community perceptions determined on the advantages and disadvantages of water use monitoring for supply and drainage water in the Coleambally region, and a water monitoring policy developed which is approved by the community.

30 A method established for documenting the major criteria for measuring functional success and accountability of a restructured water industry in three countries.

31 A system developed for community-based management to establish and maintain environmental flows in modified rivers.

32 A study completed of innovative approaches to contingent valuation of environmental services in the context of Integrated Catchment Management in the western Sydney portion of the Hawkesbury-Nepean Basin.

33 Methodology established for assessing the potential contribution of planning and economic instruments, (including land use plans, effluent taxes and transferable pollution entitlements) for groundwater protection.

34 Evaluation of the economics of wastewater re-use and stormwater pollution abatement in Australian urban areas.

35 A prototype stochastic model developed to predict daily rainfall as a function of large- scale atmospheric circulation patterns.

36 A method developed for regionalisation of runoff routing model parameters for the south west of Western Australia.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$13,652,000
External Revenue	$8,629,000
Total Revenue	$22,282,000
Operating Result	-1,231,000
End of Year Cash Balance	1,559,000

Staff by Functional Classification 1996-97*

Research	180
Total	266

*estimates as at June 1996

35. Division of Wildlife and Ecology

Objective

To develop the scientific knowledge required to incorporate both conservation and production values into the management of Australia's wildlife, plant, and land resources.

Strategy

Rising national and global awareness of the importance of terrestrial flora and fauna in sustaining ecological processes ensures public favour for the Division's research although this is not easily targetted for financial support.

- Choose research problems on the basis of feasibility and national priorities in resource management.
- Maintain multi-disciplinary, integrated programs and foster research in collaboration with other CSIRO Divisions, Federal and State agencies, tertiary institutions and industry.
- Integrate research results in ecological and biological theory with practical techniques, resource management guidelines and technical and management support systems.
- Apply and communicate research results through scientific publications, consulting, conferences and the public media.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Conserving Biodiversity for Australia's Future - MDP18

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity - MDP31

Dryland Farming Systems for Catchment Care - MDP32

Specific Objectives & Planned Outcomes

To determine the principles for sustaining rangeland systems, and to develop mechanisms with land managers to achieve the best distribution of land uses within a changing ecological, economic and social environment. (19%)

1 Publication and promotion of a book on landscape ecology for managers of Australia's rangelands.

2 Development of a collaborate research and development program on management of total grazing pressure in the mulgalands of the Murray-Darling Basin.

3 Delivery of an economic evaluation of tactical grazing for improving perennial grass levels to sheep pastoralists of eastern semi-arid rangelands.

4 Development of research and extension on sustainable land uses involving institutional and policy analysis and stakeholder participation.

5 Contribution to the development of the National Rangeland Strategy Plan.

6 Initiation of research on developing new approaches to achieving nature conservation on pastoral lands.

7 Delivery of results of drought management studies to industry and to policy makers.

8 Delivery of GIS and databases on central Australian mountain range biodiversity to Parks and Wildlife Commission, NT.

9 Delivery to DIST of report on impact on tourist infrastructure on environmental processes at Uluru.

10 Analysis of grazing impacts on the Barkly Tablelands and training of state agencies in the analytical techniques.

To determine the ecological mechanisms governing dynamics of Australia's tropical rainforests and savannas, and establish principles for maintaining their biological diversity, assisting government and other agencies to apply these principles. (14%)

11 Completion of draft manuscripts for book on Kapalga fire experiment.

12 Assessment of responses of invertebrates to variation in grazing intensity in Mitchell grasslands.

13 Refinement of predictive models of savanna structure and function in relation to variation in rainfall and soil types.

14 Establishment of a joint vegetation monitoring and fire management scheme with Queensland Department of the Environment in north Queensland.

15 Publication of models explaining the distribution of biota in wet sclerophyll forests.

16 Establishment of a wet sclerophyll vegetation distribution on a GIS.

17 Publication of a map of yellow-bellied glider densities in north Queensland.

18 Publication of a review of how rainforest fruit characteristics interact with animals to affect tree regeneration.

19 Journal article on changes in distribution of rainforest on the tropical lowland during the late Pleistocene from charcoal identifications and radiocarbon dates.

20 Completion of field experiments and publication of effects of artificial microsites and mycorrhizal infection on rainforest establishment.

21 Establishment of a replicated field exclusion experiment examining the effects of herbivory by ground vertebrates on rainforest reestablishment.

To provide Governments and other land managers with improved strategies and techniques, including novel and environmentally friendly benign biological agents, for controlling introduced or native vertebrate pests. (26%)

22 Identification of possible agents for biological control of foxes and rabbits and mice using an integrated ecological, virological, reproductive and molecular biological approach.

23 Development of a systems analysis of the rabbit-fox-endangered species complex.

24 Completion of island trials of rabbit calici virus as a new biological control agent.

25 Development of best farm management practices for controlling mouse plagues.

26 Development of integrated pest management strategies for rodents in SE Asia.

27 Assessment of impact of cane toads on native fauna.

To develop principles for conservation biology, and to assist in the application of these principles to the conservation of Australia's biological diversity. (19%)

28 Completion of a model for integrating agriculture and nature conservation in the WA wheatbelt.

29 Spatially explicit models of the population dynamics and dispersal of animals in fragmented ecosystems.

30 Baseline information on the distribution and composition of remnant native vegetation in the WA wheatbelt.

31 Establish techniques for feral cat control at high value site for conservation of flora.

32 A general framework for landscape restoration with specific guidelines for agricultural areas.

33 Major, 10-year review of results from the Wog Wog fragmentation experiment.

34 Determination of whether different agents of decline act independently of synergistically on experimentally-driven declining populations of mammals.

35 Spatial models for predicting terrestrial mammal abundance in forests in relation to habitat and disturbance by fire.

36 A systematic review and assessment of the impacts of disturbance on biota of Australian forests.

37 A vegetation map of SE NSW on a GIS suitable for deferred forest assessments.

38 Development of methods, with ANCA, for ranking vulnerability of forest biota to disturbances and identifying priorities for reservation.

39 Develop mechanisms for fully integrating biodiversity conservation and production needs at a regional level.

To develop and test future options for the use and management of Australia's environmental resource sectors at regional and continental scales, and for medium and long term time frames. (12%)

40 Completion of first round of environmental scenarios of Australia's future options out to 2050.

41 Development of two analytical frameworks for assessing opportunities and impacts within Australia's population-development-environment context.

42 An operational spatio-temporal model for exploring the implications of population growth in the coastal zone from Cairns to Adelaide.

43 A working prototype of SRIAS-2000 for testing regulatory and economic instruments affecting landuse in NSW.

44 Implementation of phase I of national soil and water audit.

To provide services to government and industry for improved assessment and management of environmental resources. (10%)

45 Identification of indicators of successful ecosystem rehabilitation on selected minesites.

46 A significant case study that balances conservation and production values in native forests.

47 Introduction of improved project management and business decision-making into external consultancies.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$14,524,000
External Revenue	$8,330,000
Total Revenue	$22,854,000
Operating Result	344,000
End of Year Cash Balance	2,692,000

Staff by Functional Classification 1996-97*

Research	173
Total	259

*estimates as at June 1996

36. Division of Wool Technology

Objective

To increase the economic returns to the Australian wool industry and the economy through effective multidisciplinary wool, textile and leather research.

Strategy

Over the last decade, wool prices have fluctuated widely and generally declined. Major factors have been worldwide recession, declining proportions of personal income spent on textiles, withdrawal of major customers from the markets and the disposal of the wool stockpile. While the outlook in the medium term is positive, terms of trade will continue to decline.

The International Wool Secretariat (and its predecessors AWC, WRDC and AWRAP) has been the major source of external funds for the Division of Wool Technology. IWS has used its reserves to cushion the impact of falling prices and falling volume on the money available for R&D, but the point has now been reached where further reductions in R&D funding are inevitable.

The Strategic Review of Future Directions for CSIRO's Research for the Wool Industry recommended relocation of the Sydney Laboratory to Geelong and this will occur on 1 July 1996. Consolidation of wool research on the Geelong site will maximise research synergies and minimise overheads. However, a consequence of the funding downturn is that research in areas where staff have not relocated will be curtailed. The Instrumentation and Computing Engineering Program will be maintained by recruitment of new staff in Geelong so that the projects of highest priority from the Sydney Laboratory will be completed.

The external fund base for wool research will be expanded by developing collaborative projects with wool textile machinery manufacturers, wool processors and chemical suppliers. There will be increased emphasis on new products and the technologies required to produce them.

Funding for the Leather Research Centre, principally from the Meat Research Corporation, has also declined dramatically and additional external funds are being sought directly from industry. In this context the Division's key strategies are to:

- With the IWS, plan a wool research and development program to achieve the required industry and CSIRO outcomes. Key projects will be "fast-tracked".
- Develop innovative wool products and enhance the appeal and performance of existing products.
- Reduce costs of chemical and physical processing and improve efficiency whilst conforming to environmental guidelines.
- Apply new techniques and measurement systems to reduce costs of marketing, processing and manufacture and, where appropriate, to promote and support their adoption in Australia.
- Ensure that the Division's intellectual property is properly protected and exploited to the benefit of CSIRO and its stakeholders.
- Establish in consultation with the Australian Hides, Skins and Leather Industries a balanced research and development program encompassing strategic, tactical and technology transfer initiatives.
- Provide an environment which recognises achievement and, through effective management, guidance and support, strive to attract and retain a practical, innovative and perceptive workforce in a safe working environment that embraces the principle of equal employment opportunity.
- Ensure effective internal and external communication of the activities of the Division.
- Collaborate with government, industry and education providers in establishing a Natural Fibres Institute at Geelong.

Specific Objectives & Planned Outcomes

Minimise the cost and improve the quality of physical conversion of fleece to fabric (16%)

1 Weavable singles yarns developed in collaboration with the IWS and the Wool Research Organisation of New Zealand.

2 Improved woollen spinning draft and twist technology commercialised.

3 Early Stage Processing know-how transferred to industry via a major international seminar.

4 Woollen card web/yarn regularity improvements introduced commercially.

5 Improved backwashing technology licensed to industry.

6 Technology and know-how package on reducing contamination in wool products due to pack damage.

Develop new and improved chemical processing techniques, with reduced environmental impact, for raw wool and wool textiles (34%)

7 Sirolan CF treatment for scour wastes introduced to industry worldwide.

8 Low-entanglement scouring technology developed.

9 Chlorine-free sliver shrinkproofing process extended to overseas wool processors.

10 Easy-Care technology for pure wool woven trousers.

11 Siroflash technology for print preparation licensed to fabric printer.

Understand wool fibre structure, composition and reactivity relevant to the current and future needs of process and product development (9%)

12 Key parameters for optimum modified wool production established and utilised in commercial trials.

Increase demand for quality wool products by market-led technical innovations and their industrial implementation (18%)

13 "Bulky" and "Silky" modified wool introduced through industrial partner to retail market.

Develop new instruments, sensors and computer-based systems to improve quality management practices and processing efficiency in the wool industry (14%)

14 Licensing agreement to manufacture, install and service on-line entanglement meters on worsted cards.

Develop new or improved processes for the handling, marketing, preservation and conversion of hides and skins into leather products (9%)

15 Commercial scale trials completed on recommended tanning procedures for the production of medical sheepskins that can withstand repeated high-temperature industrial laundering.

16 A clean technology tanning package for the production of wet-blue leathers introduced to industry.

17 A rapid method for the detection of grain strain in freshly-flayed woolskins introduced industrially.

18 Post-acetate fellmongering systems for improved pickle pelt production released to industry.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$11,547,000
External Revenue	$11,421,000
Total Revenue	$22,968,000
Operating Result	-2,499,000
End of Year Cash Balance	7,284,000

Staff by Functional Classification 1996-97*

Research	166
Total	288

*estimates as at June 1996

37. Corporate Support Units

Objective

Provide high quality, timely and responsive corporate policy advice and management services in support of CSIRO's goals.

Strategy

The former Corporate Services Department and Corporate Business Department, together with the six Institutes, have been abolished as part of recent changes in CSIRO's management and structure. Each area of corporate support is now under the direction of a Deputy Chief Executive. Where feasible and efficient to do so, functions which may have been performed centrally are being devolved to Divisions. Corporate support will continue to be provided in a number of functional areas that significantly affect the Organisation's core business performance, accountability or effectiveness. Typically the corporate support units will:

- Provide advice on the Organisation's compliance with key policy or statutory requirements.
- Provide assistance in developing policies for the Executive.
- Provide specialist professional advice to line managers.
- Coordinate and deliver services best handled centrally.
- Work closely with Deputy Chief Executives and Chiefs to facilitate the implementation of changes to CSIRO's management and structure.

Specific Objectives & Planned Outcomes

Corporate Finance: Provide professional advice and services to support financial planning and financial management within CSIRO. Specify and implement financial systems to meet the Organisation's needs.

1 Support for the Chief Executive and Board through the development of financial planning options for the current (1994-97) and following (1997-2000) triennia, consistent with the Organisation's priorities.

2 Continually improving financial planning and management in CSIRO, by working with Divisions to enhance the periodic budgeting and accounting practices for assets, liabilities, revenue and expenditure.

3 Preparation of the Organisation's budgetary documentation to meet Government timetables in the prescribed format for Commonwealth Budget Papers.

4 Development and provision to the Executive Committee and Board of financial performance monitoring reports taking account of CSIRO's new management structure.

5 Production of CSIRO's statutory financial reports. Facilitation of Audit Committee review and Board approval.

6 Development and promulgation of financial policies and procedures relevant to CSIRO's business and statutory requirements.

7 Support and development of UNIBIS and financial systems and, in particular, of a system/reports to meet the needs of project managers in Divisions and the Organisation's Sector planning process.

8 Initiation and management of major Organisation-wide contracts (eg insurances, travel), where there are benefits in doing so.

Corporate Human Resources: Provide strategic leadership in the provision of advice and the development of processes that will maximise the contribution of staff to the achievement of CSIRO goals.

9 Finalisation of HR review implementation.

10 Improvement in the industrial climate of CSIRO.

11 Provision of high quality HR services to the Executive and Divisions.

12 Development and implementation of the Occupational Health and Safety Strategy.

13 Development of succession planning processes.

14 Development of competency framework for use by line managers.

15 Implementation of a recognition and rewards program that supports corporate behaviours.

16 Implementation of a remuneration system that focuses on performance.

17 Further improvements to the performance management process in CSIRO.

CSIRO Publishing: Publish quality science for Australian and global markets in four major product categories — journals, monographs, multimedia and magazines — for a broad spectrum of readers.

18 Publication of the twelve Australian Journals of Scientific Research, *Australian Journal of Experimental Agriculture* and *Journal of the Astronomical Society of Australia*.

19 Publication of 25 new titles with a sales target of $1.525m.

20 Quarterly issues of the science magazines *Ecos* and *Rural Research*.

21 Development and publication of new multimedia products.

22 Aggressive marketing through direct mail, nationally and internationally.

Corporate Information Management: To deliver services in support of CSIRO's libraries and

information management processes and systems. To support the development of an information strategy for CSIRO.

23 CSIRO's information systems for library and information management activities are maintained to a user-defined level of functionality. These systems are: Voyager library system, SIM text retrieval system, WWW information, records management and corporate scientific and bibliographic data sets.

24 CSIRO's capability of responding to new technology, customer needs and workflow efficiency is current, relevant and robust.

25 CSIRO's information environment is developed as a portfolio of systems, resources and processes with a unity in information principles and shared behaviour in the use or handling of information.

Information Technology Services: Provide a professional, cost effective and efficient information technology service to CSIRO.

26 Provision of and support of the Unix operational environment for corporate applications.

27 Provision of and maintenance of the Corporate network infrastructure for the transmission of voice, data and image Australia wide. Continued replacement of PABXs.

28 Integration of the voice and data networks and establishment of a single CSIRO network utilising AARNet, Regional Network Organisations (RNOs) and the Virtual Private Network.

29 Development of corporate strategic plans for information technology, and networks and telecommunications.

30 Maintenance, in consultation with the relevant System Owners, of corporate application systems such as UNIBIS, Pay and Library systems. Expert technical advice provided for proposed systems and, where required, cost effective solutions developed and implemented.

Corporate Property: Provide a corporate property management service to ensure adequate and cost effective research accommodation and facilities.

31 Implementation of the approved Property Management and Capital Investment Plans, and management of CSIRO's internal leasing scheme for accommodation. Management of the North Ryde redevelopment and facilitation of projects recently submitted to PPWC.

32 PPWC approval obtained for redevelopment of Tropical Crops and Pastures (St Lucia) and a laboratory complex for Food Science and Technology/Biomolecular Engineering (North Ryde).

33 Completion of master strategy plans for all major sites as part of a total estate exercise.

Commercial Group: Identify and assist in developing relationships of mutual advantage to CSIRO and the Australian business community; support the Divisions in maximising the value of CSIRO's patent portfolio; and assist CSIRO Divisions in the development and maintenance of best practice in the commercialisation of research outcomes.

34 In association with CSIRO Divisions, initiation of a number of significant new projects with major Australian companies, and restructuring of major ongoing projects where necessary.

35 Management of the IP services contract with IPM Pty Ltd and liaison with other organisations on corporate IP issues (AIPO, Government Departments, Patent profession, etc).

36 Evaluation of the current contractual arrangements for intellectual property management services with a view to identifying potential for devolution of some functions to Divisions and further reduction in cost.

37 Implementation of a new IP database to allow Divisional access to portfolio and cost. Design and generation of reports.

38 Overseas representation for CSIRO Intellectual property strengthened and focused through refinement of existing panels of attorneys in Europe and USA and establishment of representation in the Asian Region.

39 Updates to the CSIRO Commercial Practice Manual with a major revision in November 1996 which takes into account the new structure of CSIRO.

40 Further implementation of the CSIRO Agreements Database, including all Divisions contributing data by December 1996 and the provision of reports and analysis of the data contained in the database.

Corporate Legal Network: Ensure that CSIRO's activities comply with legislative and other legal requirements; ensure that CSIRO's interests are adequately protected from a legal perspectives, and provide assistance to Divisions in respect of their legal and commercial activities.

41 Provision of advice to members of the Executive, and the Board, Chiefs and General Managers (as required) on all legal aspects of their management and commercialisation responsibilities including compliance with legislation and general law, safeguarding the legal interest of CSIRO and avoiding unnecessary exposure to legal risks.

42 Management of litigation on behalf of CSIRO

43 Preparation of model agreements embodying principles outlined in the Commercial Practice Manual and reflecting CSIRO policy, for use throughout the organisation.

44 Liaison with external solicitors to ensure timely and appropriate advice and monitoring of CSIRO Legal Panel relationships.

45 Provision of support and assistance in negotiating standard form contracts with major clients including research and development corporations.

Strategic Planning and Evaluation: Promote and facilitate a strategic approach to planning and evaluation at all levels of CSIRO; provide or locate planning and evaluation services for CSIRO managers; and coordinate the preparation of corporate planning and evaluation documents.

46 Agreement by EC on processes for developing a strategic vision for CSIRO, assessing research opportunities and making resource allocations to sectors for the next triennium (1997-98 to 1999-2000).

47 Consolidation and reporting of performance indicators for CSIRO in accordance with the triennium funding agreement.

48 Specific compilations and analyses of data on CSIRO's research effort (SEO, FOR, TOA) provided in response to internal and external needs.

49 The CSIRO Operational Plan for 1997-98.

50 A CSIRO Strategic Plan to the year 2000.

Corporate Public Affairs: Inspire interest in and support for CSIRO's research among key stakeholders and the general community, and provide an effective corporate communications service.

51 Positive media coverage of CSIRO's research with emphasis on relating CSIRO's work to public issues.

52 22,000 members of the Double Helix Club and 24,000 audited circulation of each issue of the The Helix magazine.

53 100,000 visitors to the CSIRO Science Education Centres or attending CSIROSEC sessions at schools per year; 350 students in the Student Research Scheme, 1100 students in the BHP Science Awards; 2000 students undertaking CREST projects.

54 Provision of information on CSIRO and on scientific and technical matters in response to approximately 40,000 enquiries per year.

55 Preparation and delivery of the CSIRO Annual Report according to parliamentary guidelines and EC decisions.

56 Production of the staff magazine 'CoResearch' and its extension to partial electronic delivery.

Risk Assessment and Audit: Assess risks (other than those associated with the success of research) and the evaluate of controls in significant areas; audit commercial practices and procedures particularly as they relate to the identification and management of CSIRO risks in the undertaking of commercial ventures; and conduct a comprehensive audit program, as approved by the CSIRO Audit Committee, encompassing reviews of compliance, effectiveness and efficiency.

57 Development of cost effective risk management strategies to reduce the level of risk exposure for high and significant risks.

58 Development of "best practice" guidelines for risks which are common across Divisions.

59 Better understanding of best commercial practice and reduced exposure to significant commercial risks.

60 The integrity of financial systems and safeguarding of physical assets.

Corporate Executive Office: Support the Chief Executive, the Chairman and Board members in the efficient conduct of their responsibilities; facilitate the conduct of CSIRO's business with Ministers, government departments and other parts of the Australian R&D system; and support CSIRO's responsibilities in relation to international matters.

61 Briefing or action advice on meetings, correspondence and events involving the Chairman, Board members or Chief Executive.

62 Coordination and negotiation for CSIRO's triennial funding submission and related funding agreement. Provision of regular summaries for a wide range of policy issues and enquiries to alert senior staff to opportunities for input relevant to their areas.

63 Conduct of the second Government/CSIRO Workshop in early 1997.

64 Provision of timely and high quality briefings and correspondence for portfolio Ministers, the Chief Executive and Ministerial staff in portfolios with a major interest in R&D.

65 Preparation or coordination of corporate submissions to external inquiries which arise during 1996-97.

66 Provision of advice and support for the development of corporate policy on international matters and development of alliances with selected countries.

67 Maintenance and enhancement of an international activities database for various corporate applications such as to identify potential new linkages of advantage to CSIRO.

Planned Revenue and Expenditure 1996-97*

Direct Appropriation Revenue	$24,333,000
External Revenue	$6,106,000
Total Revenue	$30,439,000
Operating Result	-188,000
End of Year Cash Balance	119,000

Staff by Functional Classification 1996-97*

Research	0
Total	330

*estimates as at June 1996

The **CSIRO Information Network** provides a free access point to CSIRO for scientific and technical enquiries.

CSIRO Information Network

NSW and ACT	Tel: (02) 413 7528 Fax: (02) 413 7635
Victoria and Tasmania	Tel: (03) 9662 7116 Fax: (03) 9662 7140
Queensland	Tel: (07) 3377 0390 Fax: (07) 3377 0387
Western Australia	Tel: (09) 387 0710 Fax: (09) 383 7894
South Australia	Tel: (08) 303 9116 Fax: (08) 303 9200
Northern Territory	Tel: (089) 22 1720 Fax: (089) 22 1714

The Task

CSIRO, Australia's principal scientific research organisation, will be a leader in developing the scientific and technological capability Australia must have to meet the challenges of this decade and the next century.
Our work will be essential to improving Australia's economic performance and, at the same time, its care of the environment. The future quality of life of all Australians will depend on the nation's success in this task.

Role

CSIRO's main role will be the conduct of strategic research to:
- develop technologies for all sectors of Australian industry;
- improve the management of its natural resources;
- protect Australia's unique environment; and
- promote the well-being of the Australian people.

CSIRO is recognised nationally and internationally for its contributions to science and Australia's development. We will build on this reputation through close collaboration with industry, government and other research institutions to ensure the nation derives the greatest benefit from our research.

Community

CSIRO will honour the trust Australians have placed in the Organisation. We will provide authoritative and independent advice and information on matters of national importance that are within our expertise. We will take an active part in public debate on the actions and changes that are necessary if Australia is to seize its opportunities and overcome its difficulties.

People

CSIRO's ability to carry out its role rests on the creativity of its staff and the quality of its management. We will attract and retain the best people by providing strong leadership, clear direction, and the resources, facilities and conditions required to encourage and enable all staff to fulfil their potential.

Mission

CSIRO's ethos will affirm, above all, the qualities of service and excellence – service to all the Australian people through scientific excellence.
Our goal will be to give Australians a better future.

CSIRO
AUSTRALIA