CSIRO Operational Plan

1994–1995

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1994–1995

CSIRO
AUSTRALIA

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Foreword

The Science and Industry Research Act requires CSIRO to prepare both a Strategic Plan and an annual Operational Plan. The Strategic Plan outlines the broad strategic goals, corporate objectives, policies and strategies of the Organisation and so provides an overall blueprint for achievement of CSIRO's mission. The Operational Plan describes how the Strategic Plan is put into effect.

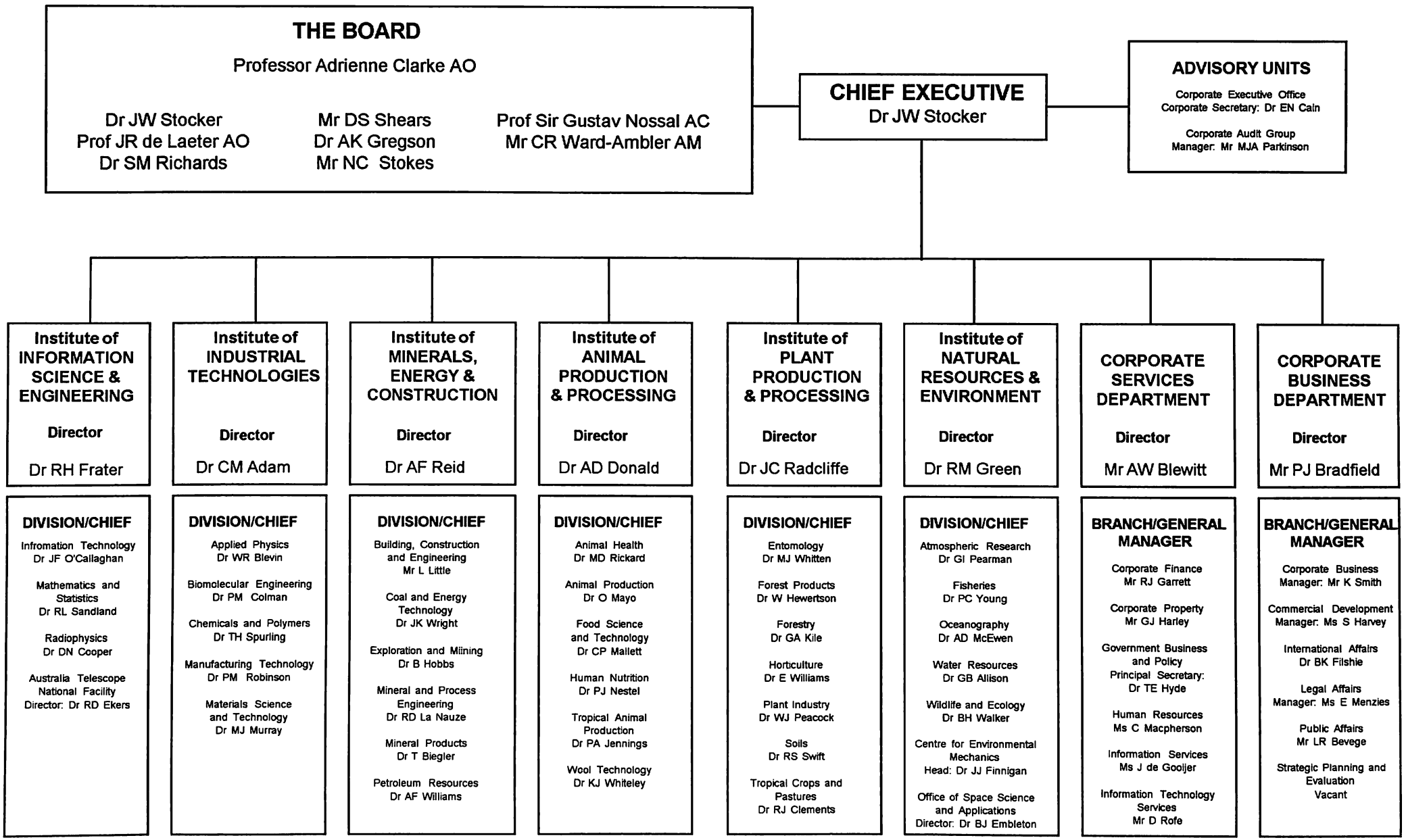
1994-95 marks the beginning of the Organisation's second funding triennium. Some hard decisions on the distribution of funds will have to be taken in the short term, but every effort will be made to protect CSIRO's long-term capacity to deliver the research outcomes necessary for Australia's growth and development and the care of its environment. Resources will be allocated in line with decisions by the CSIRO Board on research priorities. The Board decided that, although minerals, environmental and rural research continue to provide a high return to Australia, CSIRO research for manufacturing, and for information and communications industries, also provide a high return but are not receiving funding support commensurate with their importance to Australia. Increased resources will be directed to three of CSIRO's major research purposes, namely the Minerals, Manufacturing, and Information and Communications Industries. The Board also decided that appropriation funding would be maintained at the 1992-93 level for the two environmental research purposes Environmental Aspects of Economic Development, and Environmental Knowledge.

The Operational Plan provides a useful guide to the research work of CSIRO.

John W Stocker
Chief Executive
June 1994

Figure 1: CSIRO ORGANISATIONAL STRUCTURE

(as at 1 July 1994)



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INTRODUCTION

The CSIRO Operational Plan 1994-95 presents information on the objectives, strategies, major planned outcomes and planned expenditure for each of the Organisation's management units illustrated in Figure 1. It shows the distribution of resources to CSIRO's designated research purposes, identifies links to the major planned outcomes highlighted in the CSIRO Strategic Plan 1991-92 to 1995-96, and highlights the importance CSIRO places on cooperative research efforts.

The Operational Plan is complemented at corporate level by the CSIRO Annual Report and an annual Evaluation Plan. Detailed planning and evaluation are also undertaken and reported at Institute, Division, program and project level. A formal staff Performance Planning and Evaluation (PPE) program provides a basis for encouraging optimum staff performance and achievement of Organisation goals by linking the personal objectives and professional development of individual staff members with the objectives and planned outcomes of CSIRO programs.

RESEARCH PRIORITIES FOR 1994-95

CSIRO's research priorities are determined after careful assessment of the attractiveness and feasibility of research for different purposes. In addition to its application in determining corporate research priorities, the attractiveness-feasibility methodology is adapted for use at various levels throughout the Organisation.

At the corporate level, priorities are assessed on a triennial basis for a set of 'research purposes' which reflect the economic, environmental and social objectives of the Australian community. These are derived from the Socio-Economic Objective (SEO) component of the Australian Standard Research Classification. Each research purpose generally corresponds to an SEO Sub- division. Extensive input to the process is obtained from external stakeholders.

1994-95 is the first year of CSIRO's second triennium budget. In accord with decisions taken by the Board in June and December 1993, a priorities fund of $5.5 million has been reserved from CSIRO's triennial budget appropriation commencing in 1994-95 for redistribution as shown in Table 1. With matching funds from Institutes a total of $10.25 million will be redirected to these high priority areas in 1994-95 as a direct result of the priorities process. Institutes and Divisions will also independently move additional resources into priority research areas.

Note: The priority assessment methodology is described briefly in the CSIRO Strategic Plan 1991-92 to 1995-96. Recent revisions to the research classification system mean that some minor differences may be observed between the lists of research purposes in the Strategic Plan and this Operational Plan.

CSIRO GOALS AND STRATEGIES

The Organisation's goals for research and research support, as summarised in the CSIRO Strategic Plan 1991-92 to 1995-96, are listed below. As part of the priority determination process, strategies for achieving research goals are developed for each research purpose. They focus on three key performance areas - research activity, research funding and technology transfer. The goals for research support also are supported by enabling strategies which focus on three further key performance areas - human resource management, communication and corporate development.

Research Purpose Goals

- Improve the export and import replacement performance of Australia's primary and manufacturing industries.
- Develop ecologically sound management principles and practices for the use and conservation of Australia's natural resources.
- Achieve sustainable development in production systems and develop technologies to minimise environmental damage from economic development.
- Provide leverage for Australian enterprises that add value to goods and services through innovative use of information technology and telecommunications, or that contribute to reducing the trade deficit of the information and communication industries.
- Enhance productivity and effectiveness in provision of infrastructure and services, particularly health and construction.

Research Support Goals

- Further strengthen mechanisms for determining and assessing research priorities and resources allocation across the Organisation.
- Provide efficient and effective R&D support services across the Organisation.
- Maximise CSIRO's capacity to attract and retain a high quality workforce in order to produce the best possible research and development for Australia.

- Increase recognition by government, industry and the general public of CSIRO's contribution to the nation.
- Improve Australia's ability to interpret and disseminate scientific and technical knowledge for the economic benefit of our industries.

CORPORATE PLANNED OUTCOMES 1994-95

The planned outcomes listed below are those which are of major corporate significance in that, in either implementation or effect, they pertain to most if not all operational units throughout the Organisation.

- Implementation of second triennium research priorities decisions including commensurate resource allocations to priority areas and establishment of new Multi-Divisional Programs.
- Promotion and implementation of corporate guidelines on commercialisation.
- Further implementation of the Organisation's Universal Access project with integration of the voice and data networks and establishment of a single CSIRO network utilising AARNet.
- Implementation of an integrated information system for financial and project mangement.
- Completion of a major review of human resource management in CSIRO and decisions on recommendations.
- Completion of a review of the strategic planning and evaluation functions in CSIRO and decisions on recommendations.
- Publication of a new CSIRO Strategic Plan including a new vision and principle statement for CSIRO in the 21st century.
- Trialing of performance indicators for reporting and management purposes.
- Replacement of the Fujitsu mainframe with Unix servers by August 1994.

1994-95 RESOURCES SUMMARY

CSIRO's sources of funds include direct appropriation revenues, earned revenues and sponsored research funds. Together, earned revenues and sponsored research funds comprise the Organisation's external funds. External funds are expected to represent approximately 33 per cent of total funds in 1994-95.

All resource figures reported in this Plan are estimates for 1994-95 as at June 1994. Table 2 reports planned expenditure for each Institute and for corporate functions by type of fund. Table 3 shows the planned expenditure by each Institute on each research purpose. Total CSIRO expenditure by research purpose is graphed in Figure 2. Table 4 provides estimates of Institute and corporate staffing levels during 1994-95.

Table 1: Annual Distribution of Priority Research Funds in the Triennium 1994-95 to 1996-97

Research Purpose	$'000
Mineral Resources	1500
Manufacturing Industries	1500
Information and Communications Industries	1500
Environmental Aspects of Economic Development	500
Environmental Knowledge	500
TOTAL	5500

Table 2: ESTIMATED EXPENDITURE BY INSTITUTE 1994-95[1]

(Provisional estimates as at June 1994)

	Direct Appropr	External Funds	Total Funds
	($'000)	($'000)	($'000)
Institute of Information Science and Engineering	37,924	16,309	54,233
Institute of Industrial Technologies	69,716	29,000	98,716
Institute of Minerals, Energy and Construction	68,953	49,233	118,186
Institute of Animal Production and Processing	69,982	57,641	127,623
Institute of Plant Production and Processing	89,082	46,915	135,997
Institute of Natural Resources and Environment	68,158	28,834	96,992
Corporate Services Department	23,385	6,440	29,825
Corporate Business Department	6,039	1,307	7,346
Chief Executive Advisory Units	4,380		4,380
Other[2]	9,928		9,928
TOTAL	447,547	235,679	683,226

[1]Excludes Magnesium Industry Development Loan (1994-95 instalment $2,800K). Expenditure on the CSIRO supercomputing facility has been apportioned across the user Institutes. Expenditure of funds brought foward from 1993-94 is included. The distribution of funding for new projects arising from the Industry Statement has not been finalised and in most cases is identified against the Lead Institute.

[2]Comprises $8,500K of estimated capital expenditure in excess of Institute/Department contributions to the capital program; amounts not yet allocated to specific Institutes/Departments for PABX programs, and payments to Attorney General's Department.

Figure 2: PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95

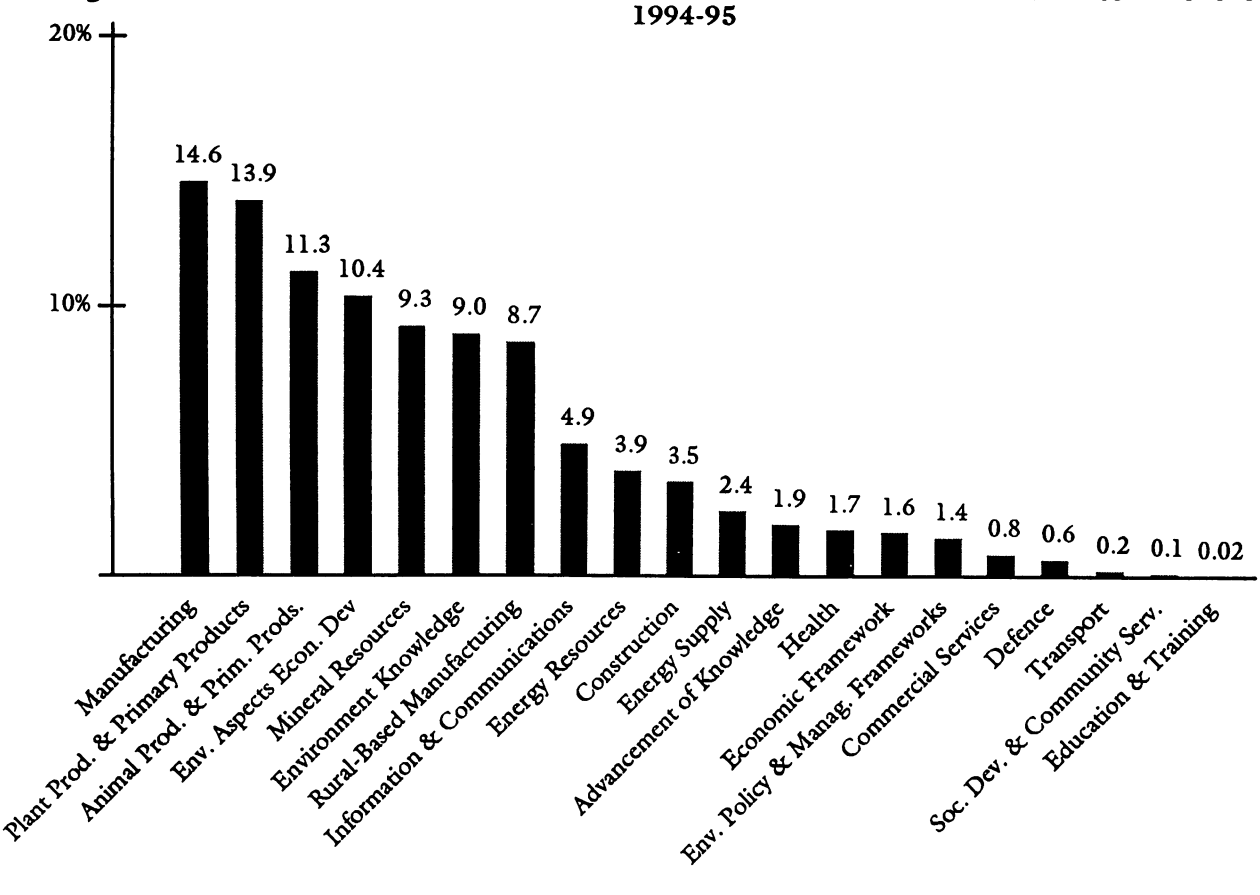


Table 3: PLANNED DISTRIBUTION OF EXPENDITURE BY INSTITUTE [1] AND RESEARCH PURPOSE
(Provisional estimates as at June 1994)

Research Purpose[2]	IISE	IIT	IMEC	IAPP	IPPP	INRE	TOTAL[3]
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
Plant Prod. & Primary Products		296		1,123	84,998	1,455	94,968
Animal Prod. & Prim. Prods.		395		53,066	4,352	13,385	77,205
Mineral Resources	3,200	2,961	51,293		272	970	63,540
Energy Resources	651	3,455	19,264			970	26,646
Energy Supply	488		12,528	893		970	16,397
Rural-Based Manufacturing	108	1,974		45,089	7,480		59,441
Manufacturing	6,020	67,226	2,364	13,949	1,632	970	99,751
Information & Communications	23,483	4,837	1,064		1,496	194	33,478
Environment Knowledge	271			217	9,656	46,653	61,490
Advancement of Knowledge	12,202						12,981
Env. Aspects Econ. Dev	651	4,936	11,464	5,679	22,712	29,097	80,621
Infrastructure & Services	7,159	12,635	20,210	7,607	3,400	2,328	58,211
TOTAL[4]	54,233	98,716	118,186	127,623	135,997	96,992	683,226

[1]See Footnote 1 to Table 2.

[2]Env. Aspects Econ. Dev includes Env. Policy & Mangt Frameworks; Infrastructure & Services includes Defence, Construction, Transport, Commercial Services, Economic Framework, Health, Education & Training, and Social Development & Community Services.

[3]This column includes non-Institute expenditure distributed to research purposes on a pro-rata basis.

[4]Due to rounding, columns may not sum to total.

Table 4: CSIRO STAFF NUMBERS, 1994-95
(Equivalent full-time units, provisional estimates as at June 1994)

Staff	IISE	IIT	IMEC	IAPP	IPPP	INRE	CSD	CBD	CEAUs	TOTAL
Research[1]	303	617	716	746	1,055	606				4,043
Research Support[2]	177	318	406	652	393	409	282	57	14	2,708
Management[3]	32	42	52	51	64	38	17	10	6	312
TOTAL	512	977	1,173	1,449	1,511	1,053	299	67	20	7,061

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

[2]Includes Technical Services, Communication and Information, Administrative Services and General Services functional classifications.

[3]Includes Research Management, Corporate Management and Senior Specialist functional classifications.

LIST OF MULTI-DIVISIONAL PROGRAMS 1994-1995

Plant Production and Primary Products

1 Gene Shears
2 Novel Management Techniques for Plant and Plant Product Pests
25 Improving Forestry

Animal Production and Primary Products

3 Fibre Utilisation
26 Gene Mapping

Mineral Resources

4 Alumina Production
5 Aluminium Production
6 Heavy Mineral Processing
7 Integrated Geological, Geophysical, Mine Design Visualisation
8 Iron Ore Processing
9 Magnesium Alloys
10 Magnesium Production

Rural-Based Manufacturing

12 Active Packaging

Manufacturing

13 Biomaterials and Medical Devices
14 Boeing - CSIRO Joint Research Effort
15 Process and Maintenance Optimisation in Manufacturing
27 Biosensors
28 Smart Manufacturing

Commercial Services

16 Urban Water Systems

Environment Knowledge

17 Climate Change
18 Conserving Biodiversity for Australia's Future
19 Data Acquisition and Utilisation
29 Climate Variability and Impacts

Environmental Aspects of Economic Development

20 Algal Research Program
21 Coastal Zone Program
23 Management of Marine Living Resources
24 Minesite Rehabilitation
30 Air Quality
31 Management of Eucalypt Forests for Timber Production and Conservation: Spatial prediction of forest productivity
32 Dryland Farming Systems for Catchment Care

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 and participating Divisions for each MDP, with the lead Division named first. The major outcomes and expenditure planned for 1994-95 are also shown. The MDPs have been grouped by CSIRO research purpose.

Plant Production and Primary Products

MDP01 *Gene Shears*

Objective:
To further develop the core technology of the gene shears discovery and its applications in the agri-food business system; to develop delivery systems for these applictions.

Planned Outcomes:
1 Development of a modified strategic plan for the Gene Shears MDP on the basis of achieved outputs and outcomes, and decisions on new opportunities. (Eval)
2 The program will be reviewed at an MDP Workshop in mid-1994. Participation and resourcing to be determined.

Participants:	***% Share***
Divisions of IPPP, IAPP and IIT	tbd

Total Expenditure: tbd

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 Implementation of current programs focussing on:
- evaluation of cotton strains resistant to *Heliothis* attack and further strain development;
- semi-commercial scale-up of a heat treatment process for disinfesting fresh fruit;
- isolation of scarab beetle viruses and selection of compatible cell lines.

Participants:	***% Share***
Division of Entomology	69
Division of Plant Industry	9
Division of Horticulture	18
Division of Biomolecular Engineering	4

Total Expenditure: $1,446,000

MDP25 *Improving Forestry*

Objective:
To develop genotypes of forest trees with improved characteristics including high growth rates, enhanced wood quality and insect resistance.

Planned Outcomes:
1 In collaboration with industry, significant progress towards detecting genes controlling early growth wood density and other traits in *P. radiata.*
2 Introduction of Bt genes into eucalypts for control of beetles. (PP3)
3 Introduction of anti-sense constructs for achieving sterility in plantation eucalypts.
4 Automation of instrumentation for scanning the wood properties of *P. radiata* increment cores.
5 Analysis of the effects of fertilisation and irrigation on *P. radiata* wood pulping properties.
6 Estimation of age-age correlations for wood properties in *P. radiata.*

Participants:	***% Share***
Division of Forestry	28
Division of Plant Industry	32
Division of Forest Products	14
Division of Entomology	26

Total Expenditure: $2,730,000

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 Expression of recombinant esterase genes in rumen bacteria in stable form.
2 Reliable assay procedures established to detect transformed rumen bacteria and cloned fungal enzymes in rumen contents.
3 Assessment of persistence of the modified microbes in ruminants, and effects on digestion in the rumen.
4 Determination of enzymes in rumen bacteria and fungi that have significant involvement in pectin degradation, and an assessment of their role in fibre fragmentation and digestion.
5 Isolation of rumen organisms with the capability of degrading phenolic/protein complexes from shrub legumes.
6 Construction of putative "cassettes" consisting of promoter, signal sequence, and fibre degrading gene(s), and preparation for transfer to target rumen bacteria.
7 Antibiotic resistance genes transferred to target rumen bacteria via a vector system.
8 Measurement of the effect of free lipid on the contributions of bacteria, protozoa and anaerobic fungi to digestion in the rumen.
9 Determination of the ability of 10 species of non-indigenous anaerobic fungi to colonise the sheep rumen.
10 Evaluation of experimentally-induced changes in rumen fungal populations using DNA-based quantitative methods.

Participants:	***% Share***
Division of Tropical Animal Production	43
Division of Tropical Crops and Pastures	31
Division of Animal Production	26

Total Expenditure: $1,762,000

MDP26 *Gene Mapping*

Objective:
Identify and transfer to industry genetic markers for economically and biologically important traits in cattle, sheep and other livestock.

Planned Outcomes:
1 A commercialisation plan for the outcomes of gene mapping research. (AP2, AP3)
2 A bovine genetic map with 95% genome coverage. (AP2, AP3)
3 Development of the ovine genetic map using the bovine map as a template. (AP2, AP3)
4 Preliminary assessment of the cost/benefits of DNA fingerprinting in the sheep industry. (AP3)
5 Phenotypic assessment of sheep resource flock for *T. colubriformis* and evaluation of at least 50 markers on 200 animals completed. (AP3)
6 DNA from three generation full sib families in the sheep reference flock collected and distributed. (AP3)
7 Epidermal growth factor gene in sheep cloned and partially characterised. (AP3)
8 Preliminary results on genetic markers for growth, tenderness, carcass yield, carcass fat, tick and worm resistance in cattle. (AP2, AP3)

Participants:	***% Share***
Division of Tropical Animal Production	66
Division of Animal Health	18
Division of Animal Production	11
Other Participants	5

Total Expenditure: $1,638,000

Mineral Resources

MDP04 *Alumina Production*

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

Planned Outcomes:
1 Development of further skills in the areas of solution speciation and polyelectrolyte characterisation in alumina processing.
2 Improvement in understanding of mechanisms of silica dissolution and "desilication product" precipitation to reduce caustic soda losses.

3 A model to describe the effects of the impact of organic compounds on alumina hydrate precipitation.

Participants:	*% Share*
Division of Mineral Products	63
Division of Mineral and Process Engineering	26
Division of Building, Construction and Engineering	11

Total Expenditure: $5,540,000

MDP05 *Aluminium Production*

Objective:
To support development of aluminium technology that will increase the proportion of Australian raw materials processed locally, improve smelter productivity and reduce the environmental impact of the aluminium industry.

Planned Outcomes:
1 Identification and evaluation of ceramic-based materials suitable as inert anodes in aluminium smelting cells.
2 Quantification of electrochemical performance of aluminium smelting cells that employ advanced electrolytes.
3 Laboratory demonstration of a complete carbothermic process route to aluminium and a costed flowsheet for a proposed industrial implementation.
4 Development of physiochemical models of aluminium and smelting electrolytes (including low-temperature types).
5 Completion of pot-room trials of a laser-based hydrogen fluoride measurement system.

Participants:	*% Share*
Division of Mineral and Process Engineering	45
Division of Mineral Products	47
Division of Materials Science and Technology	8

Total Expenditure: $2,140,000

MDP06 *Heavy Mineral Processing*

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

Planned Outcomes:
1 Development of an optimised model for the reduction and leaching processes that takes account of different ilmenite deposits and coal/char types.
2 Determination of the thermodynamics of ilmenite reduction in the presence of magnesium, manganese, aluminium and chromium.
3 Establishment of a new project on the fundamentals of the little-studied aeration step in the Becher process.

Participants:	*% Share*
Division of Mineral Products	93
Division of Mineral and Process Engineering	7

Total Expenditure: $2,360,000

MDP07 *Integrated Geological, Geophysical, Mine Design Visualisation*

Objective:
To develop a fully integrated, three dimensional, mining and exploration software system capable of handling the geoscientific data derived from such operations.

Planned Outcomes:
1 Completed prototype of 3D data model for geology.
2 Interfacing of 3D data model with two other models, e.g. deformation modelling and forward modelling.
3 Completion of the prototype of the forward modelling package, as applied to magnetics and radiometrics within Sandking data.
4 Prototype geological editor plus requirements for visualisation.
5 Industry funding for evolving projects not covered by priority funding.

Participants:	*% Share*
Division of Exploration and Mining	67
Division of Information Technology	33

Total Expenditure: $1,000,000

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 Confirmation of the functionality of the CSIRO ore group classification scheme and its implications for mineral processing.

2 Installation and calibration of prototype commercial gauges for the on-belt determination of aluminium, manganese and moisture in iron ores.

3 Preliminary development of prototype infrared spectrometer for ore characterisation.

4 Revision of international Standards for sampling iron ores.

Participants:	***% Share***
Division of Mineral and Process Engineering	98
Division of Exploration and Mining	2

Total Expenditure: $2,115,000

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.

Participants:	***% Share***
Division of Manufacturing Technology	60
Division of Materials Science and Technology	25
Division of Mineral and Process Engineering	15

Total Expenditure: $2,100,000

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 Improvement in cell design and efficiency of power utilisation through hydrodynamic modelling of electrowinning cells. (MI2)

2 Identification and optimisation of conditions for producing anhydrous magnesium chloride and transferring this to electrolytic cells. (MI2)

Participants:	***% Share***
Division of Mineral Products	82
Division of Mineral and Process Engineering	18

Total Expenditure: $1,820,000

Rural-Based Manufacturing

MDP12 *Active Packaging*

Objective:

To develop and demonstrate the use of packaging materials, particularly plastic films, to extend the high quality shelf life of fresh horticultural produce.

Planned Outcomes:

1 Development of new high-strength biodegradable packaging film. (RM2)

2 Development of special absorption film. (RM2)

Participants:	***% Share***
Division of Materials Science and Technology	33.4
Division of Food Science and Technology	33.3
Division of Horticulture	33.3

Total Expenditure: tbd

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 composite polymeric materials which incorporate active molecular fragments from key molecules.
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.

Participants:	***% Share***
Division of Biomolecular Engineering	45
Division of Chemicals and Polymers	45
Division of Applied Physics	10

Total Expenditure: $2,400,000

MDP14 *Boeing - CSIRO Joint Research Effort*

Objective:
Under a Memorandum of Understanding with Boeing Commercial Group conduct advanced technology research linked to manufacturing and exports from Australia.

Planned Outcomes:
1 Studies on ozone depletion, ultrasonic non-destructive testing of aerospace materials and corrosion inhibitive materials to replace chromium.

Participants:	***% Share***
Division of Applied Physics	36
Division of Materials Science and Technology	14
Other Participants (Boeing)	50

Total Expenditure: $442,000

MDP15 *Process and Maintenance Optimisation in Manufacturing*

Objective:
To develop more productive and export-competitive manufacturing enterprises by the creation and integration of new systems to provide managers and technicians with the information they need to effectively operate complex manufacturing systems.

Planned Outcomes:
1 Five potential industrial partners identified and their requirements for tactical and strategic research related to the overall objective assessed.
2 Models and information systems for maintenance management projects with several of the industrial partners identified above. (MF4)
3 Plans for strategic research in modelling, simulation, software and information systems, and statistical data analysis for maintenance, scheduling and process optimisation. (MF4)
4 Graphical user interface for stockpile process simulations.

Participants:	***% Share***
Division of Mathematics and Statistics	34.0
Division of Manufacturing Technology	29.5
Division of Information Technology	22.0
Division of Food Science and Technology	14.5

Total Expenditure: $1,200,000

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 Completion of an international biosensor market analysis aimed at identifying target biosensor analytes in food and chemical manufacturing, agriculture and the environment. Develop specific operational requirements for chosen device targets.
2 Construction and screening of libraries of antibody-like molecules. Develop strategy for preparation of three targeted analytes.
3 Incorporation of self-assembled films into receptor immobilisation procedures, improving linking robustness.

4 Development of prototype robust acoustic wave devices for operation in gases and liquids.

Participants:	***% Share***
Division of Chemicals and Polymers	35
Division of Applied Physics	32
Division of Biomolecular Engineering	11
Division of Animal Health	11
Division of Food Science and Technology	11

Total Expenditure: $2,300,000

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 for inter-enterprise management and concurrent engineering.

Participants:	***% Share***
Division of Manufacturing Technology	45
Division of Materials Science and Technology	10
Division of Chemicals and Polymers	10
Division of Food Science and Technology	10
Division of Mathematics and Statistics	10
Division of Information Technology	10
Division of Applied Physics	5

Total Expenditure: $2,000,000

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 users of models dealing with urban planning/hydrology, contaminant generation and transport, applied using the HSPF model in a study of development options for greater Sydney.

2 The TOPAZ model for urban landuse - transportation planning, developed and linked to an upgraded version of the SUCO model (Service Utility Cost Optimisation Model). The SUCO upgrades allow joint optimisation of water, wastewater and drainage systems, including alternative scaler of water or wastewater treatment.

3 A prototype Local Area Water Balance Planning Model developed with inputs on water treatment aspects.

4 Investigations conducted into the feasibility of harvesting near urban stormwaters for recharging aquifers and subsequent re-use.

5 A prototype model developed for assessing the potential for changed management practices to influence the level and distribution of pollutants in urban runoff.

6 A series of studies conducted in Australian capital cities to determine the scope for greater community involvement in wastewater management and stormwater pollution control.

7 The role of spatial information data bases in improving urban water management considered in a number of case studies.

8 The FILTER techniques developed for seasonal storage and re-use of treated sewage effluent in irrigation of field crops.

9 Studies conducted into the economics of water demand in Australian cities, and the principles that should govern the design of infrastructure charging systems. A report prepared on the relevance of contingent valuation techniques to the choice of water quality standards.

Participants:	% Share
Division of Water Resources	42
Division of Building, Construction and Engineering	18
Division of Chemicals and Polymers	18
Division of Information Technology	14
Division of Mathematics and Statistics	8

Total Expenditure: $600,000

Environment Knowledge

MDP17 *Climate Change*

Objective:
To apply multi-disciplinary research regarding the processes that determine climate and climate change to the prediction of climate change.

Planned Outcomes:

1 Major "greenhouse" modelling experiment using a coupled ocean-atmosphere model involving transient growth CO_2 and including dynamic sea-ice and advanced land-surface schemes.

2 Commencement of extended full annual cycle climate simulations using nested modelling techniques.

3 An improved method for determining N_2O emissions from grazed pasture systems for national greenhouse gas inventories.

4 Analysis and compilation of directly-measured (turbulence) coupled ocean-atmosphere response experiment (COARE) data-set and publication of *Franklin energy budget* closure experiment.

5 Validation study of longwave radiation fluxes in GCMs.

6 Assessment of the impact of plausible scenarios of climate change on water resources and crops.

Participants:	% Share
Division of Atmospheric Research	44
Division of Oceanography	19
Division of Fisheries	10
RV *Franklin* (A National Facility)	9
Centre for Environmental Mechanics	4
Division of Plant Industry	3
Division of Water Resources	2
Division of Wildlife and Ecology	1
Other Participants	7

Total Expenditure: $14,000,000

MDP18 *Conserving Biodiversity for Australia's Future*

Objective:
To produce an operational interactive national framework for conserving biological diversity and maximizing its economic benefits, through a national collaborative venture involving all appropriate agencies.

Planned Outcomes:

1 Data capture and analysis of patterns of Australian biodiversity. Capture of specimen label point source data from 6000 plant and insect collections as computerised specimen data from target groups: termites, scarab beetles, ants, eucalypts, grasses, legume shrub species. (EN4)

2 Genetic structure of populations of ectomycorrhizal fungi. Establishment of long-term field plots, in collaboration with CALM, for characterising fungal biodiversity, monitoring shifts in biodiversity and identifying indicator fungal taxa; initiation of molecular analysis of *Laccaria* species. (ED6)

3 Experimental elucidation of extinction processes. Completion of fencing of all experimental populations; removal of all potential predators and competitors; manipulation of habitat quality and population sizes. (EN4)

4 Resource use and management. Fully operational GIS for the Western Australian wheatbelt; preliminary landscape model. (EN4)

5 Biodiversity Public Awareness Campaign. Identification of key target audiences, key issues/concepts and communication strategy.

Participants:	% Share
Division of Plant Industry	17
Division of Wildlife and Ecology	35
Division of Entomology	14
Division of Soils	15
Division of Forestry	19

Total Expenditure: $2,664,000

MDP19 *Data Acquisition and Utilisation*

Objective:
To ensure efficient data gathering and use of earth observation satellite data to support the research objectives of CSIRO Divisions and co-operating organisations.

Planned Outcomes:

1 Finalisation of the arrangements with SPOT Imaging Services of Sydney to introduce a discount voucher system for purchase of SPOT satellite data for research use by CSIRO.

2 Completion and evaluation of the second stage of the Continental Instrumented Ground Site Network project, relating to installation of radiance and environmental measurement instruments for use in calibrating earth observation satellite measurements. (EN1)

3 Evaluation of the possibility of moving Marine Observation Satellite data reception from Alice Springs to the Tasmanian Earth Resources Satellite Station.

4 Incorporation of ATSR data into the Australian Land Research Data Centre at the Division of Wildlife and Ecology at Gungahlin. (EN2)

5 Feasibility determination of placing some or all of the NOAA 1 km Data Project data archive "on-line" for use by the Australian and international research community. (EN1, EN3)

6 Investigation of the Geostationary Meteorological Satellite as a source of digital time series data for CSIRO research programs. (EN1)

7 Exploration of additional opportunities for research collaboration in earth observation data management projects, particularly with NASA and NASDA. (EN3)

8 The formal constitution of a Program Advisory Panel in consultation with participating Divisions.

Participants:	***% Share***
CSIRO Office of Space Science and Applications	70
Division of Wildlife and Ecology	13
Division of Atmospheric Research	5
Other Participants	12

Total Expenditure: $774,000

MDP29 *Climate Variability and Impacts*

Objective:

To develop decision support systems aimed at minimising adverse impact on Australia due to the extremes of climate variability by bringing together and enhancing CSIRO research on climate processes, climate modelling and impacts.

Planned Outcomes:

1 This MDP commences 1 July 1994. Although the scope of the program has been defined, detailed outcomes and plans will be determined as the first action for the new MDP.

Participants:	***% Share***
Division of Oceanography	13
Division of Atmospheric Research	22
Division of Water Resources	7
Division of Fisheries	12
Division of Soils	5
Division of Plant Industry	5
Division of Wildlife and Ecology	10
Division of Animal Production	2
Centre for Environmental Mechanics	3
Division of Tropical Crops and Pastures	15
Division of Forestry	3
Division of Building, Construction and Engineering	2
Biometrics Unit (IPPP)	1

Total Expenditure: $9,800,000

Environmental Aspects of Economic Development

MDP20 *Algal Research Program*

Objective:

To increase our understanding of toxic cyanobacteria blooms to better manage blue-green algal problems in Australia, in particular in a Murrumbidgee weirpool, the Swan Estuary and Queensland reservoirs, and to increase interaction with Agencies.

Planned Outcomes:

1 Collection of physical and biological data from suitable weirpools. Development of models of circulation, mixing, cyanobacterial distribution and bacterial growth in weirpools.

2 Calibration, testing and placement of two Aqualab units for monitoring the water quality of surface and bottom waters.

3 Commencement of monitoring and sediment sampling in the Swan River. Periodic flights for remote sensing and "ground truthing" with the spectro-radiometer.

4 Characterisation of toxin degradation by whole bacteria and isolated enzymes.

5 Integration of instream component into the catchment management support system. Understanding of the cause of blooms in subtropical reservoirs.

6 Delivery of conceptual models to agencies for comment.

Participants:	*% Share*
Division of Water Resources	65
Division of Fisheries	26
Centre for Environmental Mechanics	9

Total Expenditure: $1,500,000

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 Development and testing of process models to predict nutrient and sediment flushing from soils by leaching and surface runoff.

2 Construction and testing of mesocosm systems for assessing the key biological processes in determining the fate, transport and biological impact of heavy metals in estuarine sediments.

3 Enhanced Pritchard model and tested against data gathered in Derwent estuary, including organic components, and continued development of fully 3D variable density hydrodynamic estuary model.

4 Collation of available information on subtidal marine floral habitats (principally sea grasses) for Coastal and Marine Resources Information System (CAMRIS).

5 CAMRIS (scale 1 : 2.5 million) operational.

6 In collaboration with Sydney Water Board:
(a) Characterisation of suspended particulate matter and bed sediments in selected creeks and rivers in Sydney's north west sector.
(b) Workshop to compile internally consistent physical and chemical data sets for developing and testing process models.

Participants:	*% Share*
Centre for Environmental Mechanics	7.8
Division of Coal and Energy Technology	11.1
Division of Fisheries	10.4
Division of Oceanography	10.1
Division of Soils	6.5
Division of Water Resources	6.0
Division of Tropical Crops and Pastures	5.3
Division of Wildlife and Ecology	2.0
Other Participants	40.8

Total Expenditure: $1,800,000

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 Finalisation of the program's project structure and implementation strategy following the appointment of key staff.

2 Organisation of an international meeting on Management Strategy Evaluation in Marine Resource Management; the outcome of this meeting will be a "state-of-the-art" report which will set the direction for the Program in the years to come.

Participants:	*% Share*
Division of Fisheries	70
Division of Oceanography	30

Total Expenditure: $700,000

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 Participation in the Australian Centre for Minesite Rehabilitation Research application for a Cooperative Research Centre; establishment and successful trial operation of a separate cost-centre for the Program to facilitate research operations and financial reporting; and development of a business plan for the MDP for presentation to the Steering Committee of Chiefs.

2 Evaluation of monitoring data from a series of research projects dealing with establishment of woodland ecosystems on waste-rock dumps at Ranger uranium mine, and commencement of initial research on fire management of mature woodland ecosystems.

3 Completion of research on the rate of soil formation in coal mine spoil in BHPAC mines in the Bowen Basin; characterisation of coal mine spoils at BHPAC and MIM coal mines; development of initial models for water quantity and quality in final voids at BHPAC coal mines; and establishment of field trials on spoil at BHPAC coal mines to determine potential for erosion control using grasses.

4 Completion of industry- and agency-sponsored research including assessment of rehabilitation at various minesites; determination of key factors in rehabilitation of a gold tailings dam at Pine Creek (NT); and investigations of discharge from the Mount Morgan mining leases (Qld).

5 Initiation of sponsored projects on self-heating of spoils in Hunter Valley coal mines; co-disposal of coarse and fine rejects from coal mines; rehabilitation of final voids and tailings dams at various minesites; and characterisation of wetland systems for controlling downstream water quality.

6 Publication of results of recently concluded research in the scientific literature.

Participants:	***% Share***
Division of Soils	67
Division of Exploration and Mining	11
Division of Water Resources	6
Division of Wildlife and Ecology	8
Division of Coal and Energy Technology	5
Division of Tropical Crops and Pastures	2
Division of Entomology	1

Total Expenditure: $2,200,000

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.

Participants:	***% Share***
Division of Atmospheric Research	32
Division of Coal and Energy Technology	30
Division of Building, Construction and Engineering	32
Centre for Environmental Mechanics	6

Total Expenditure: $4,250,000

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 date 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 Evaluation of geochemical indices as predictors of soil fertility.

2 GIS coverages of terrain, soil physical and chemical properties, and forest distribution for selected areas of the SE forests. (EN4)

3 GIS coverages of estimated forest productivity based on remotely-sensed data (NDVI) for the forests of SE NSW and East Gippsland.

Participants:	*% Share*
Division of Forestry	39
Division of Wildlife and Ecology	42
Division of Soils	19

Total Expenditure: $573,000

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 sustainability of farming and grazing systems and their impact on the catchment.

Planned Outcomes:

1 Effective partnerships for focussed and integrated catchment management involving internal CSIRO arrangements, links to TCM/ICM community groups, State and Federal agencies, and landholders.

2 Quantification of the relationships between land use and catchment health. Specifically, this requires: identification of best land management practices, solutions and options for implementation; and identification of barriers and inhibitors to adoption and achievement of catchment health.

3 A coherent set of models and tools that can predict and visualise the long-term impact of current and alternative land uses on land and water resources of the catchment, and which can be used by government agencies and TCM/ICM groups.

4 A set of indicators and a set of benchmark measures that can be used to predict problems and change to catchment health.

5 Informed advice for framing effective policies on catchment management at the Local, State and Federal levels of government.

Participants:	*% Share*
Divisions of IPPP, INRE and IAPP	tbd

Total Expenditure: tbd

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, 51 Centres have been established over three completed selection rounds. CSIRO is a core participant in the 43 centres listed below. The list is derived from the second edition of the *CRC Compendium* (1993). The material is organised into six broad fields of research, based on the purpose of the activities: Manufacturing Technology, Information and Communications Technology, Mining and Energy, Agriculture and Rural Based Manufacturing, Environment, and Medical Science and Technology. The *CRC Compendium* also provides additional information on each CRC including location, research focus, areas of expertise and a contact person. The *CRC Compendium* is available from the Office of the Chief Scientist, Department of the Prime Minister and Cabinet, 3-5 National Circuit, Barton ACT 2600.

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

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 Mineral and Process Engineering
- Division of Manufacturing Technology
- Division of Coal and Energy Technology

G K Williams CRC for Extractive Metallurgy
- Division of Mineral and Process Engineering

A J Parker CRC for Hydrometallurgy
- Division of Mineral Products

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 Mineral and Process Engineering

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

CRC for Hardwood Fibre and Paper Science
- Division of 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

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

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

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

Guide to Operational Unit Entries

All entries include an objective, strategy, planned outcomes and resource summary. Additional information is presented depending on whether the unit is an Institute, Division or Department. Each of the possible components of an entry 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 under the heading 'Cooperative Research'. Other less formal forms of inter-divisional collaboration, though not highlighted 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 other than Institutes. For Divisions they often correspond to particular research programs. After each specific objective there is an estimate in parenthesis of the percentage of the unit's resources devoted to the pursuit of that specific objective.

Planned Outcomes

For each operational unit progress to be achieved in 1994-95 toward stated objectives is detailed in a list of selected planned outcomes. Each planned outcome is numbered and, where appropriate, a planned outcome may also be followed by one or more codes in parentheses. These codes are included to highlight the following:

- Where a planned outcome for 1994-95 demonstrates progress toward one or more of the major planned outcomes highlighted in the CSIRO Strategic Plan 1991-92 to 1995-96 the link is shown by a code of the form (AA1). An example of how to follow the cross-reference is given in the Annex 'Strategic Plan Implementation'.

- Planned outcomes which reflect an intent to undertake or implement the results of major program evaluations or reviews of functional areas in 1994-95 are followed by (Eval).

- Planned outcomes which reflect significant progress with the development or application of new indicators of performance in relation to CSIROs six key performance areas (research, technology transfer, funding, human resources management, communication and corporate development) are followed by (Perf).

Summary of Resources, 1994-95

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

Financial estimates are shown as **planned expenditure** from direct appropriation funds and from external funds. External funds consist of earned revenues and sponsored research funds.

All figures in the summary of resources section are estimates for the 1994-95 year as at XX June 1994.

External Earnings

Each entry includes an estimate of the operational unit's external earnings for 1993-94 and targets for 1994-95 and 1995-96. This is shown as a percentage of total income. These are the only financial data in the Operational Plan shown on the basis of income rather than expenditure.

Planned Distribution of Total Expenditure by Research Purpose 1994-95

All research in CSIRO is directed toward particular Research Purposes. These are based on the socio-economic objectives which form part of the Australian Standard Research Classification. In each Institute's entry a chart shows how the Institute's total expenditure in 1994-95 will be allocated between CSIRO's Research Purposes. Figure 2 in Section One shows the distribution for CSIRO as a whole.

1. Institute of Information Science and Engineering

Objective

To be a leader in strategic research on information and communications technologies and the integration of systems based on these technologies for the benefit of Australia. To help increase the international competitiveness and export orientation of Australian information and telecommunications industries. To assist other industry sectors to improve their competitiveness through process improvement and the use of advanced computer and communication systems.

Strategy

- Value-added opportunity areas are the driving force for the Institute's research. Services have been identified as a major value-added opportunity. Particular emphasis will be placed on the converging areas of telecommunications and information services.
- The Institute will base its research effort on strengths in generic technologies and systems understanding. The Institute will maintain itself at the forefront of international research on information and communications technologies and industrial mathematics and statistics to ensure the continued excellence of its technology.
- The Institute hosts the Australia Telescope in recognition of its strategic importance for the development of key technologies relevant to the Australian information and telecommunications industries.
- Research groups in the Institute will be of a size that will ensure their viability and maximise the impact of their work. The Institute will encourage pre-competitive R&D in Australia, particularly in conjunction with groups of companies.
- The Institute will work with active research teams possessing complementary skills in academic and other research establishments. To this end joint research centres will be established in conjunction with tertiary educational institutions. This will involve, in particular, improvement of software engineering. The Institute will also become involved in education and training, both undergraduate and postgraduate.
- Rapid prototyping and demonstration will be a prime mechanism for initial deployment of the Institute's technology.
- The Institute conducts its research programs in collaboration with other CSIRO Institutes, academic institutions and industrial research groups, and encourages education and training in its core technologies. It plans to exploit the results of its research through joint ventures, collaborative research, development projects and consultancy with Australian industries.
- The growth of the Institute will take place by evolution from existing areas of strength since this maximises the commercial impact of the Institute's work.

Planned Outcomes

1 Two industry support groups established as a focus for links with small and medium-sized enterprises.

2 Projects initiated in the priority areas of software engineering and telecommunications engineering.

3 A plan for the evolution of the Institute's core technologies to meet the future needs of Australian industry.

4 Establishment of projects as the fundamental mode of operation for all the Institute's activities.

5 Publication of the second issue of "Research Results" which will cover achievements across CSIRO relevant to the manufacturing, information technology and telecommunications industries.

6 An investigation, based on material collected for the Austrade/LEK Service Exports Study, of the role CSIRO could play in supporting Australia's service exporters.

7 Results of the Institute Director's Planning Reviews incorporated into plans for 1995 and beyond. (Eval)

SUMMARY OF RESOURCES, 1994-95

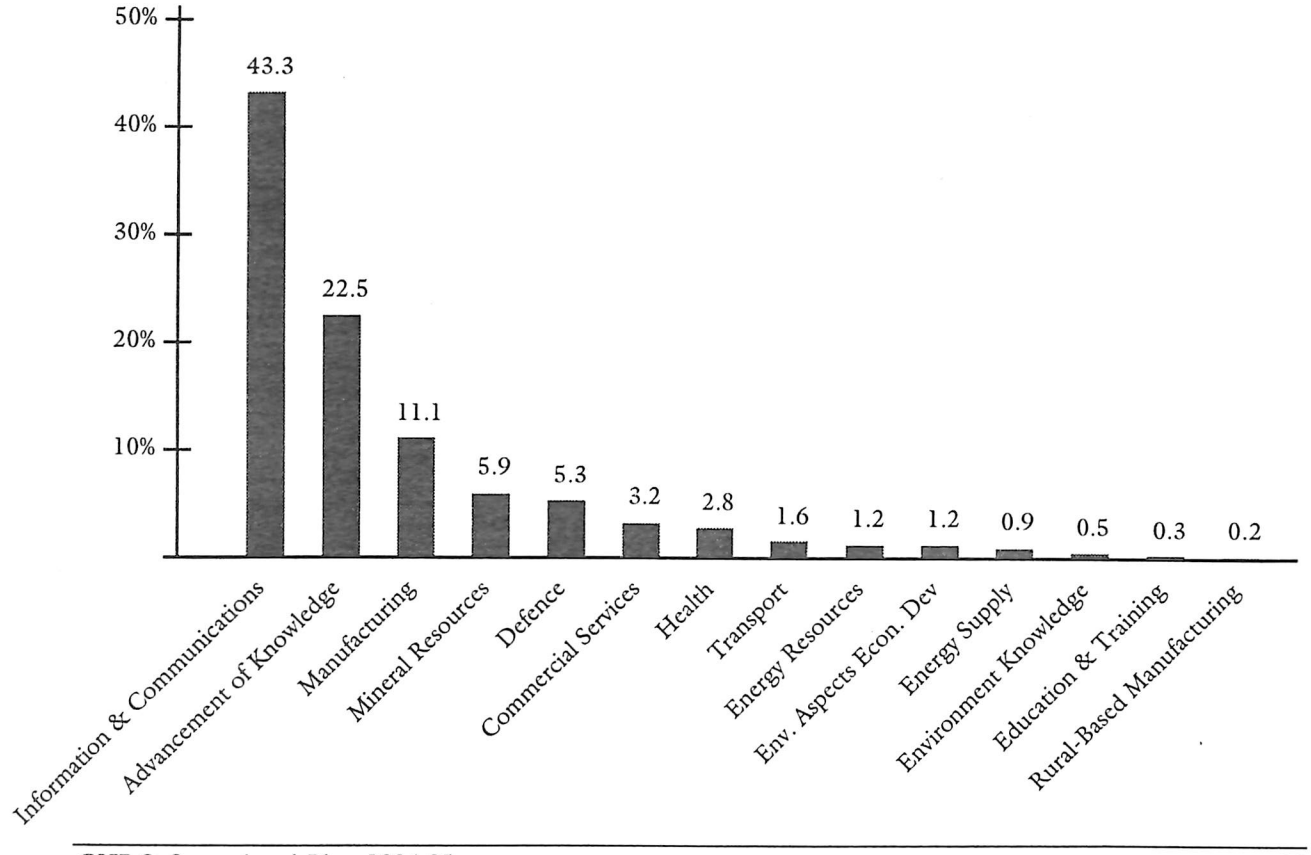
(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Information Technology	77	17	6	100	6,830	3,360	10,190
Mathematics and Statistics	76	16	5	96	6,974	3,399	10,373
Radiophysics	94	60	11	166	11,562	8,100	19,662
Australia Telescope National Facility	51	74	7	131	10,249	1,450	11,699
CSIRO Supercomputing Facility[2]	4	0	0	4			
IISE Institute Headquarters	1	11	3	15	2,309		2,309
TOTAL	303	178	32	512	37,924	16,309	54,233

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

[2]Supercomputing expenditure is charged to user Divisions.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



2. Division of Information Technology (IISE)

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.
- Focus research on the demonstration and development of advanced software technologies and information systems particularly for the following industries: 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 processing geographic data in problem-oriented geographic information systems. (25%)

1 Demonstration of prototype spatial information services for public access to land-related data within State Government enterprises. (IC3)

2 Initial demonstration of a high-performance traffic and road network simulation package for designing the next generation of traffic management systems. (IC3)

3 Demonstration of a decision support system integrating geographic data processing and hydrological models for planning of urban water systems. (IC3)

To develop methodologies, tools and techniques for engineering knowledge- based information systems. (20%)

4 A prototype hypertext-based system for intelligent training and documentation in commercial services applications. (IC5)

5 Extension of a respirator product advisory system based on Australian standards to a system for international use.

6 A functional design of a distributed multi-media systems architecture for on- line news and information services. (IC5)

To develop architectures, tools and techniques for distributed information systems and processes. (20%)

7 Pilot studies demonstrating open systems standards for the implementation of electronic directories in government and business organisations.

8 An R&D plan for "information and resource discovery" aimed at providing interactive access to large distributed document sets in government and business. (IC5)

9 An industry requirements study on workgroup information systems.

To develop system architectures, tools and techniques for image-based visualisation and interactive user interfaces. (25%)

10 An extended implementation of a generic toolkit on parallel computers for interactively visualising three-dimensional images. (IC4)

11 Demonstration of fractal compression techniques for interactive visualisation of complex three-dimensional representations, in collaboration with the Division of Exploration and Mining and with industry partners. (IC4)

12 An investigation of data models and user interaction paradigms for exploratory data analysis requiring interactive visualisation and multi-media tools. (IC4, IC5)

To develop and apply object-oriented design and implementation methodologies which improve the productivity and quality of software engineering. (5%)

13 Collaboration with selected software development groups in other CSIRO Divisions aimed at improving the productivity and quality of applications software developed in CSIRO.

To promote and support effective use of high-performance computing facilities in CSIRO (5%)

14 A level of support that satisfies the requirements of the users of the CSIRO Supercomputing Facility.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$6,830,000
External funds	$3,360,000
Total Expenditure	**$10,190,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
29%	32%	33%

*estimates as at June 1994

3. Division of Mathematics and Statistics (IISE)

Objective

To develop new opportunities, environments and technologies for the application of mathematics and statistics to problems of national significance, especially in the areas of process improvement and quality, in industry, science and government.

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:

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. (29%)

1 Mathematical models to help understand and improve specific processes and products: metal casting, electromagnetic stirring of molten steel, design and fabrication of progressive spectacle lenses, metal rolling, metal buckling, and heat radiation in ceramic fuel cells.

2 Completion of further development work, in collaboration with users and other CSIRO Divisions, on Project FASTFLO ("New Computational Fluid Dynamics Algorithms for Industrial Applications").

3 Models and software for specific applications problems involving fluid flow: pulsed combustion, heat transfer in coke ovens, and design of yacht keels.

4 Optimisation algorithms and software for specific applications; scheduling of trains and airline crew, temperature variation in the distribution of fuel, mineral processing, registry offices, and rostering and scheduling of shift workers.

5 Completion of further development of particle-based computational algorithms for flow of granular materials and other fluid flow problems and marketing to identify leading edge customers for such research.

To carry out research into aspects of quality improvement which will have a significant impact on Australian enterprises, to carry out research in anticipation of their needs and to communicate the importance and benefits of statistical thinking to Australian enterprises and the community. (30%)

6 Methods for statistical process control of processes with measurement-to- measurement correlation and software implementing these methods.

7 At least one project aimed at important quality problems arising in the manufacturing sector and requiring a range of measurement, data capture and data analysis skills for their solution identified and underway. (MF4)

8 Models for lifetime distributions of pipelines developed and evaluated using data from State water authorities.

9 A program of research in software quality initiated.

To develop new methods, algorithms and environments for the modelling, processing and analysis of high dimensional data and to apply these methods in relevant industrial and environmental contexts. (27%)

10 Methods for detecting and classifying cracks from images of road surfaces, with potential for implementation in hardware.

11 Methods for detecting, measuring, monitoring and mapping change in land condition (salinity, wind erosion, vegetation status) using remotely sensed and other spatial datasets.

12 Methods of mapping dryland salinity in the WA wheatbelt and maps of the spatial extent of salinity in the WA wheatbelt.

13 Methods for assessing, representing and combining the uncertainty in the data layers of a geographic information system. (IC3)

14 Methods for identifying mineral mixtures from field spectra.

15 Segmentation and classification methods for colour and multispectral imagery.

16 Methods for modelling transient horizontal dynamics in constructed wetlands and natural water bodies.

17 Prototype methods for correlating sferics noise measured at remote receivers.

18 Models for strain occurring during the manufacture of paper.

19 Image-based methods for classifying abnormal cells.

To develop new components for interactive graphical data analysis software that will provide better visualisation of complex data and models, and develop a network system for the Division's computers to enhance the environment for research collaboration between locations. (14%)

20 The final release of a graphical user interface for the Geological Statistics Module (a software product for the mining and exploration industry).

21 S software which provides a graphical user interface for presentation of Divisional solutions to clients in an intuitive manner.

22 A version of the NESSIE system that will operate with X-Windows and have an improved intuitive graphic user interface.

23 Technical support service to S-PLUS users expanded and enhanced.

24 New S-PLUS courses developed in collaboration with the University of Adelaide.

25 A help desk system for handling user problems which is closely integrated across locations using AARNet.

26 Groupware systems used for Divisional information services such as the client database.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$6,974,000
External funds	$3,399,000
Total Expenditure	**$10,373,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
40%	40%	41%

*estimates as at June 1994

4. Division of Radiophysics (IISE)

Objective

To extend and apply the knowledge and techniques of radiophysics, electronics, communications and imaging for the benefit of Australian industry and the Australian community.

Strategy

- Conduct research into generic technologies appropriate to telecommunications and image forming systems.
- Recognise emerging trends in services relevant to the Division's strengths and adapt its technology research to meet the future needs.
- 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.

Specific Objectives & Planned Outcomes

To develop and apply electronics and communications technologies in conjunction with telecommunications equipment manufacturers and providers of telecommunications services. (20%)

1 Establishment of a new discipline group in telecommunications in network management for the intelligent network.

2 Preliminary experimental investigation into wireless access to ATM networks by simulating wireless access on ATM switches. (IC1)

3 Experimental evaluation of theoretical models for microcellular propagation and base station antenna requirements. (IC1)

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. (12%)

4 Demonstration of the quality of service achievable on a wireless local area network through use of a functional prototype. (IC1)

5 Demonstration of key radiofrequency and antenna components for high bit rate wireless applications such as real time video transfer. (IC1)

6 A demonstration mm-wave telecommunications link for wireless telecommunications network reticulation to subscriber premises. (IC1)

7 A 38 GHz radio for cellular telephone infrastructure. (IC1)

To develop advanced GaAs based semiconductor devices and MMIC's and design tools for application in communications and defence systems. (22%)

8 0.15 micron quantum-well doped HEMTS and MMICs based on these HEMTS for low-noise and moderate power application at frequencies up to 110 GHz.

9 Completion of Phase 1 of a process and equipment upgrade for the fabrication of MMICs on two-inch wafers.

10 Completion of a quality system implementation plan for use in the design, fabrication and testing of MMICs.

11 Novel single and multi-function MMICs developed for generic applications. (IC1)

To develop new and improved ultrasonic imaging, Doppler, tissue characterisation and transducer techniques for medical diagnosis and industrial applications, and expand into applications of medical imaging technology. (15%)

12 An acoustic mine vision concept demonstrator.

13 Prototype version of an "expert assistant" workstation to assist radiologists in the diagnosis of breast and lung disease.

14 A World Federation for Ultrasound Medicine report on non-thermal mechanisms of bioeffects and the safety of diagnostic ultrasound.

To develop and apply radio-frequency related technologies to L-band mobile communications systems in support of service providers and industries in Australia. (2%)

15 Evaluation of trials with users (railway operators) and transceiver manufacturers of the L-band electronically-tracking mobile satellite service. (IC2)

16 A production prototype for a low-cost vehicle-mounted antenna. (IC2)

To apply advanced signal processing technology in the following areas: digital electronics, telecommunications, communications and sensing technologies for the minerals industry. (8%)

17 The A4 audio processing chip commercialised, and board and system level products using this chip investigated in conjunction with industry.

18 Novel methods for the compression and processing of a sequence of images.

19 Investigation of performance limitations in a geological imaging system which uses radio imaging and information fusion techniques.

To develop robust and adaptive methods for telecommunications and control, as part of the activities of the Co-operative Research Centre for Robust and Adaptive Systems. (4%)

20 Evaluation of blind equalisation for wireless communication schemes. (IC1)

21 The shape of towed sonar arrays estimated using methods from radioastronomy.

22 Speech coding for telecommunications and other applications.

23 Demonstration of rapid search of image databases for applications such as object or texture recognition.

To develop techniques for the design and manufacture of antennas and passive microwave devices for communications systems. (17%)

24 Modelling software for on-board satellite reflectors and feeds.

25 Modelling software for the design and manufacture of dual-band feed systems for earth stations.

26 Demonstration and testing of millimetre-wave antennas for wireless networks. (IC1)

27 Measurements of direction of arrival from two-dimensional scanned data at millimetre-wave frequencies for use in indoor wireless communications. (IC1)

28 A demonstration satellite-tracking system, that uses feed horn movement only, for the multibeam earth station antenna.

29 Upgrade of a meteorological radar antenna for dual polarisation operation.

30 Delivery of an X-band feed system for a satellite ground station.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,562,000
External funds	$8,100,000
Total Expenditure	**$19,662,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
32%	47%	46%

*estimates as at June 1994

5. Australia Telescope National Facility (IISE)

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, galaxies and quasars investigated.

2 A program of pulsar timing initiated at Parkes Observatory and timing accuracy better than 1 microsecond achieved for strong millisecond pulsars.

3 A precision astrometric reference frame for Southern hemisphere radio sources established to an accuracy of better than 5 milliarcseconds and tied in with the optical reference frame.

4 At least 50 scientific papers published in refereed journals.

5 Publication of the Parkes-MIT-NRAO (PMN) survey of radio sources.

To operate the Narrabri and Mopra Observatories as a National Facility. (39%)

6 A level of access to the facilities that satisfies the community of scientific users.

7 At least 50% utilisation of the telescope and time lost during scheduled observing periods kept to less than 5%.

To operate the Parkes Observatory as a National Facility. (12%)

8 A level of access to the facilities that satisfies the community of scientific users.

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

To operate and develop the joint ATNF-RP computing facility. (5%)

10 Hardware and software for the network of computers needed to satisfy the operational and research environment requirements at the three sites developed, operated and maintained.

To develop the next generation of ATNF instrumentation. (13%)

11 The 90-116 GHz dual-channel SIS receiver on the Mopra 22m antenna commissioned.

12 Four sites (Parkes, Mopra, AT Compact Array, Hobart) equipped with S2 recorders and data acquisition systems for VLBI.

13 The LBA correlator system commissioned.

14 Completion of the design of the HI multibeam system at Parkes.

To satisfy external agreements for telescope use and instrumentation development. (16%)

15 Construction of feeds and receivers as specified in the SETI Institute collaborative research agreement completed.

16 Observing time provided at Parkes and Mopra telescopes for 18 weeks, as specified in the SETI Institute collaborative research agreement.

17 Completion of designs as specified in the Parkes upgrade to support future NASA deep space missions, such as Galileo.

18 Provision of a 22 GHz cryogenically-cooled dual-channel front-end package for the Shanghai radio telescope.

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

19 The Parkes and Narrabri visitor centres operated at a level satisfying their users.

20 Educational opportunities provided at the high school, undergraduate, graduate and post doctoral levels. This includes: 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.

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

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$10,249,000
External funds	$1,450,000
Total Expenditure	**$11,699,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
20%	13%	8%

*estimates as at June 1994

6. Institute of Industrial Technologies

Objective

To increase the international competitiveness, efficiency and scope of Australia's manufacturing industries, and to be a leader in strategic research for those industries.

Strategy

Manufactured goods are the fastest growing export sector and now exceed the value of our traditional rural exports. Improvement in Australia's current account position will rely increasingly on exports of manufactured products. There is significant potential for the Institute to help improve the international competitiveness of Australian manufacturing industry in the production of value-added goods and services, and the Institute intends to work with world-class Australian companies to expedite their entry into new technologically intensive markets.

- Research areas within the Institute include:
  - design and manufacture of scientific, industrial and medical instrumentation.
  - biotechnology, waste management and recycling.
  - the design and production of specialty chemicals and of agricultural and pharmaceutical products.
  - integrated manufacturing systems and their introduction for specific company applications.
  - the properties, production, and fabrication of materials (metals, ceramics, polymers and composites) as engineering components and manufactured products.
- The Institute is committed to working extensively with private sector companies to facilitate the transfer of advanced technology, aided by the existence of various Government-sponsored assistance schemes including tax deductions for research and development, the Grants for Industry Research and Development and the National Industry Extension Service.
- The Institute will ensure productive research links with academic institutions and industry through several Cooperative Research Centres directed in support of manufacturing export opportunities.
- Program/Divisional reviews based on the Institute-wide project reporting system will be continued as a precursor to Institute resource allocation decisions.

Planned Outcomes

1 Field-trial demonstrations of a SQUID-based magnetometer for airborne large-area mineral exploration continued; pre-production prototype instrumentation completed with one of Australia's leading mining companies.

2 Prototype gas-meters delivered to potential world-scale manufacturers for evaluation and testing, and technology transferred to appropriate licensees of the CSIRO-AGL ultrasonic metering technology.

3 Boeing-related research projects integrated into the CRC for Aerospace Structures with Hawker de Havilland and Aerospace Technologies of Australia. Further development and testing of composite materials and manufacturing technology with Boeing for adoption by Australian industry.

4 Review of results of human-trials with the Biota/Glaxo anti-influenza compounds originating from CSIRO research, and assessment of research implications.

5 New biologically active compounds delivered to Dunlena under the CSIRO/DuPont joint-venture arrangement for evaluation as low environment-impact insecticides, herbicides and fungicides.

6 Pilot-scale development of SIROFLOC Mark II for drinking water delivery undertaken for the Hamilton Water Board.

7 Completion and delivery to customer of the 3D solidification modelling software. Demonstration of capability for Australian automotive applications with contracted customers.

8 Completion of Phase II of the Safe-T-Cam development with Telecom and the Road Transport Authority of NSW, with installation of up to twenty vision systems on the NSW Hume Highway for real-time heavy vehicle identification.

9 Construction and testing of ceramic fuel cell stacks of 100W capacity with Ceramic Fuel Cells Ltd. Continued support for technical development of the technology and the company.

10 Active-packaging technology transferred to a group of Australian packaging companies for manufacturing controlled-permeability and ethylene-scavenging films.

11 New prototype imaging spectrometer designed with commercial collaborators for airborne mineral prospecting applications.

12 Representation of Australian research consortia within the international Intelligent Manufacturing Systems initiative. Leadership of specified activities with Australian collaborating companies.

13 Research-related activities supported in twelve Cooperative Research Centres, including delivery of research outcomes to collaborating companies.

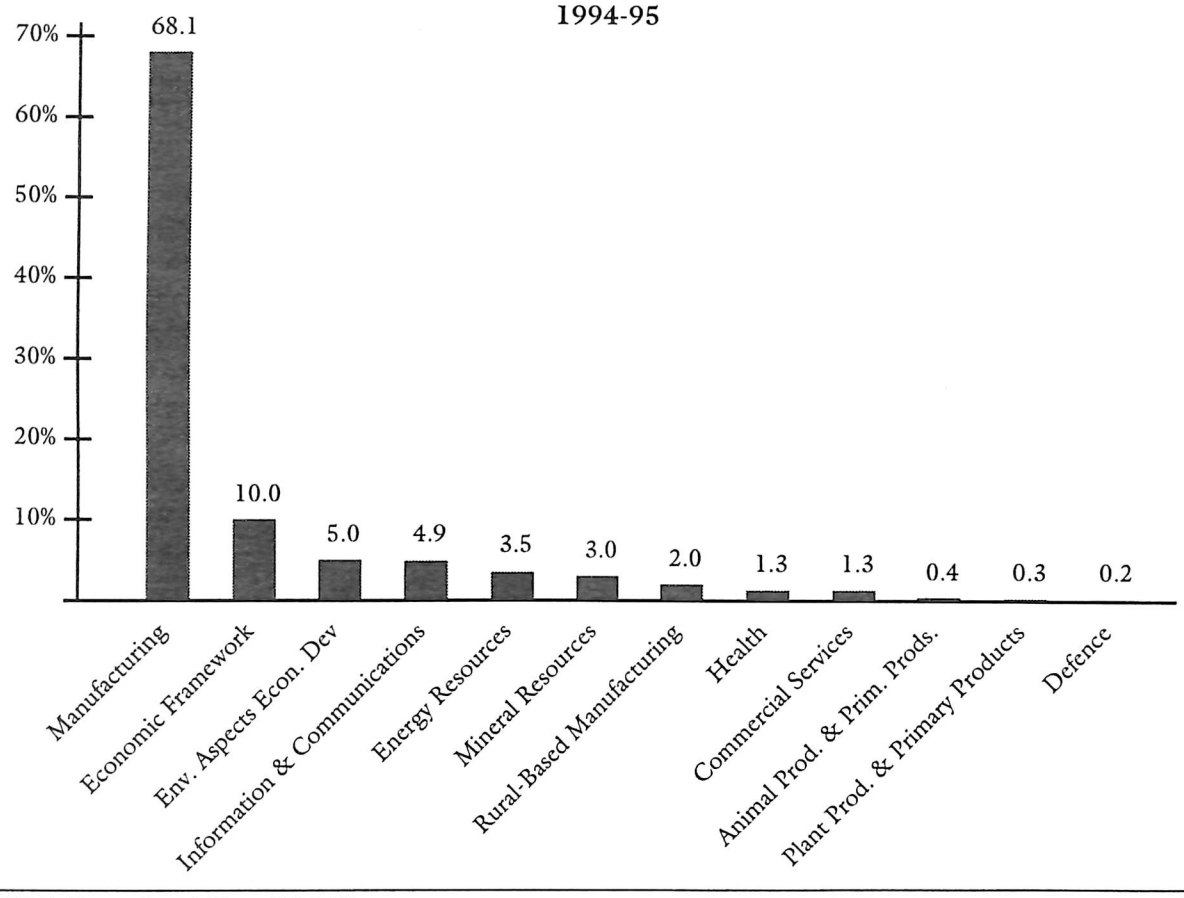
SUMMARY OF RESOURCES, 1994-95

(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Applied Physics	179	94	7	280	20,647	6,900	27,547
Biomolecular Engineering	111	44	9	164	11,035	3,600	14,635
Chemicals and Polymers	113	68	8	189	11,595	6,700	18,295
Manufacturing Technology	122	55	7	184	11,664	6,800	18,464
Materials Science and Technology	92	52	7	151	12,504	5,000	17,504
IIT Institute Headquarters	0	6	4	10	2,271		2,271
TOTAL	617	319	42	978	69,716	29,000	98,716

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



7. Division of Applied Physics (IIT)

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, 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.
- 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:

Biomaterials and Medical Devices - MDP13

Boeing - CSIRO Joint Research Effort - MDP14

Biosensors - MDP27

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

Develop electrotechnology of current or potential value to Australian industry, and provide standards and calibration services for electric potential and impedance. (18%)

1 Development, improved engineering and field trial demonstrations with an industrial partner of SQUID-based magnetometers for large-area mineral exploration.

2 With an industrial partner and UNSW, achievement of scheduled milestones in a program to develop and field trial a high-dynamic-range seismic sensing system for seabed exploration.

3 In collaboration with CSIRO Division of Food Science and Technology, Sydney University and the AMBRI Group, achievement of scheduled milestones in the prototype development of a highly-sensitive biosensor for targeted analytes of commercial significance.

4 In association with the CRC for Mining Technology and Equipment, development of high-frequency radar systems for (1) characterisation of coal/rock interfaces, and (2) characterisation of coal seam fault lines, with consequences for safe operation.

5 In collaboration with an industrial partner and the University of Wollongong, establishment of three-year funding for the establishment near Liverpool of a pilot plant for high-temperature superconducting wire as the basis for future commercial applications.

Develop magnetic and electromagnetic technology of current or potential value to Australian industry, and provide standards and calibration services for ac electrical quantities, time and frequency, high voltages, magnetic quantities and dielectrics. (21%)

6 Completion of the design, construction of prototypes and testing of two novel electromechanical controllers, in collaboration with Transfield Technologies and Australian Defence Industries.

7 Completion of the design, construction and testing of new electrical drives and controllers for a range of SME companies through SEMCOR (Sydney Electrical Machines Cooperative Research), an unincorporated joint venture between the Division and the University of Technology, Sydney.

8 Development of two demonstration prototype induction cooking systems, one low-frequency and one high-frequency, with high efficiency, high reliability and low radiated emissions.

9 Completion of Stage 2 of a facility to calibrate test equipment for the measurement of electromagnetic compatibility of information technology equipment. (MF4)

10 Completion of Stage 3 of a contract with Pacific Power to study and test the electrostatic charging tendency characteristic of electrical insulating oils from ageing and defective equipment; investigation of the use of this characteristic as a diagnostic tool.

11 Construction of a second buffer-gas-cooled-ion trap to permit the evaluation of stability of a cooled ion system as a new frequency standard.

Develop plasma and thermometric technologies of current or potential value to Australian industry; develop ozone assessment models for

environmental evaluations; provide standards and calibration services for mass and temperature. (20%)

12 In collaboration with Boeing, continued development of a two-dimensional stratospheric model for assessing the impact of supersonic aircraft on ozone, ensuring that the model remains state-of-the-art with potential as a useful policy-making tool for the Australian Government.

13 With the Division of Manufacturing Technology, development of diagnostic and modelling techniques to assess the effectiveness of plasma-based processes for the destruction of ozone-depleting substances, and provision of assistance in commercial application of the technology to the destruction of chlorofluorocarbons. (ED5)

14 In collaboration with BHP, initiation of a strategic project aimed at improving technology used for remote temperature measurements of steel during the hot-rolling process.

15 Maintenance and dissemination of an effective national measurement system for Australia in the fields of mass and related quantities and of temperature.

Develop acoustical, ultrasonic, and surface-mechanical technologies of current or potential value to Australian Industry, and provide standards and calibration services for acceleration, acoustics and hardness. (24%)

16 Continuation of a major collaborative research project with Boeing on the non-destructive testing of bonded structures, using acoustic/vibrational and ultrasonic techniques and involving Australian aerospace component manufacturers ASTA and Hawker de Havilland.

17 Completion, in collaboration with AGL Ltd, of international licensing arrangements for production of a new-generation ultrasonic domestic gas meter, maximising the return to Australia; extension of the technique to liquid flow applications.

18 Establishment of overseas marketing arrangements for the Ultra-Micro Indentation System and implementation of arrangements for manufacture of the instruments in Australia for the world market.

19 As part of a multi-Divisional project on biosensors, development of surface acoustic wave (SAW) devices suitable for use as ultrasensitive gravimetric transducers in biosensor systems.

20 Maintenance of an effective national measurement system for Australia in the fields of acceleration, acoustics ultrasonics and hardness. (MF4)

Develop optical and electro-optical technologies of current or potential value to Australian industry and provide relevant standards and calibration services for length, angle and other dimensional quantities, photometry and optical radiometry. (17%)

21 Production and delivery of OSP130 coin-profiling systems to the national Mints in USA and China, and identification of potential licensees for further sales of these instruments to other Mints.

22 With the Divisions of Manufacturing Technology and Mathematics & Statistics, completion of a project to determine the feasibility of instrumentally detecting and classifying cracks in road pavement.

23 With ICI Australia and the Division of Exploration and Mining, demonstration in the field of an instrument to remotely measure fragment sizes in the muck pile of a mine blasting operation.

24 Provision of a national test and calibration service in length, angle, radiometric and other standards to clients in industry and government departments.

25 Establishment of a cryogenic radiometer as Australia's primary standard of radiometric power.

Summary of Planned Expenditure 1994-95*

Direct Appropriation	$20,647,000
External funds	$6,900,000
Total Expenditure	**$27,547,000**

External Earnings as a Proportion of Total Income*

1993-94	1994-95	1995-96
24%	25%	28%

*estimates as at June 1994

8. Division of Biomolecular Engineering (IIT)

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

- The re-direction of the bulk of the Division's resources, from research for rural and food based industries to research for the rapidly developing pharmaceutical industry, has seen a drop in external fund generation while new intellectual property positions are generated.
- 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 Cardiovascular Research and the Biomolecular Research Institute (a joint venture between CSIRO and the Strategic Research Foundation).

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

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. (10%)

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 SRF. (MF2)

2 A decision to commence human trials with anti-influenza compounds developed from CSIRO research in collaboration with BIOTA Holdings has been made by Glaxo. The trials will start in 1994. (MF2)

To devise new pharmaceutical agents and diagnostic strategies based on the structural analysis and engineering of antibodies and to design and develop valuable products and processes using engineered proteolytic enzymes and peptide-fat conjugates. (17%)

3 Production of antibodies which have been specifically designed for diagnostic applications under the Discretionary and Generic Grant agreements with AGEN Biomedical Ltd and for 3-D structure analysis with BRI.

4 Production of antibody fragments for biosensor applications under Research Priorities funding and in collaboration with CRC-MET.

5 Improved diagnosis of prostatic disease states based on novel methods of analysis of prostate specific proteases.

6 New reagents and formulations for enhanced immunogenicity of peptide-based vaccines in particular for the treatment of hormone dependent prostate cancer. Evaluation of fat conjugates for targeted delivery of peptides and nucleic acids and as potential HIV therapeutics.

To design, develop and evaluate novel regulators for gene targeted therapies, particularly for acquired human diseases. (24%)

7 Design, delivery and evaluation *in vivo* of minizymes directed against therapeutically important targets.

8 Acquisition of basic knowledge in gene regulatory mechanisms in eukaryotic and prokaryotic systems (with reference to infectious diseases, and prostate cancer) and its application to gene therapy.

9 Design and construction of recombinant adenovirus vectors expressing vaccine antigens or toxin genes for cancer therapy.

To develop anti-viral compounds based on the structure and function of viral regulatory proteins and molecular mechanisms employed in virus replication cycles. (15%)

10 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. (19%)

11 Establishment of a medium scale fermentation facility in the Division.

12 Continuation of genetic constructs, medium to large scale mammalian cell fermentation and purification of milligram quantities of purified domains of different members of the insulin receptor family for structural studies.

13 Electron microscopic and protein crystalization analyses of purified insulin receptor domains and their complexes with antibodies and/or ligand.

14 Completion of agreement with commercial partner to support this structure-based diabetes research program.

15 Elucidation of molecular mechanisms involved in insulin receptor signaling pathways.

16 Purification and characterisation of a natural product with insulin-like effects.

To develop biomaterials and pharmaceuticals for use in tissue replacement and repair. (15%)

17 Evaluation of *in vitro* trials of collagen-based biomaterials.

18 Expression of the key genes for collagen biosynthesis.

19 Optimisation of surface chemistry for persistence of cell attachment.

20 Evaluation of prototype materials for use in artificial cornea applications.

21 Determination of the interactive effects of extracellular matrix molecules, growth factors and enzymes upon vascular cell behaviour.

22 Transfer of technical innovation to commercial partners associated with GIRD projects and two Cooperative Research Centres.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,035,000
External funds	$3,600,000
Total Expenditure	**$14,635,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
25%	26%	30%

*estimates as at June 1994

9. Division of Chemicals and Polymers (IIT)

Objective

In collaboration with enterprises involved in the use of chemical, polymer, water and waste water 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, adding about $3 billion to the negative trade balance each year. The chemical industry is of vital importance to the Australian economy and will find increasing relevance as we attempt to 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.

- 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. (20%)

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

2 Identification of new areas of generic drugs to produce by fermentation processes.

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

4 Increased use of the process bay facilities by Australian chemical producers and other CSIRO Divisions.

Invent and synthesise organic compounds with biological activity which have potential as pharmaceuticals. (20%)

5 Completion of animal tests for compounds active against Flaviviruses, Hepatitis B and Alzheimer's Disease.

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, physical/chemical characterisation and thermal processing of plastics. (16%)

8 Development of carbon fibre composites meeting all of Boeing BMS8-256 specifications.

9 Development of prototype block copolymers by emulsion polymerisation and evaluate these as pigment dispersants.

10 Development of surfactant-free emulsion polymerisation process for macromonomer synthesis.

11 Reactive processor installed, commissioned and used to produce maleated polyolefin compatibilizers.

12 Mode of action of additives for reducing stress whitening in polyolefin blends established.

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. (ED3)

14 Development of polyurethanes which are blood and tissue compatible and show better retention of strength and elasticity under long term implantation.

15 Assistance provided in the development of further security devices.

16 Commercialisation of membrane reactors for effective chemical synthesis.

17 Further upgrade of microwave chemical reactors.

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. (12%)

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 and environmental acceptability.

20 Design and assessment of polymers for metals recovery and organic removal from waters and participation in the establishment of a full scale demonstration plant for removal of organics from water.

21 Improved synthetic procedures for biodegradable surfactants from saccharide sources particularly sucrose.

22 Working parameters established for integrated processes for arsenic, selenium and manganese removal from wastewaters.

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

Apply physicochemical and biological knowledge through laboratory and pilot scale operation to the treatment of potable water, wastewater and sewage. (16%)

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

25 Achieve commercial uptake of the results of research into anaerobic digestion.

26 Laboratory experience of physicochemical nutrient removal translated into production of high grade fertiliser.

27 For the Hamilton Water Board, pilot scale development of SIROFLOC Mk2 for drinking water.

28 Research instigated into processes for the treatment of storm water.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,595,000
External funds	$6,700,000
Total Expenditure	**$18,295,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
33%	37%	37%

*estimates as at June 1994

10. Division of Manufacturing Technology (IIT)

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, Institute 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 Co-operative 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, setting up specific commercialisation strategies 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.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Magnesium Alloys - MDP9

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. (MF3)

2 Investigation of influence of operating parameters on the structure and properties of low pressure diecast aluminium alloys and squeeze cast aluminium-matrix composites.

3 Refinements to 3D solidification modelling software, and application of the model to predict microstructure and static tensile properties.

4 Determination of the iron-rich corner of the ternary iron-chromium-boron phase equilibrium diagram, and completion of weldability test studies of alloys based on this ternary system.

5 Cooperative research under the auspices of the CRC for Alloy and Solidification Technology. (MI2, MF3)

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 the joining of aluminium plate in shipbuilding applications.

9 Assessment of the weldability of overaged aluminium alloys for re-fabrication as aluminium reduction cell components.

10 Design and simulation of a robotic arc welding cell for the fabrication of large marine components.

11 Development of a model of the GMA welding process to take account of weld pool flow, thermal cycles and metal transfer.

Develop new processes to enhance the properties of engineering surfaces. (9%)

12 Production of further prototype cast-bonded products for field trial in the alumina refining industry and extension to other wear products.

13 Investigation of surface treatments and scale-formation phenomena on the wear of hot forging dies.

14 Scaling-up of the solid-state laser cladding process to surface/reclaim marine components.

15 Development of a short-circuit transfer technique for roughening the surface of sugar cane rolls.

Develop an acceptable method of treating organic liquid wastes and gases using the technology of electrically generated plasmas. (6%)

16 Completion of scale up work based on laboratory studies and physical 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. (ED5)

17 Completion of an evaluation of the PLASCON process to reduce process costs and improve process performance. (ED5)

Develop generic technologies for the vertical integration of the manufacture of pipes from oxides. (5%)

18 A laboratory facility for the direct reduction of metal ores by plasma; prediction of the operating parameters and running cost for a full scale plasma furnace.

19 A method of directly making seamless thin walled steel tube from the melt.

Develop new technologies based on electrically generated plasmas for manufacturing applications. (5%)

20 Completion of prototype integrated plasma cutting system, incorporating new technologies for on-line diagnostics and improved quality of cutting.

21 Completion of commercialisation arrangements for the manufacture and marketing of the Electronic Plasma Spray System.

Develop sensing and integrated automation modules and systems for specific industrial applications in manufacturing, services infrastructure and mining industries. (22%)

22 Completion and testing of an improved system for the identification of heavy vehicles.

23 Completed evaluation of processing and image acquisition requirements for a system for identifying cracks in roads.

24 Completion of field prototype system for measurement of internal surfaces of full and drained sewers.

25 Development of prototype walking robot (Mr Plod) to realise its potential for smooth motion.

26 Design and development of prototype flexible fixtures for trimming operations and latest selected hardware and software modules.

27 Demonstration of the machine vision system to control draglines.

28 Development of an hydraulic manipulator as a laboratory testbed to develop and demonstrate technologies to automate underground mining equipment by using machine vision.

29 Determination of basic cutter wear mechanisms in cutting hard rock.

30 Establishment of the critical parameters for used-oil debris identification through computer image processing.

Develop integration architectures, methodologies and associated software suitable for integrating business and manufacturing activities in small and medium sized enterprises. (4%)

31 Enterprise Integration projects developed for the CRC for Intelligent Manufacturing Systems and Technologies and the international research program on Intelligent Manufacturing Systems.

32 A new Generic Enterprise Integration Architecture concept developed within the Smart Manufacturing priority program.

Develop generic production management methodologies and software tools for integrated manufacturing decision support systems. (5%)

33 Field trial of the cellular manufacturing software at Boeing's Whichita plant completed and a generic manufacturing facility design methodology developed.

34 Integrated software for optimising sheet metal fabrication.

35 Completion of beta tests of the RETA scheduling software.

36 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%)

37 Assembly Planning software completed and tested for commercialisation at Hoover and three other industrial sites.

38 A method and software tools to speed up product design phase. Design concepts for parts planning software.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,664,000
External funds	$6,800,000
Total Expenditure	**$18,464,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
46%	37%	35%

*estimates as at June 1994

11. Division of Materials Science and Technology (IIT)

Objective

To develop and exploit advanced high value materials and associated technology to support the growth of an internationally competitive Australian manufacturing industry.

Strategy

The rapidly increasing importance of Elaborately Transformed Manufactures 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 new alloys, ceramics and composites to add value to Australian raw materials.
- Apply expertise in scientific instrumentation applied to materials characterisation to capitalise on new market opportunities.
- Maintain an appropriate balance between technological development and strategic research.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Aluminium Production - MDP5

Magnesium Alloys - MDP9

Active Packaging - MDP12

Boeing - CSIRO Joint Research Effort - MDP14

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

To apply fundamental skills in materials and alloy structure to the development of improved materials and methods of production for Australian industry. (15%)

1 Preparation of age-hardenable iron aluminides. Assessment of new TiAl duplex alloys.

2 Microstructural and property assessment of aluminium and magnesium alloys. Determination of alloying strategies for improvement of AZ91 and other Mg-Al alloys.

3 Establishment of competitive rare-earth conversion coatings technology for aluminium alloys, and delivery of technology to commercial partner.

4 Development of new corrosion resistant surface coatings for copper pipes.

5 Development of electroformed prototype tooling for injection moulding.

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. (28%)

6 Demonstration of the use of low grade alumina powders to produce inexpensive refractory materials.

7 Assistance provided in the production of batch quantities of SiC powder with commercial partners.

8 Fabrication of test non-consumable anodes with improved performance as part of MDP project on inert anodes with DMP and DMPE.

9 Identification and implementation of improvements in near nett-shape forming of manufactured ceramic components.

10 Continued support of refractory testing service for Australian mining companies in collaboration with IMEC Divisions.

To develop solid oxide fuel cells for electricity generation. (15%)

11 Construction and testing of cell stacks up to 100W capacity. Continued support for development of the technological capability of Ceramic Fuel Cells Ltd.

To develop collaborative projects based on advanced scientific and analytical instrumentation which will lead to the establishment of new, and strengthen existing, businesses in the manufacturing industry sector. (19%)

12 Prototype atom interferometer design initiated.

13 Development of new light sources for Atomic Absorption spectrophotometers with commercial partner.

14 Participation in imaging spectrometer design for a commercial collaborator.

15 Airborne mineral scanner delivered.

16 Design, construction and testing of a prototype X-ray imaging system.

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. (16%)

17 Development of a new process for the recovery of ZnO from ZnS ores.

18 Process optimisation and commercial viability assessment of carbon fibre pilot plant production.

19 Independent assessment of pigment-grade titania extraction process.

To develop techniques to optimise packaging and to develop environmentally benign packaging systems. (7%)

20 Development of new biodegradable packaging film for commercial partner.

21 Technological assistance provided to companies undertaking commercial development of controlled permeability film and ethylene scavenging film technologies.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$12,504,000
External funds	$5,000,000
Total Expenditure	**$17,504,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
30%	29%	32%

*estimates as at June 1994

12. Institute of Minerals, Energy and Construction

Objective

To play a major contributing role in the development of sustainable and competitive minerals, energy and construction industries in Australia and in the creation of a better living and working environment for all Australians.

Strategy

IMEC research serves industries whose profitability relies on world markets and prevailing economic conditions. As a result, factors external to IMEC impact on the Institute's operating environment and funding support base. The minerals, energy and construction industries together represent in excess of 20% of the GDP, over 50% of total merchandise exports and approximately 60% of total fixed private capital investment. On the world and domestic scenes the industries are expected to face improving economic conditions despite trade protection policies by major trading partners, emerging new trading nations and the environmental factors facing these industries.

- Ensure that research is directed to the major technological needs, both present and emerging, of industry.
- Play a major contributory role in the identification and development of new R&D based opportunities or industries.
- Ensure the Institute has the resources, facilities and reputation nationally and internationally to attract and retain top scientists and bright young graduates and to support and facilitate IMEC's research and technological application efforts.
- Deliver to the short and long term needs of our clients, and underpin future technological innovation by ensuring that sufficient strategic research is undertaken against strategic objectives and with multi-benefit outcomes.
- Maintain an adequate funding base to support existing and emerging priority research areas, strategic research, and provide an ongoing contribution to the major sectors served by IMEC.
- Strengthen synergies between the research efforts of Divisions within IMEC and between IMEC and other research bodies or groups both within and outside CSIRO.
- Achieve best management practices and a high level of management capability.
- Ensure recognition and support for the Institute from all stakeholder groups, organisational, public, political and industrial.
- Develop the capacity to anticipate and respond to crucial changes in the political and economic environment which are likely to have a major impact on the Institute.
- Ensure that the location and physical infrastructure fully supports and facilitates IMEC client applications and strategic research.

Planned Outcomes

1 Further implementation of portfolio analysis of research projects within IMEC. (Eval)

2 Development of enhanced strategic alliances with, amongst others, WMC, BHP, Comalco, CSR, Lend Lease, and ANI. (Perf)

3 Application of appropriation funds to strategic research and development of mechanisms to grow external earnings. (Perf)

4 Advancement of Institute redevelopment planning and activities for the establishment of new accomodation at North Ryde, Clayton, Highett, Perth and Pinjarra Hills.

5 Continued monitoring of industry needs in research and technology, and, where attractive and feasible, establishment of research programs.

6 Implementation of the IMEC Human Resources Strategy across the Institute.

7 Development of an IMEC finance strategy.

8 Implementation of the CSIRO Commercialisation Manual across IMEC.

SUMMARY OF RESOURCES, 1994-95

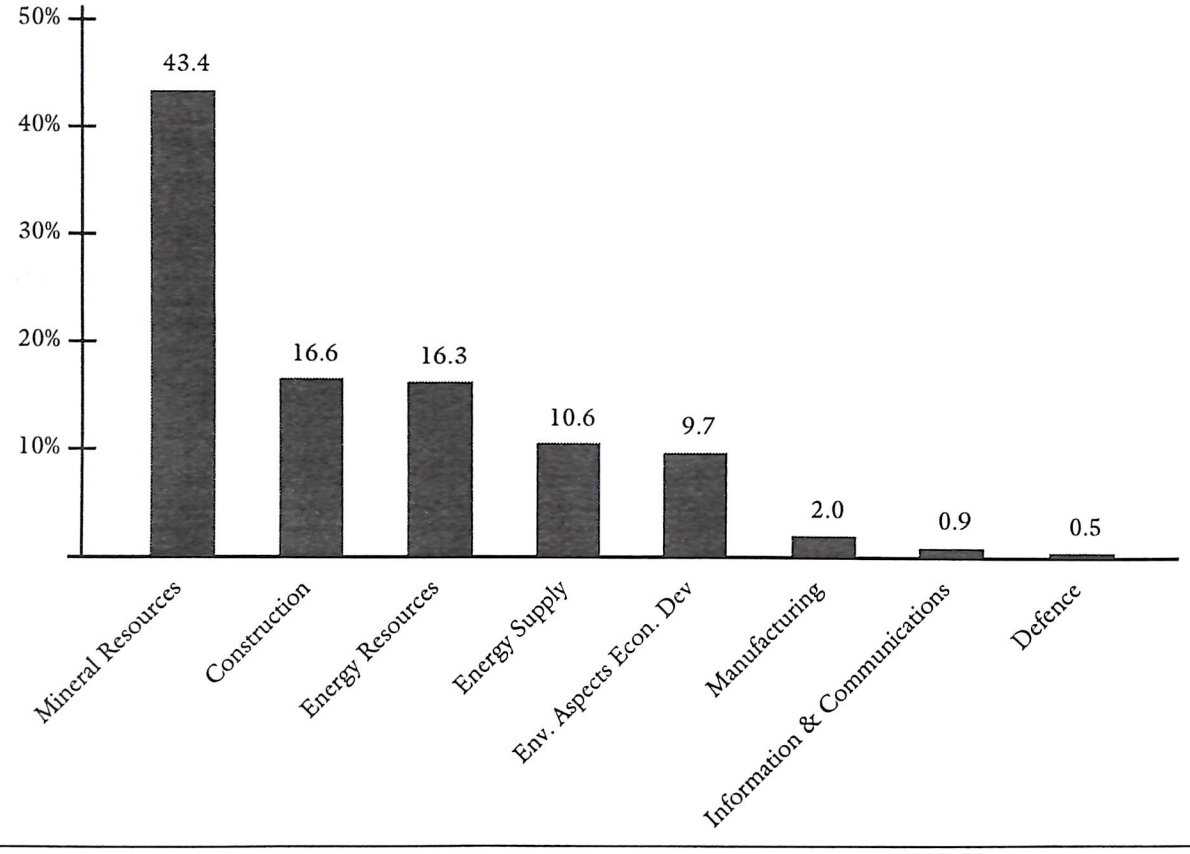
(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Building, Construction and Engineering	193	106	8	307	17,383	10,500	27,883
Coal and Energy Technology	133	56	6	194	10,377	8,700	19,077
Exploration and Mining	144	74	12	230	13,831	10,300	24,131
Mineral and Process Engineering	112	57	9	178	10,034	6,830	16,864
Mineral Products	90	62	7	159	8,458	7,965	16,423
Petroleum Resources	44	38	6	88	4,700	4,938	9,638
IMEC Institute Office[2]	0	13	4	17	4,171		4,171
TOTAL	716	406	52	1173	68,954	49,233	118,187
						41.6%	

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

[2]Includes Institute Managed Funds

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



13. Division of Building, Construction and Engineering (IMEC)

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 (15% if including services). It addresses more than 70% of total fixed capital investment 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 given R&D a greater focus in building international competitiveness. It is a major economic factor.

- Develop strong collaborative research ties with industry through the Construction Industry Development Agency (CIDA); 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 the industry through development of collaborative R&D projects and consultative work; input to 140 national and international standards committees; input to industry and professional associations; and input to education and training courses.
- Collaborate with international agencies 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

Urban Water Systems - MDP16

Climate Variability and Impacts - MDP29

Air Quality - MDP30

Specific Objectives & Planned Outcomes

Improve the life cycle performance of materials and components for constructed facilities. [Construction Materials Program] (21%)

1 Novel surface engineering techniques developed and applied in production of polymeric composites of recycled plastics and particulate rubber. Also to adhesive bonding and painting.

2 Methodologies for life-time prediction of metal products and plastic pipe systems.

3 Pollutant emissions from materials that affect indoor air quality determined.

4 Development of structural concretes utilising brown coal ash and high loadings of black coal ash completed.

5 Binder systems formulated and high performance concretes specified utilising industrial by-products.

6 Failure mechanisms of concrete structures identified and repair strategies identified.

7 Opportunities for the utilisation of municipal wastes, recycled concrete, marginal aggregates and industry wastes in construction explored.

8 A computer model to predict the failure mode of ceramic tiling systems developed and validated.

9 Development of novel gypsum products completed and opportunities in plaster and building stone products explored.

Improve the commissioning, operation and refurbishment of engineered products, components and services. [Engineered Products and Services Program] (27%)

10 Large area planar heat exchangers for combined radiation and convection heat transfer developed.

11 Improved prototypes of a personal cooling system developed with ADI.

12 Models of indoor air flow for heating, cooling, thermal comfort and contaminant dispersion in buildings.

13 Improved thermal design tools to assess energy use in commercial buildings.

14 More efficient and effective means of mixing fluids developed from agitator and mixing vessel models.

15 Model of the flow in the aeration step of the Becher Process.

16 Model of the fluid dynamics of shear vessels for the improvement of thickener performance.

17 Numerical prediction of the three-dimensional flow in a slurry pump and software transferred to the sponsor.

18 Low NO_x burner systems and combustion diagnostic tools.

19 Applicability of fluidics in plumbing to improve product performance investigated.

20 Prediction equations for sound absorption in polyester materials.

21 A probe to measure gas and particle flows in hostile environments.

22 A system for active control of noise in water filled pipes.

Improve the lifetime performance of structures in terms of the competing demands of safety, function and cost. [Structural Engineering Program] (15%)

23 Models of the interaction of wind, rain and hail with buildings using computational fluid mechanics, wind tunnel and field investigations.

24 Completion and commissioning of the Dynamic Weather Testing Facility.

25 Timber structural properties modelled as an input to international standards and collaboration with industry on in-grade structural properties of radiata pine.

26 Further development of masonry and metal framing design for domestic construction.

27 Further development of Australian structural standards and their harmonisation with relevant New Zealand standards.

Improve design and management procedures in building and construction to reduce construction times and costs while improving quality. [Construction Systems] (15%)

28 Performance based national building code developed; BCAider adapted to overseas building codes and integrated with product data bases.

29 Simulation, optimisation and visual models of construction flow process to identify time and cost reductions developed and applied to construction projects.

30 Artificial intelligence software development completed for sewer inspection system and extended to other infrastructure pattern recognition problems.

31 Models for embodied energy in constructed facilities developed; a CAD design tool produced and applied to projects.

Reduce the risks and costs of life and property losses through fire. [Fire Technology] (17%)

32 A product certification and labelling program established for passive fire protection products.

33 Publication of the hard-copy version of FIREDATA, the compendium of fire rated products, and development of the software version.

34 Negotiation of CSIRO's participation in the Fire Code Reform project and completion of the first project on restructuring the fire provisions of the Building Code of Australia.

35 A user-friendly version of the 3-D field model of fire gas flows suitable for commercial release.

Improve planning, design and management procedures applicable to housing, infrastructure and urban development in order to achieve more productive and sustainable cities. [Housing and Urban Development] (5%)

36 Contributions to the operational structure and research program of the Australian Housing and Urban Research Institute (AHURI)

37 Enhanced dynamic land-use transport and communication planning appraisal model based on TOPAZ developed under IMEC Productive Cities initiative.

38 Development of computer-based tools for network infrastructure planning and management; systems for terrestrial network visualisation and management and cellular mobile network optimisation, extensions to road/rail route optimisation and alignment model. (Align-3D)

39 Development of broadband applications in building, construction and planning. CAD Conferencing System operational on commercial networks.

40 Enhancement and marketing of suite of facility location models.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$17,383,000
External funds	$10,500,000
Total Expenditure	**$27,883,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
28%	38%	41%

*estimates as at June 1994

14. Division of Coal and Energy Technology (IMEC)

Objective

To increase the efficiency, competitive advantage and environmental acceptability of Australia's coal, energy and related industries.

Strategy

Whilst profit margins in the Australian coal industry continue to be low, the increased attention now given by the coal industry to coal R&D will provide opportunities for the Division to increase external funding levels and serve both long and short term industry needs. There is also an increasing worldwide demand for new technologies and processes which will provide cleaner production, higher efficiencies and improved waste management.

- Enhance ties with the coal industry and other research organisations to pool expertise and produce coordinated and effective projects which will enable the Division to be more competitive in seeking an increased share of the limited funding available for coal research.
- Allocate divisional resources and effort in support of priority areas: coal preparation and supply, utilisation of coals in advanced technologies for power generation and new environmental technologies.
- 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.
- 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. (25%)

1 Introduction of concept for objective measurement of inherent moisture in coal to the coal industry by December 1994. (ER4)

2 Commissioning of new facilities for coal surface science studies by December 1994. (ER4)

3 Initiation of new projects on sensors and instrumentation for coal quality assessment. (ER4)

4 Strengthening of collaboration with CMTE (including University of Queensland, JKMRC) by further joint project submissions for ACARP/BHPAC funding. (ER4, M12)

5 Completion of multi-process dewatering pilot plant and expansion of dewatering process technology activities. (ER4)

6 Initiation of projects on washability assessment, hyrdraulic splitting, riffled spirals and process control of froth flotation. (M12, ER4)

7 Establishment of technical and economic feasibility of fine coal recovery via oil agglomeration and of phosphorus reduction by chemical procedures. (ER4)

8 Determination of reasons for fluctuations in moisture levels of coarse coal after centrifuging and identification of remedial procedures. (M12, ER4)

9 Initial investigation of feasibility of engineering modifications and chemical additives to enhance dewatering. (ER4)

10 Evaluation of performance and cost-effectiveness of agglomeration process to improve handling and transport of coals. (ER4)

11 Complete statistical evaluation and report of an extensive industry coal-coke property database. (ER4)

Support the marketing of Australian coals in current and advanced technologies for the power and metallurgical industries, with emphasis on increased efficiency and economy and reduced environmental impact. (26%)

12 Collaboration with Pacific Power to commission laboratory-scale entrained flow pressure gasifier. (ER4)

13 Collaboration with coal and power industries in proposal for 4th round CRC on Clean Coal Technologies. (ER4)

14 Commissioning of test method and new laser reactor for assessing coal combustion reaction. (ER4)

15 Enhance work in control of gaseous and particulate pollutants and establish new work on advanced gas cleaning. (ER4)

16 Continued commercialisation of PMRTA technology including its introduction to Japanese coal utilisation industry. (ER4)

17 Refinement of capability of thermomechanical analyser for study of coal, pitch and carbon characteristics. (ER4)

18 Report on refined procedures developed to predict carbonisation properties of coal blends by December 1994. (ER4)

19 Increase collaboration with metallurgical industry on using coal in new technologies, eg PCI. (ER4)

20 Complete prototype of thin film carbon capacitor by December 1994.

Develop processes and equipment for the expanded use of Australian natural gas resources. (19%)

21 Completion of current project on reforming of natural gas by CO_2 as a means of energy storage.

22 Development of collaboration with KACST scientists leading to commencement of project on production of environmentally-acceptable octane enhancers.

23 Agreement with commercial partner for development of project on natural gas for direct iron ore reduction.

24 Initiation of projects on coalbed methane extraction. (ER2)

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. (18%)

25 Completion of research of impact of copper mining on algae of Fly River, PNG.

26 Determination of dependence of methane emissions on seam permeability of selected coals. (ER2)

27 Evaluation of effect of chlorine-free bleaching methods on toxicity of pulp mill effluent. (ED4)

28 Evaluation of a new method for removing selenium from flyash leachate.

29 Characterisation of mechanism of release of metals and organics from contaminated sediments.

30 Development of techniques for measurement of fugitive dust from industrial chimneys.

31 Complete plume data analysis for Air Quality MDP.

32 Assessment of current water quality in Bowen Basin pits and determination of spoil leaching characteristics. (ED7)

Reduce the environmental impact of the energy and minerals industries by development of new processes for minimisation, removal and destruction of waste. (13%)

33 Completion of design of demonstration-scale unit for soils contaminated with hydrocarbons.

34 Commissioning of fully integrated prototype unit for regeneration of transformer oils and destruction of PCB contaminants.

35 Demonstration of feasibility of prospective projects on octane enhancers, soil-cleaning using electrokinetics, and extraction and destruction of intractable wastes.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$10,377,000
External funds	$8,700,000
Total Expenditure	**$19,077,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
34%	38%	40%

*estimates as at June 1994

15. Division of Exploration and Mining (IMEC)

Objective

To improve the international competitiveness of Australian industry in the production of minerals and coal 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

Steadily declining commodity prices for minerals and coal over the past nine years have forced producers to increase production and export volumes to maintain revenue levels, whilst at the same time reducing their costs of production. Indications are that further productivity gains can be achieved by even more extensive use of advanced technologies. The Division aims to:

- Establish and maintain 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.
- Realign the physical resources of the Division through restructuring of Programs, to optimise the effectiveness of the Division in matching the logical continuum of company activities (area selection, area evaluation, deposit delineation, excavation design and engineering, mining technology and equipment and mining environmental management).
- Build strong commercialisation alliances with selected mining equipment manufacturers, and speed the transfer of technology to 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

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. (11%)

1 Exploration strategies for world-class nickel deposits.

2 Archaean volcanogenic deposits of base metals and gold in Australia.

3 Deep lithospheric mapping for diamondiferous kimberlites and lamproites.

4 Resistate indicator minerals for hydrothermal/deuteric ores.

5 Hydrothermal / porphyry copper - gold deposits in Australia and the Pacific Rim.

6 Development of the AUSTRALIS analytical facility.

To produce an integrated synthesis of the geodynamics of the larger scale rock movements, deformation and geological processes that have formed the Australian continental plate over geological time and improve the success rate for Australian exploration companies looking for new world class minerals and energy deposits. (7%)

7 Development of a 4D computer model to constitute the next generation of the Tectonic Map of Australia.

8 A major 2D seismic reflection profile across the Mt Isa Inlier in NW Queensland with coordinated tectonic synthesis.

9 Geodynamics history of the Australian continent.

10 Construction of an integrated tectonics-geophysical analysis package.

To develop more effective concepts, methods and technologies that will optimise area evaluation in the search for world-class mineral deposits in terrain types of strategic importance to the Australian mineral industry. (15%)

11 Improved methods in exploration in areas of deep weathering or transported overburden.

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

13 New initiatives for exploration to locate blind, high quality iron ore deposits.

14 Development of empirical relationships between the mineralogical features of ore deposits and non-invasive exploration techniques.

15 Operational capabilities for monitoring the distribution of arid and semi-arid vegetation characteristics by use of satellite imagery.

To dramatically improve exploration technology for Australian conditions. Key areas are electromagnetic (EM) including airborne EM and airborne gravity. (7%)

16 3-D maps of conductivity, resistivity contrast and polarisation of the regolith to develop empirical relationships for mineral exploration.

17 Improved signal/noise performance of Airborne Electro-Magnetic systems to detect targets to 300m depth.

18 A dramatic increase in the cost-effectiveness of EM and AEM systems.

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

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

To develop concepts and technologies by which mining companies may improve the visualisation, evaluation, definition and delineation of the 3D geometry of economic mineralisation associated with anomalous areas or existing deposits, and improve their capability to manage and interpret the data and so optimise the subsequent mining process. (21%)

21 New geophysical methods to accurately characterise deposits in 3D.

22 Integrated/interactive modelling capabilities for 3D geoscience data.

23 Effective technology transfer to industry.

To enhance the capability of mining companies to optimise the excavation design, the mine layout, and the extraction process to minimise dilution from an improved understanding of rock mass characteristics, and its behaviour under the influence of mine operations. (11%)

24 Improved methods for determining the geomechanical characteristics of the rock mass during mining operations.

25 New pre- and post-excavation design techniques to optimise mineral extraction.

26 Enhanced geomechanical sensing technologies to forewarn against excavation instability.

27 Laser scanning system for mapping joint structures in exposures and fragment sizes in muck piles.

To develop more efficient methods of breaking rock, develop prototype equipment based on new methods of mining, and enhance the performance of existing mining equipment. (12%)

28 Improved methods of production scheduling.

29 Geophysical characterisation of an orebody for production purposes.

30 Improved methods of controlled rock breakage.

31 Improved equipment technologies.

To develop solutions to environmental problems facing the metalliferous and coal mining industries, to develop new technologies which can maintain the highest standards of occupational health and safety in the industry, and to monitor its impact on the broader community. (10%)

32 Improved methods for a safer operating mine environment.

33 Sustainable rehabilitation methods for reconstructed mining landscapes.

34 New containment and monitoring technologies for subsurface pollution in natural and newly generated rock or mine wastes.

35 New geoscientific instrumentation, expertise and tools to locate and monitor ground conditions for safe, long term containment of high level nuclear wastes.

To develop the Division's scientific support services and enhance the overall research ability in minerals exploration and mining, particularly health and environmental issues. (6%)

36 Environmental and occupational health issues addressed as a basis for developing remedial, industrial and environmental strategies.

37 Prediction of the weathering processes and products of waste rocks, tailings and spoil.

38 Improved skills to monitor the effects of pollutants on vegetation, the regolith and groundwaters.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$13,831,000
External funds	$10,300,000
Total Expenditure	**$24,131,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
39%	40%	50%

*estimates as at June 1994

16. Division of Mineral and Process Engineering (IMEC)

Objective

To play a leading role in defining and implementing technology in Australia's mineral processing and metal production industries.

Strategy

The industries served by the Division contribute over $30 billion per annum to the Australian economy and rely on continued technological advances and effective application of technology to maintain their competitiveness in world markets. The depressed world market for commodities places increasing demands on the Division to perform in areas of high research leverage. The Division's strategy is to:

- Develop strategic alliances with those companies whose mineral processing and/or metal production activities will be significant to Australia in the first decade of the next century.
- Create a continuous improvement culture within the Division to improve productivity and delivery of quality R&D.
- Develop a portfolio approach to the prioritisation and establishment of the Division's research activities.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4

Aluminium Production - MDP5

Heavy Mineral Processing - MDP6

Iron Ore Processing - MDP8

Magnesium Alloys - MDP9

Magnesium Production - MDP10

Specific Objectives & Planned Outcomes

Develop new and improved mineral beneficiation and primary processing methods to add value to Australia's mineral resources. (31%)

1 Laboratory evaluation of a new approach to counteracting the effects of metal hydroxides on flotation separations.

2 Confirmation of the functionality of the CSIRO iron ore group classification scheme and its implications for mineral processing.

3 Development of the rotary swirl dust agglomerator for capture of fine dusts completed. (MI2)

4 The measurement of oxygen concentration using QEM*SEM demonstrated.

5 Enhancement of the capability of QEM*SEM to characterise nickel minerals and development of a comprehensive capability in gold mineralogy.

6 Requirements for consolidation of the Mineral Processing Research Group at Pinjarra Hills integrated into the QCAT Strategic Plan. (M12)

Improve existing high temperature mineral processing systems and develop new processes for secondary processing of mineral products. (26%)

7 Demonstration of the technical and economic feasibility of producing aluminium and magnesium by carbothermic reduction. (MI1)

8 Research leading to the piloting of a technique for the production of blister copper using Isasmelt technology. (MI3)

9 Completion of construction and commissioning of a DC arc furnace at Clayton. (MI3)

10 Continued development of physiochemical models of slag systems. Extension of the techniques to aluminium electrolytes.

11 Completion of industrial studies of copper flash smelting targeted at improving existing operations.

To improve the productivity of the mineral, energy and process industries by developing and applying new and improved instrumentation and control strategies. (22%)

12 Plant test of gauges for the on-line determination of pulverised coal mass flow and commence commercialisation.

13 Commercialisation of gauge for the on-line determination of gaseous hydrogen fluoride concentrations over long paths in aluminium smelters.

14 Development and plant test of on-line gauges for the determination of pre-reduction degree and hot ore mass flow in iron ore smelters.

15 Installation and calibration of prototype commercial gauges for the on-belt determination of aluminium, manganese and moisture in iron ores.

Enhance process optimisation and the exploitation of new concepts aimed at developing more efficient processes in the mineral processing and energy industries. (21%)

16 Establishment of capacitive/microwave tomographic imaging in fluidised bed systems for flow-field visualisation and validation of computational fluid dynamic models.

17 Provision of ongoing support for commercialisation of the HIsmelt direct ironmaking process.

18 Establishment of a dedicated techno-economic evaluation group to enhance Divisional decision-making in terms of future project selection. (Eval)

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$10,034,000
External funds	$6,830,000
Total Expenditure	**$16,864,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
38%	37%	39%

*estimates as at June 1994

17. Division of Mineral Products (IMEC)

Objective

To deliver successful R&D and its consequent economic benefits to the Australian mineral processing, metal production and energy storage industries, especially in the areas of value-added processing and products.

Strategy

The Division undertakes research in support of the value-added mineral processing and metal production industries of Australia, and the energy storage segment of the economy. These industries require process improvements and innovations in order to remain technically advanced and internationally competitive and to meet environmental requirements. Important opportunities also arise for the Division to provide technology to support the emergence of new mineral resource-based industries. In order to set and achieve its goals, the Division implements the following strategies:

- Maintain a world class research skills base in key chemical and mineral sciences relevant to the current and emerging needs of the minerals industry.
- Identify the key strategic issues facing the mineral processing, metal production and energy storage industries, amenable to the Division's research efforts and expertise.
- Through external funding arrangements, ensure that the Division has clients who have identified a need for the outcomes of the Division's research and are committed to their commercial development and application.
- Ensure that the Division's project portfolio contains a balance between collaborative or contract research with an existing client focus and appropriation-funded research directed towards the potential needs of future clients.
- Foster a continuous improvement culture within the Division in line with the newly introduced Commercial Practices Manual to improve productivity and delivery of quality R&D.
- Maximise the potential of the Division's human resources through implementing sound work-force planning procedures, effectively recruiting and training staff for their careers in CSIRO, and consistently rewarding staff whose performance advances the Division towards its strategic objectives.
- Capitalise on the synergies between the Division of Mineral Products and the Division of Mineral and Process Engineering.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4

Aluminium Production - MDP5

Heavy Mineral Processing - MDP6

Magnesium Production - MDP10

Specific Objectives & Planned Outcomes

Improve the productivity, product quality and product range of Australian alumina refineries. (15%)

1 Development of further skills in the areas of solution speciation and polyelectrolyte characterisation in alumina processing.

2 Improvement in understanding mechanisms of silica dissolution and "desilication product" precipitation to reduce caustic soda losses.

3 A model to describe the effects of the impact of organic compounds on alumina hydrate precipitation.

Improve the international competitiveness of Australian mineral sands operations by improvement of existing processing routes and by the introduction of new technologies and marketable products. (25%)

4 Development of an optimised model for the reduction and leaching processes that takes account of different ilmenite deposits and coal/char types.

5 Determination of the thermodynamics of ilmenite reduction in the presence of magnesium, manganese, aluminium and chromium.

6 Establishment of a new project on the fundamentals of the little-studied aeration step in the Becher process.

Develop processes, products and product applications that will expand existing, and create new, market opportunities for Kunwarara magnesite. (7%)

7 Develop a strategic research plan to provide a sound framework for long-term research aimed at developing new and existing processes and products for basic magnesia refractories.

8 Optimisation of the conditions for the formation of magnesia slurries and development of a better understanding of the precipitation mechanism needed to tailor product properties for specific applications.

9 Development of methods to produce magnesium hydroxide with suitable characteristics for application as a fire retardant in plastics.

Improve storage devices in energy conversion and delivery systems. (16%)

10 Seek opportunities to establish research in alternative (to lead-acid) battery systems, particularly those that use metals for which Australia is a major supplier.

11 Securing support for new research opportunities in novel lead/acid battery grid alloy compositions, fast recharging techniques and intelligent control systems for the management of battery packs.

12 Development of innovative techniques to solve the critical problem of premature capacity loss in lead/acid batteries.

13 Increased productivity of lead/acid battery manufacture through reduction in the formulation time for positive plates.

Support development of aluminium technology that will increase the proportion of Australian raw materials processed locally, improve smelter productivity and reduce environmental impacts of the aluminium industry. (20%)

14 Identification and evaluation of ceramic-based materials suitable as inert anodes in aluminium smelting cells.

15 Quantification of electrochemical performance of aluminium smelting cells that employ advanced electrolytes.

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. (11%)

16 Improvement in cell design and efficiency of power utilisation through hydrodynamic modelling of electrowinning cells.

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

Assess and control the impact of pollutants on fresh and marine water systems. (5%)

18 Demonstration of the technical viability of novel microelectrode arrays as detectors for environmental monitoring.

Improve the efficiency of gold extraction in Australian carbon-in-pulp operations. (1%)

19 Identification of the relationship between ore mineralogy and reagent consumption.

20 Establishment of technical feasibility of the alternative process of slurry electrolysis to extract gold from arsenopyrite ores.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$8,458,000
External funds	$7,965,000
Total Expenditure	**$16,423,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
39%	38%	38%

*estimates as at June 1994

18. Division of Petroleum Resources (IMEC)

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 by 1997. (48%)

1 Continuation of the second stage of a demonstration study of organic parameter relationships. (Eval)

2 Continued testing and commissioning of fluorescence microprobe. (EX1, EX2)

3 Completion of petrographic and geochronologic analysis of reservoir from NW quadrant. (EX1)

4 An assessment of fluid dynamics/oil generation and migration theory. (EX1)

Development of tools for characterising and interpolating reservoir heterogeneity for use in petroleum reservoir development and management. (8%)

5 A software package that uses seismic data to interpolate petrophysical data from well logs. (EX1)

6 Extension of existing sedimentary depositional models and application of models to specific locations within Australia. (EX1)

7 Establishment of a petroleum x-ray computer-aided tomography scanner for use as a facility in future exploration and production projects. (EX1)

Development and assessment of technology to manage stress-induced instability encountered in wellbores in major Australian oil and gas basins by October 1996. (15%)

8 Preparation of a draft stress orientation map for the Australian basin. (EX1)

9 Completion of strength parameter tests on a model shale material. (EX1)

10 Completion of concepts to incorporate time dependent stress changes in procedures developed to assess stability and analyse risk. (EX1)

Development of a fundamental understanding, and verification by field and laboratory investigation, of range of stimulation technologies for use in the oil and gas and coalbed methane industries. (29%)

11 Preparation of a position statement to assist research decisions relating to the development of the Australian coalbed methane industry. (EX2)

12 Development of an improved method of modelling hydraulic fracturing. (EX2)

13 Identification and evaluation of material and environmental parameters critical to stimulation of coalbed methane by cavitation. (EX2)

14 Preparation of an interim report on the relative importance of factors controlling coal seam permeability. (EX2)

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$4,700,000
External funds	$4,938,000
Total Expenditure	**$9,638,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
48%	46%	53%

*estimates as at June 1994

19. Institute of Animal Production and Processing

Objective

To enhance the global competitiveness of Australia's animal-based and food industries, the health and well-being of all Australians and the wise long-term use of the nation's natural resources for these purposes.

Strategy

The livestock and food and fibre processing sectors generated value-added wealth of almost $16 billion in 1991/92 with a very strong export orientation. In the same year health service expenditures were $30.5 billion. Together these represented around 12% of GDP. Over the medium term there are excellent growth prospects for the rural-based manufacturing (including processed foods), veterinary pharmaceutical and health sectors; good prospects for beef cattle, dairy and intensive livestock; but static prospects for wool.

- Allocate research resources and manage projects in accordance with CSIRO and Institute priorities guided by customers' needs and advice from the CSIRO Agricultural Sector Advisory Committee.
- Seek collaboration with other CSIRO Institutes and research organisations in defining research opportunities and conducting research.
- Ensure a balanced portfolio of research programs and skills, with longer-term strategic research and short-term applied research, supported by external funds where the benefits are of a private, marketable type.
- Strengthen working relationships with business enterprises, rural research and development corporations, and public bodies.
- Manage research through devolution of line responsibilities, commitment to objectives and milestones, and the measurement and rewarding of performance against these.
- Develop business and marketing plans for each business area, covering targeting of potential customers, prospective cost:benefit evaluations and market research to estimate benefits to the nation and potential customers, selection of the most appropriate patenting and commercialisation strategies, and effective interaction with customers from business enterprises, industry organisations and government departments.

Planned Outcomes

1 Completion of marketing strategies for the beef and wool business areas, further development of strategies for processed food and veterinary products, and initiation of strategy development for aquaculture. (Eval)

2 Development of MDPs for gene mapping, aquaculture, biosensors, dryland farming/catchment care and climate variability, involving IAPP Divisions.

3 Establishment of a joint venture in food research with the Victorian Government Food Research Institute and completion of plans for moving the Dairy Research Laboratory to Werribee Technology Park.

4 Relocation of McMaster Laboratory to the Prospect site.

5 Complete implementation of new strategic directions for the Division of Food Science and Technology in accordance with the accepted recommendations of the 1992 Review. (Eval)

6 Carry out a wide ranging review of CSIRO's wool related research. (Eval)

7 Completion of the review of CSIRO's research in human nutrition. (Eval)

8 Strategic planning of research program priorities in collaboration with other Institutes, particularly IPPP, on a business area basis. (Eval)

9 Develop plans for, and obtain commitment to, the Institute's rationalisation and restructure in accordance with its future sustainable funding base.

10 Development of a professional Commercial Group whose focus will be on the formation and maintenance of strong networks with CSIRO Divisions and the market place.

11 Development and implementation of workshop programmes to effectively facilitate the phasing in of best commercial practice principles as promulgated by the CSIRO Commercial Practice Manual.

12 Development of an IAPP information kit to support commercialisation activities.

13 Development and implementation of an IAPP promotional plan based upon market research into stakeholder information preferences; sound criteria for prioritising communication activities; allocation of resources to reflect those priorities.

14 Maintain commitment to maximising redeployment opportunities for potentially redundant staff, including the completion of skills exercises in all Divisions.

15 Induction and guidance for the new Institute Director (expected appointment January 1995).

SUMMARY OF RESOURCES, 1994-95

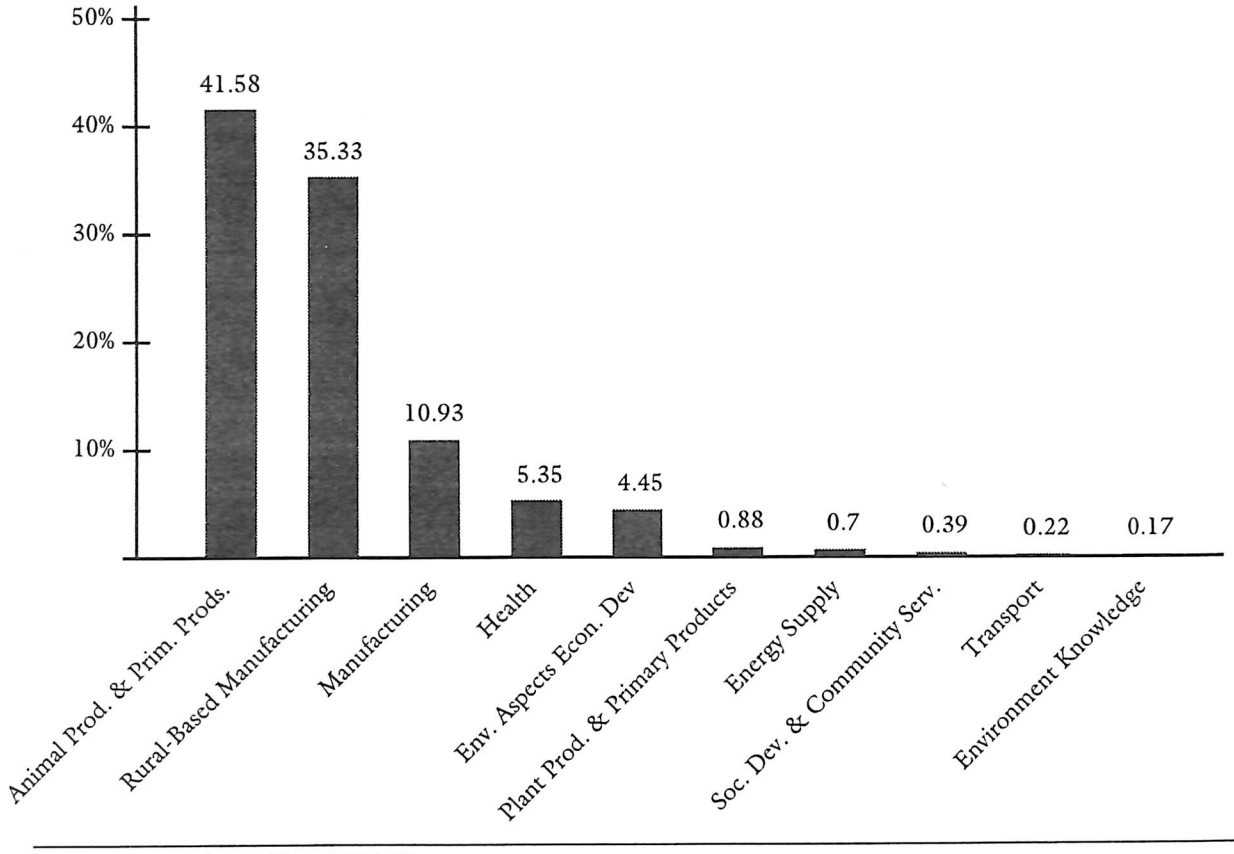
(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Animal Health	104	57	7	168	8,223	4,220	12,443
Australian Animal Health Laboratory	37	143	2	182	6,140	7,595	13,735
Animal Production	118	120	10	248	10,998	8,077	19,075
Food Science and Technology	184	70	3	257	15,497	9,413	24,910
Human Nutrition	44	63	5	111	5,562	3,162	8,724
Tropical Animal Production	65	69	3	137	7,936	3,879	11,815
Wool Technology	186	118	14	318	11,697	15,659	27,356
Biometrics Unit	9	0	0	9	538	20	558
Institute Headquarters	0	12	7	19	2,891		2,891
Institute Specific Funds[2]	0	0	0	0	500	5,616	6,116
TOTAL	747	652	51	1449	69,982	57,641	127,623

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

[2]Includes $1500k for Divisional activities yet to be approved; $500k for "Technology Transfer to SMEs"; and $4000k second year costs of retrenchment program approved in 1993-94.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



20. Division of Animal Health (IAPP)

Objective

To discover and develop methods and products for the diagnosis, control or eradiction of the major endemic diseases of farm livestock in temperate Australia to improve the quality and marketability of livestock products and enhance Australia's capability and preparedness to combat exotic livestock disease outbreaks.

Strategy

The Division plays an important role in reducing the impact of endemic diseases on the health, welfare and productivity of farm animals and in maintaining Australia's preeminent status in freedom from major epizootic animal diseases. Freedom from disease confers trade advantage for Australia's livestock products. The Division's strategies are to:

- Develop new diagnostic tests, subunit vaccines, vaccine delivery systems and disease control methods compatible with sustainable agricultural systems.
- Develop a diagnostic capability and effective control methods for those exotic diseases that represent the greatest threat to Australia so as to complement the activities of State and Commonwealth disease control authorities.
- Collaborate with other bodies and institutions to facilitate research, obtain external funding for projects, and where appropriate, develop commercial opportunities to maximise the benefits to Australia of research results.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Mapping - MDP26

Biosensors - MDP27

Specific Objectives & Planned Outcomes

Develop new or improved vaccines and diagnostic tests to control or eradicate the economically important bacterial diseases of livestock and poultry. (19%)

1 A new avian viral vector constructed and the potential of avian cytokines as vaccine adjuvants evaluated. (MF5)

2 The vaccine potential of a new strain of avian *Coccidiosis* evaluated.

3 Antigens of *Mycobacterium paratuberculosis* (Johne's disease) identified and evaluated for species specificity, and new technologies for diagnosis of footrot compared in a multicentre collaborative project.

develop sustainable control strategies for internal parasites of sheep and cattle. (21%)

4 Prototype recombinant vaccine against Barber's Pole worm of sheep evaluated for efficacy and production responses and interaction with genotype under field conditions. (AP4)

5 Product development completed with commercial partner for novel anthelmintic formulations for sheep and cattle.

6 Delivery systems finalised for biological control of pasture populations of sheep nematodes using nematophagous fungi.

7 Recommendation finalised for nutritional strategies to enhance immunocompetence against internal parasites in young sheep.

Develop methods for diagnosis, treatment and prevention of poisoning diseases of livestock caused by natural toxicants of plant and microbial origin, and reduce their contamination of food. (6%)

8 Efficacy of an antidote to treat annual ryegrass toxicity established.

9 Efficacy of a vaccine to prevent annual ryegrass toxicity assessed.

10 Immunoassay for detecting trace levels of corynetoxins in plant and animal food products evaluated.

Improve the efficacy of current vaccines and the design and delivery of new vaccines for livestock. (10%)

11 Expression of foreign antigens in bacterial vaccine vector. (MF5)

12 Determine adjuvant potential of recombinant cytokines. (MF5)

13 Test efficacy of new CLA vaccine in sheep. (MF5)

Develop and maintain diagnostic services for exotic diseases of livestock and diseases of fish and provide laboratory diagnostic support, training in exotic animal diseases and expert advice to government agencies. (13%)

14 Three hundred wild pig sera from the Northern Territory tested to establish background reactivity in standard tests for important exotic diseases.

15 Immunoperoxidase tests to identify viral haemorrhagic septicemia virus and infectious haematopoietic necrosis virus in salmonid fish tissues, developed and validated.

Devise and assess new techniques for the identification and characterisation of pathogens that cause specified exotic diseases of livestock. (15%)

16 Australia's diagnostic capability for hog cholera improved without using live virus so that tests can be transferred to regional laboratories within Australia.

17 Examination of the impact of rabbit haemorrhagic disease virus when introduced into small natural rabbit populations living in remote locations as the first stage in the field assessment of the potential of rabbit haemorrhagic disease for the biological control of wild rabbits.

Investigate the structure and genetic organisation and immune response to selected viruses for application in disease control and vaccine delivery. (16%)

18 Final transfer of diagnostic technology from AAHL to the Berrimah Agricultural Research Centre thus enhancing Australia's capability to detect northern disease incursions.

19 Development of a new research method utilising recombinant bacteriophages to rapidly screen and identify antigenic sites in virus proteins.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$8,223,000
External funds	$4,220,000
Total Expenditure	**$12,443,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
37%	37%	35%

*estimates as at June 1994

21. Division of Animal Production (IAPP)

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

Of Australia's two major livestock industries, the beef industry appears poised for further growth and expansion, whereas the wool market difficulties are widely predicted to continue for several years.

- In this context, the Division must deliver such outcomes as will aid in the sustainable and profitable expansion of the meat industry, and as will aid in product quality improvement and cost reduction in the wool industry.
- It must nevertheless continue to provide a strong research base for the eventual recovery of the wool industry.
- The likelihood that direct funding for animal research will be static at best for several years means that the Division must as a matter of urgency maintain and develop strategic alliances with strong growing companies in the global animal production industries.
- In addition, the Division must exploit to the full the new collaborative links in the three CRCs with which it is closely associated.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Fibre Utilisation - MDP3

Gene Mapping - MDP26

Climate Variability and Impacts - MDP29

Specific Objectives & Planned Outcomes

Improve the quality of meat for specific domestic and export markets and enhance the efficiency of its production. (28%)

1 Determination of optimal processing conditions for high oleic sunflower seed, canola seed, soybean and lupin for feed supplements.

2 Determination of optimal composition of Rumentek supplement for different feedlot markets.

3 Determination of optimal lipid/protein supplements for feedlot dairies.

4 Contract to commercialise protected anthelmintic technology for sheep and cattle.

5 Release of AUSPIG version 3.00, including improvements to simulation of effects of hot climate conditions, in Australia.

6 Completion of AUSBEEF FMRS (Feedlot Management and Recording System) for commercial release.

7 Nutrient repartitioning trial carried out on prime lamb immunised against clenbuterol specific antibody to determine potential commercial utility of the antibody. (AP5)

8 Complete disposal of high rate-of-lay poultry flock to QDPI.

9 Complete assessment of the production and reproduction performance of two commercial dam lines of meat chickens and White Leghorn layer line under conditions of restricted and adlib feeding, identifying the endocrine mechanisms contributing to the low reproductive performance of broiler breeders.

Develop optimum procedures for improving wool quality and sheep production efficiency through superior breeding technologies. (13%)

10 Completion of a study of the fibre diameter distribution, wool quality and fleece structure attributes of the Peppin Merino stud population of New South Wales to derive industry-based estimates of associations between these traits. (AP1)

11 Completion of software to allow the national Merino sire evaluation database to be used throughout Australia for advanced genetic evaluation procedures. (AP1)

12 Completion of breeding program designs specifically for fine and superfine wool genotypes. (AP1)

13 Determination of the potential for experimentally selected Merinos to be used in industry flocks to improve nematode resistance. (AP3)

14 Completion of a commercialisation plan for the Booroola Leicester sheep breed.

Improve the textile quality of Australian wool, reduce the environmental impact of its processing and increase the efficiency of its function through manipulating skin function. (25%)

15 Contract with a new commercial partner to initiate commercial release of biological wool harvesting technology.

16 Demonstration of the efficiency of recombinant plant chitinase against the sheep blowfly larvae on the sheep's back. (AP3)

17 Production of transgenic mice containing a tyrosinase gene and an anti-sense tyrosinase gene to eliminate ultimately pigmented fibres in sheep. (AP1)

18 Test of whether the combination of the metallothionein promoter and the cysteine producing bacterial genes are lethal in early stage sheep embryos. (AP1)

19 Establishment of embryo culture systems for producing transgenic sheep. (AP3)

20 Isolation and characterisation of the sheep MT-1b promoter for subsequent use in altering gene expression in the wool follicle bulb. (AP1)

21 Isolation of the sheep FGF-5 gene. (AP1)

Sustain the long term viability of animal production from pastures. (34%)

22 Determination whether cortisol affects differently the staple strength of sheep that differ genetically in susceptibility to tender wool and the relative importance of cortisol on follicle shutdown and fibre diameter reduction in the decline in staple strength. (AP1)

23 Determination of the merits of canola meal as a short term protein supplement for preventing reduction in wool growth in late pregnancy and increasing staple strength of reproducing ewes.

24 A map of major pasture types based on a broad botanical composition in three areas of the high rainfall zone based on remote sensing data.

25 Determination of the effects of the anti-parasitic drug Ivermectin on soil fauna.

26 Approval by regulatory authorities of a test system for *in vitro* quality control of ruminal slow release devices for anthelmintics and other products.

27 Development of a practical indicator of molybdenum status of sheep under field conditions.

28 Determination of the ability of superior fungal strains to enhance digestibility of poor quality forage by sheep.

29 An agreement with a commercial partner to commercialise a natural defaunating agent obtained from an organism native to Australia.

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
43%	41%	34%

*estimates as at June 1994

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$10,998,000
External funds	$8,077,000
Total Expenditure	**$19,075,000**

22. Division of Food Science and Technology (IAPP)

Objective

To provide the Australian food industry with new processes or technologies for the efficient production of processed foods, including meat and dairy products, 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 greatly increase its exports, particularly of value-added processed foods to expanding markets in Asia. To do this it will need to improve its international competitiveness, address market specifications and provide "clean, green" foods of consistent quality.

- Acquire knowledge of the chemical, physical, biological and psychophysical attributes of foods and food components.
- 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:

Active Packaging - MDP12

Process and Maintenance Optimisation in Manufacturing - MDP15

Biosensors - MDP27

Smart Manufacturing - MDP28

Specific Objectives & Planned Outcomes

Develop new microbial cultures for use in dairy processing, establish the efficacy of using probiotic organisms in foods, and improve microbiological quality of dairy products. (6%)

1 Clinical trial using anti-gastritis probiotics completed.

2 Efficacy of probiotics for protection against cancer in rats established.

Develop and commercialise technologies for the manufacture and utilisation of novel milk protein products for the benefit of Australian dairy manufacturers. (6%)

3 Commercial operation of technology for manufacture of whey growth factor extract.

4 Novel technology developed for manufacture of beta-casein, a dairy protein food ingredient with unique nutritional and physical functional properties.

Devise new or improved products for improvement in manufacturing profit margin for Australian cheese and milk powder manufacture. (6%)

5 Cost-effective cow diet for improving the functionality of late-season cheese milk proven in commercial trials.

6 New surface-active milk powder process technology transferred to industry.

Develop new and improved processes and technologies for the processing, packaging and transport of foods for the Australian industry. (16%)

7 A pilot-scale, twin-screw food extruder, installed and commissioned.

8 Extrusion-processed protein sources produced for evaluation in aquaculture diets.

9 PMOM: consultations with industry; definition and implementation of appropriate projects.

10 Production of commercial oxygen detection films for permeation measurements on packaging films. Development of these films as freshness indicators for packaged foods.

11 Evaluation of sulphur dioxide emitting films for the preservation of selected varieties of Australian table grapes.

12 Completion of a Cold Chain Study, examining temperature management of chilled and frozen foods during transfer from manufacturer to retail outlet.

By 1997, determine factors responsible for sensory quality of foods on domestic and selected export markets. (15%)

13 Chemical contaminants derived from packaging materials in foods identified.

14 Establishment of food preference studies in Asian markets and continuation of sensory evaluation services in Japan and Asia. (RM1)

Provide a microbiological, including mycological, basis for the safe processing and storage of foods and to modify foods and develop food ingredients with improved nutritional and functional properties. (15%)

15 Derivation of a predictive model for the responses of *Aspergillus* species to temperature and water activity.

16 Assessment of fungal contamination and potential for mycotoxin production in wheat.

17 Expanded range of polysaccharides from plant cell culture tested in foods, cosmetics, health care and industrial applications.

18 The microbiological status of Australian beef and sheep meat determined, and the impact of new processing technologies on this baseline microbiological quality assessed.

19 Improved methodology for the isolation of *E. coli* 0157 and assay animal and meat isolates for the presence of factors necessary for pathogenicity.

Transfer information and technology to the food industry and consumers. (3%)

20 Provision of information and technical publications for the food processing industries and to consumers.

Improve the quality of meat and meat products, especially that exported with high added value. (24%)

21 Assessment of meat quality of grain-fed and grass-fed CRC 'core' gene market and 'collagen' cattle.

22 Evaluation of the interaction between beef marbling and cooking method, and degree of 'doneness' on taste panel assessments.

23 Evaluation of the quality of hot-boned Australian and New Zealand table meats and determination of total processing systems for the hot-boning of beef carcasses.

24 Processing and handling factors which affect the appearance and eating quality of Australian beef in Japan and Korea identified.

25 Measures of collagen stability that are indicative of its role in meat texture determined.

26 An optimal way to monitor pigmeat quality determined and applied to investigate the influence of processing factors on the quality of pork products.

27 Factors that influence the display-life of fresh meat determined.

Improve the efficiency of converting livestock to beef. (9%)

28 Commercialisation of *Fututech.*

29 Development of additional machines for the *Fututech* automated slaughter facility and conventional abattoirs and provision of technical expertise of Fututech Pty Ltd.

30 Development of modules to improve productivity in beef fabrication.

Summary of Planned Expenditure 1994-95*

Direct Appropriation	$15,497,000
External funds	$9,413,000
Total Expenditure	**$24,910,000**

External Earnings as a Proportion of Total Income*

1993-94	1994-95	1995-96
44%	40%	39%

*estimates as at June 1994

23. Division of Human Nutrition (IAPP)

Objective

To improve human well-being and community health and reduce the incidence of diet-related disease in Australia by nutritional and other means including influencing the production and consumption of the appropriate foods.

Strategy

Increased Government and consumer expectations of nutrition based solutions to health problems, and the capacity and willingness by the food industry to produce foods that satisfy those expectations, provide major opportunities for the Division's R&D.

- Conduct research to develop an understanding of those nutrition-related disorders that account for the greatest morbidity and mortality within the Australian community and communicate and explain the application of these findings.
- Encourage and actively collaborate with food and health care industries to produce and evaluate foods with optimal nutritional characteristics, and other therapeutic agents.
- Develop techniques for improving nutritional knowledge and behaviour in the community and transmit that information to community health agencies and to food industry.
- Maintain a strategic approach to integrating and improving links with the food and pharmaceutical industries to develop business plans for newly identified opportunities.
- Collaborate with other CSIRO Divisions and research institutions including participation in CRCs, to maximise Australia's skills and knowledge in the health, food and pharmaceutical industries.

Specific Objectives & Planned Outcomes

Develop diets and assist industry to develop foods with altered fat and fibre composition and develop other health strategies that will reduce the national risk from cardiovascular diseases. (13%)

1 Dietary fatty acid and novel plant antioxidant mix to minimise heart disease including specific areas of women's health. (RM5, HE1)

2 New cholesterol-lowering margarines and modified dairy products for the consumer and food service areas. (RM5, HE1)

Investigate the protective and cancer-causing factors in food with a view to advising the health, food and pharmaceutical industries on nutritional strategies to help reduce the incidence of cancer in Australia. (18%)

3 Novel plant and other antioxidants for incorporation into foods to prevent mutation changes. (HE1)

4 Cereal and legume fibres and proteins, and fermented milk products to protect bowel health. (HE1)

To promote the well-being of the Australian community and food industry through the development of targeted nutrition intervention and food policy strategies. (16%)

5 Point-of-Sale strategies, including food labelling, to improve consumer awareness of the nutritional value of foods. (RM5)

6 Development of extensive food consumption and consumer behaviour databases for use by food industry and health groups for planning and evaluating nutrition strategies. (RM5)

To develop therapeutic strategies based on nutrients, foods, food ingredients and drugs, to optimize health outcomes. (20%)

7 Cardiovascular health benefits of pure polyunsaturated fatty acids and plant antioxidants. (HE1, RM5)

8 Development of strategies for new product opportunities in functional foods. (HE1, RM5)

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. (24%)

9 Commercialization of whey growth factor extracts through GroPep Pty Ltd to the Australian dairy industry.

10 Recombinant growth factors developed to target specific human health and agricultural applications.

To develop diets and assist industry to develop foods with altered starch and fibre composition and to develop other health strategies including probiotics that will reduce the national risk from gastrointestinal disease. (9%)

11 New starch and fibre food products that improve bowel health. (RM5)

12 Development and evaluation of probiotics for use by yoghurt manufacturers. (RM5)

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$5,562,000
External funds	$3,162,000
Total Expenditure	**$8,724,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
37%	39%	35%

*estimates as at June 1994

24. Division of Tropical Animal Production (IAPP)

Objective

To be the most significant provider of that intellectual property in the areas of animal biology and management which, when transformed into innovation, will increase the competitiveness and sustainability of northern Australia's animal-based 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, green" products of consistent quality, and achieve this using sustainable management systems. To assist, the Division will:

- Perform research in animal biology and management with reference to increasing the competitiveness and sustainability of northern Australia's animal-based industries.
- Strategically target and manage the research so that success in providing appropriate intellectual property attracts increasing amounts of funding, enabling the Division to grow.
- Ensure that the intellectual property generated is turned into innovation in a timely way and that commercialisation is effective, by using skills and structures appropriate to the task.
- Enhance our ability to perform by collaborating with others in CSIRO, other research providers, the funders of our research, the extension providers, and the users of our research results.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Fibre Utilisation - MDP3

Gene Mapping - MDP26

Specific Objectives & Planned Outcomes

Quantify the distribution and competence of possible vectors of viruses of importance in the cattle and sheep industries. (2%)

1 Evaluation of the competence of *Culicoides* species being collected at sites in Victoria and South Australia as a vector for a second bluetongue virus serotype.

Produce non-living vaccines against ticks, the tick fever organisms, *Babesia spp.* and *Anaplasma marginale*, buffalo fly, the larva of sheep blowfly and maintain chemical control of ticks. (23%)

2 Evaluation of enhancement of existing tick vaccine by additional recombinant antigens. (AP4)

3 Licence agreements with commercial companies for the transfer of technology which will facilitate the development of recombinant vaccines against *Babesia canis* and *Babesia bovis.* (AP4)

4 Evaluation in vaccination experiment of *Anaplasma marginale* antigens which induce T-cell proliferative responses *in vitro.* Testing of recombinant interferon-gamma as vaccine adjuvant and attentuating agent against *Anaplasma marginale* infection. (AP4)

5 Evaluation of purified and recombinant proteins as vaccine antigens in *in vitro* buffalo fly assays.

6 Production and testing of recombinant *Lucilia cuprina* antigens in large scale pen trial. (AP4)

7 Examination of emerging chemical-resistant cattle tick strains, evaluation of potential new acaricides for control of resistant ticks and evaluation of acaricides with decreased residue problems.

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. (15%)

8 Successful mating of 600 *Brahman* females with terminal cross sires of 7 breeds as part of the cross breeding program for the Cattle and Beef Industry (Meat Quality) CRC.

9 Continuation of comparative evaluation of reproduction, growth, survival, resistance to environmental stresses and meat and carcase attributes of a range of straightbreds and 2-way and 3-way crossbreds.

10 The action of the main gene for tick resistance from the Belmont Adaptaur tested in five other genetic backgrounds.

11 Production of 80 additional contemporaneous purebred Borans and Tulis.

Develop molecular genetic techniques for improved livestock breeding. (17%)

12 A bovine genetic linkage map with 95% genome coverage. (AP2, AP3)

13 Preliminary assessment of genetic markers for growth, tenderness, yield and carcass fat traits, tick resistance and worm resistance with some markers ready for evaluation in industry and research herds. (AP2, AP3)

14 A high quality (at least three genome equivalents) bovine Yeast Artifical Chromosome (YAC) library. (AP2, AP3)

Develop reproductive technologies to: increase calving rate of female cattle, increase the rate of livestock improvement, suppress fertility of male and female cattle, and to regulate the onset of puberty in male and female cattle. (8%)

15 Routine conception using oocytes derived from prepubertal heifers.

16 Establishment of the capacity to biopsy bovine IVF preimplantation embryos and to test for genetic markers.

17 Feasibility of current approaches to changing the sex ratio of offspring in domestic animals determined.

18 Feasibility of site specific recombination of DNA in mammalian embryos determined.

Improve the quality and composition of carcase and efficiency of production through an understanding of physiological processes during growth. (14%)

19 Quantitative and qualitative assessment of the antibody response of cattle to a β_2-adrenoceptor vaccine.

20 Assessment of a strategy to achieve sustained growth promotion of steers through alternate use of growth promoting agents with different mechanisms of action.

Understand the effects of environmental inputs (including quality of water) on growth and contribute to their sustainable use. (3%)

21 Determination of the effect of mineral components of coal mine pitwater on health, growth and reproductive function of beef cattle.

22 Isolation of genes encoding enzymes involved in the degradation of toxins of blue green algae and expression of these genes in *E. coli.*

Improve nutrition of northern cattle and sheep by increasing energy and protein digestion through dietary and microbial manipulations. (11%)

23 Expression of recombinant esterase genes in rumen bacteria in stable form. (PP2)

24 Assessment of persistence of the modified microbes in ruminants, and effects of digestion in the rumen. (PP2)

25 Determination of enzymes in rumen bacteria and fungi that have significant involvement in pectin degradation, and an assessment of their role in fibre fragmentation and digestion. (PP2)

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

27 Establish practicality of novel chemical treatment to improve digestibility by ruminants of low quality lignocellulosic materials.

Generalise and extend existing therapeutic and vaccine technologies through derivation of structural principles and through the development of new systems for targeted delivery of antigens. (7%)

28 Construction of a bovine ephemeral fever (BEF) virus-like particle (VLP) for use as a vaccine and delivery vehicle for other vaccine antigens and therapeutic substances. (MF5)

29 Assessment of the efficacy of rabies VLPs as a vaccine in large animal hosts.

30 Construction of VLP genomes to demonstrate the delivery and expression of human papilloma and Epstein-Barr virus T-cell epitopes by either rabies or BEF VLPs. (MF5)

31 Identification of T-cell subsets activated and cytokines produced during the immune response to *Babesia bovis.* (AP4, MF5)

32 Development of methods for refolding recombinant *Babesia* antigens. (AP4, MF5)

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$7,936,000
External funds	$3,879,000
Total Expenditure	**$11,815,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
36%	34%	35%

*estimates as at June 1994

25. Division of Wool Technology (IAPP)

Objective

To increase worldwide demand for Australian wool, wool products, hides, skins and leather.

Strategy

The current crisis in the wool industry will cause a major reduction to the Division's total funds received from the Australian Wool Research and Promotion Organisation (AWRAPO). It is expected that external resources available to the Division's Leather Research Program will remain approximately constant.

- With the AWRAPO, plan a wool research program to achieve the required industry and CSIRO outcomes from a lower funding base.
- Develop innovative wool products and enhance the appeal and performance of existing products.
- Apply new techniques and measurement systems to reduce costs of marketing, processing and manufacture and where practicable, 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.
- Ensure effective internal and external communication of the activities of the Division.

Specific Objectives & Planned Outcomes

Develop technology and other knowledge aimed at increasing consumer demand for products made from Australian wool. (42%)

1 In conjunction with an industry partner examine market feasibility and if appropriate develop a commercialisation strategy to introduce a new CSIRO process for providing wool upholstery and apparel fabric with a high level of stain resistance.

2 Garment trials undertaken to demonstrate in-wear performance benefits from chemically assisted annealing and the durability of the beneficial effect.

3 Optimise fabric construction, polymer treatments finishing routes and garment pressing to produce improved easy care garments.

4 Bulky wool products evaluated with selected partners in UK, Italy and Australia.

5 Marketing strategy and market testing undertaken for comfortable next-to-skin knitwear based on fibre selection criteria. (RM4)

6 Pilling research extended to woollen spun knitwear and the applicability of antipill processes developed for worsted spun knitwear evaluated. (RM4)

7 Commercial plan for the evaluation of stable single jersey knit technology developed and implemented. (RM4)

8 Mechanism for separating coarse fibres from wool investigated.

9 Simple device to demonstrate coolness of wool fabrics to consumers developed.

Improve the efficiency of conversion of raw wool to end products. (33%)

10 Round trial of fibre strength in top instrument completed.

11 Evaluation of the technical feasibility of detecting contaminants in coloured yarn using novel techniques.

12 Fluorescent wool packs for facilitating the detection of woolpack fragments in wool products developed.

13 Know-how package assembled which predicts best commercial practice for yarn production and properties as a function of top properties and machine settings. (RM4)

14 Robust zero AOX sliver shrinkproofing process trialled under commercial conditions.

15 Collaborative research agreement finalised to develop the second stage of the effluent treatment package for wool scour effluent.

Develop new or improved processes for the handling, marketing preservation and conversion of hides and skins into leather products. (9%)

16 Conditions for the concentration of spent chrome tanning liquors for reuse established.

17 Optimum procedures and conditions for the salt-free long term preservation of Australian wool skins established.

18 Pilot-scale trials of a new non-swelling salt-free pickling system completed.

Develop and implement techniques to completely specify raw and semi-processed wool so as to enable introduction of wool marketing by description (Sale by Description) and prediction of processing performance. (16%)

19 Validity of prototype designs for a wire calibration system for laserscan instruments demonstrated.

20 System for the prediction of dark fibre contamination in tops passed to industry for evaluation.

21 First commercial prototype style type instrument produced.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,697,000
External funds	$15,659,000
Total Expenditure	**$27,356,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
57%	53%	52%

*estimates as at June 1994

26. Biometrics Unit (IAPP)

Objective

Provide statistical expertise for scientists in those CSIRO Divisions in IAPP, INRE and IPPP who are located in Armidale, Geelong, Hobart, Melbourne and Sydney.

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.

- Collaborate in Divisional research projects.
- Provide a high quality statistical consulting service.
- Train Divisional staff in basic statistical methods and in the use of statistical computer packages.
- Carry out biometrical research relevant to Divisional programs.
- Unit staff will be located with relevant Divisions.
- Advertise our expertise externally and undertake relevant consultancies.

Specific Objectives & Planned Outcomes

Enhance Divisional research projects by use of efficient experimental designs and good data analysis. (70%)

1 Consultations and collaboration with scientists.

2 Publications and/or consulting reports.

3 Internal refereeing of relevant Divisional papers and reports.

4 External funding obtained from Divisional research contracts/grants and other sources.

Train Divisional staff in the areas of basic statistical methods and the use of statistical computer packages. (10%)

5 Short courses including "basic statistics", "introduction to MINITAB" and "advanced regression in MINITAB" prepared and/or given. At least three courses given.

6 Selected statistical packages supported.

Maintain the Unit's skills base and research output. (20%)

7 Within Unit training given including attendance at conferences and visits to and from other biometricians.

8 New relevant statistical methods developed and published in statistical journals.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$538,000
External funds	$20,000
Total Expenditure	**$558,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
3%	4%	4%

*estimates as at June 1994

27. Institute of Plant Production and Processing

Objective

To enhance sustainability, competitiveness and growth of Australia's field crop, horticultural, foresty and pasture-based production and processing industries, and to improve the knowledge of Australia's indigenous plants, insects and soils leading to the development of technology for the better management of its natural resources.

Strategy

There are opportunities for moderate growth in the plant based industries despite current cost pressures and low commodity prices. They contribute 12% to Australia's export earnings (1991-92). In addition, pastures contribute nearly half the earnings of the extensive livestock industries. There is widespread awareness of the need for sustainable resource use. The main businesses served by the Institute are those concerned with wheat, course grain, grain legumes, oilseeds, sugar, cotton, timber and horticultural crops, including new crops in these categories. The work on pastures and insect pests serves the wool, beef, sheep meat and dairy industries. The Institute's strategy is to:

- Concentrate efforts on areas judged to give Australian plant-based businesses and industries a competitive economic advantage while conserving the country's biodiversity and maintaining or improving its resource base, within the context of a national agricultural research strategy for Australia.
- Develop new technologies and products, in response to user needs and to identified market opportunities and in association with other research agencies.
- Provide scientific advice to underpin government and industry policy formulation.
- Increase the effectiveness of technology transfer to client industries and their advisors.
- Develop strategic alliances where it will further improve the effectiveness and efficiency of Australia's research and technology transfer activities.
- Develop research applications in agri-food industries.
- Secure and manage resources to achieve research and technology transfer leading to economically successful adoption of new technologies.
- Provide an environment in which staff can maintain the highest standards in science, technology and management, and can develop their creativity with enthusiasm and a sense of shared purpose.

Planned Outcomes

1 Performance evaluation of Divisions of Tropical Crops and Pastures, and Forest Products. (Eval)

2 Revised 5 year plan to take account of CSIRO triennium priorities across the rural sector.

3 Formulation and evaluation of corporate and Institute strategy options for the distribution and management of resources for CSIRO's research for plant-based agri-food business systems.

4 Continuation of the management development workshops for Divisional program and project leaders, including commercialisation, project planning and market research, so that all Divisional program leaders have access to training opportunities.

5 The development of Divisional strategic human resources plans encompassing current and following triennium (1994-1997).

6 Implementation of shared research support services at Glen Osmond and North Ryde, and continuation at Black Mountain, covering both site needs and the individual needs of those Divisions whose headquarters are co-located.

7 Establishment of additional programs of integrated R&D effort within CSIRO and with research providers from other agencies where that will achieve a better likely outcome for clients than a sole-provider approach.

8 Improved financial management practices in IPPP - including improved management of cash and reserves, consistent automatic monthly financial reporting, and improved budget estimation.

9 Development and implementation of a communication plan for the Institute including communication plans in relevant research projects, a database of formal discussion groups, a regular column in a major rural weekly newspaper, and market research on publications.

10 Further linkages with IAPP including joint management initiatives.

SUMMARY OF RESOURCES, 1994-95

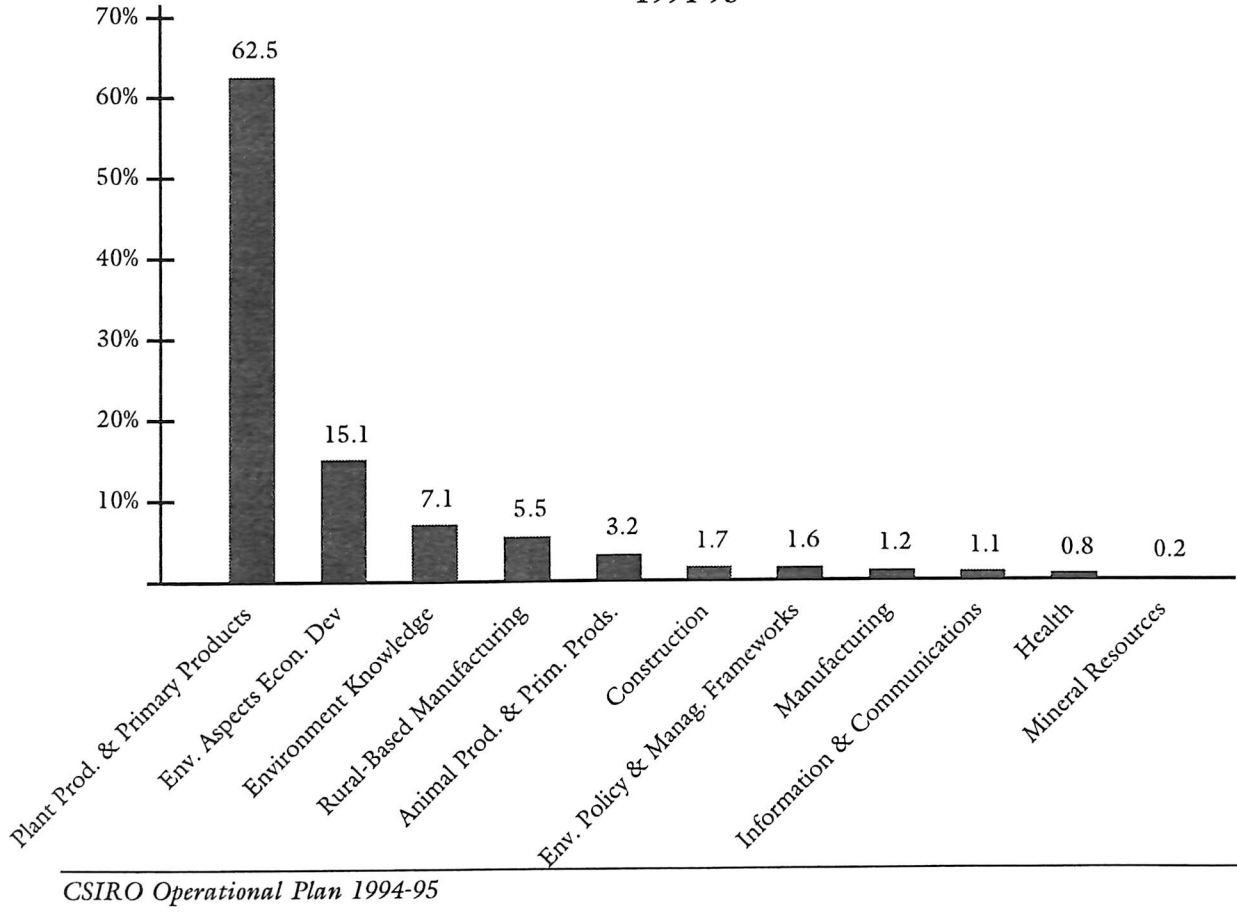
(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Entomology	209	76	10	295	14,316	12,422	26,738
Forest Products	73	22	8	103	6,573	2,718	9,291
Forestry	119	52	8	179	10,532	4,200	14,732
Horticulture	72	24	5	101	5,703	3,429	9,132
Plant Industry	332	106	12	450	23,960	13,022	36,982
Soils	117	51	6	174	11,094	4,864	15,958
Tropical Crops and Pastures	127	49	6	182	12,190	6,260	18,450
Institute Headquarters	0	0	8	8	2,022		2,022
Biometrics Unit	6	2	1	8	517		517
Institute Other[2]	0	0	0	0	2,175		2,175
Supporting Sites	0	11	0	11			
TOTAL	1055	393	64	1511	89,082	46,915	135,997

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

[2]Includes undistributed Industry Statement and other funds.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



28. Division of Entomology (IPPP)

Objective

To devise ways of controlling insect and other pests of crops, crop products, livestock and man, and to understand the role and impact of insects in the environment.

Strategy

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 environmentally acceptable long-lasting solutions. Solutions may include exploitation or enhancement of the effects of native and introduced beneficial insects, other invertebrates and insect-associated microorganisms.
- 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.
- The Division achieves its objectives partly through collaboration with industrial partners, univeristies, state and federal organisations, and international and aid organisations, and partly by carrying out directly funded research in the national interest.

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

Improving Forestry - MDP25

Specific Objectives & Planned Outcomes

Study the ecology and behaviour of major pests attacking field and horticultural crops, and for termites timber and building materials, in order to develop effective management strategies against them that increase productivity and minimise the use of broad spectrum insecticides; thereby contributing to the development of sustainable agricultural systems and the protection of the environment. (15%)

1 Completion of host specificity testing of the egg parasites of fruit piercing moths from PNG to determine if they are suitable for use as biocontrol agents in Australia. (PP3)

2 Completion of the collaborative project on IPM of codling moth that is evaluating season-long mating disruption with pheromones plus suppression of the first generation with sprays as a means of achieving commercially acceptable levels of control in apple orchards. (PP3)

3 Field and laboratory studies of pest resistance in a range of cotton varieties expressing insecticidal proteins from *Bacillus thuringiensis.* (PP3)

4 Commencement of studies of environmental impact and management of Bt transgenic cottons in a large scale co-ordinated study with State Departments and commercial partners. (PP3)

5 Assessment of chemical and physical barriers and the attractant and toxic components of baits suitable for management of termites.

Develop strategies for the eradication or control of insects and related invertebrates affecting humans, livestock and pastures, that are either in Australia or threaten to enter the country. These management approaches will minimise the use of pesticides through the implementation of ecologically sustainable practises. (13%)

6 Establishment of a facility in Malaysia capable of mass rearing Screw worm fly in order to test procedures for sterile insect control of this pest.

7 Initiation of studies on the relationships between soil organism biodiversity, soil conservation practises and productivity.

8 Studies on the development of a long term bioassay method for redlegged earth mite in order to evaluate compounds with the potential to confer resistance against this pest.

9 Establishment of a project on the use of Metarhizium as a biological control agent of locusts and wingless grasshoppers. (PP3)

10 Negotiations finalised with potential partners with the aim of entering into commercial agreement on a mycoinsecticide for termites. (PP3)

Undertake strategic and applied research into the molecular biology and biotechnology of insect physiology and pathology. Combine the development of gene transfer technologies in insects and their microbial pathogens with the cloning of strategic genes so as to develop new ways of controlling insect pests with minimal environmental disruption. Develop

environmentally sound biotechnologies for pest control as adjuncts or alternatives to chemical insecticides. (19%)

11 Recombinant NPVs bearing recently acquired toxin genes made and assessed for their efficacy against heliothis. (PP3)

12 Genes encoding gut inhibitory peptides from sheep blowfly cloned and characterised and the functions of these peptides in whole insect and isolated tissue systems examined.

13 Development of a rapid and specific DNA-based method for detecting and identifying the honey bee chalkbrood fungus and other closely related fungal species.

14 The range of economically important nematodes identifiable by current ID-kit technology expanded.

15 Field trials over 1000 ha of orchard to evaluate efficacy of the nematodes *Steinernema carpocapsae* produced in China for controlling peach borer. (PP3)

Develop well-based, efficient pest and commodity management strategies for stored grain and similar products. (19%)

16 Further development of aeration as a residue-free method of pest control in grain. Full scale trials conducted in bunker storages and farm stores, to extend the utility of the technique and improve its cost/efficiency. (PP3)

17 Commercialisation of SIROFLO® pursued in non-BHA sector within Australia, and generally overseas, concluding commercial arrangements to be operational by June 1995. (PP3)

18 Assessment and, if possible, development of alternatives to methyl bromide for treatment of imported and exported timber and cut flowers. Other commodities/processes to be assessed if time allows. (PP3)

19 Information on heat disinfestation of grain and similar commodities provided in a form that will assist in a go/no-go technical decision on construction of a large facility at a port terminal.

20 Approval of a new draft agreement between the Division and grain industry partners for SGRL.

Document, describe and improve the understanding of Australia's insect and mite fauna with special emphasis on those groups that are of economic, social, scientific or environmental importance. (13%)

21 Commencement of research on taxonomy, diversity and distribution of soil mites of the order Oribatida.

22 Complete compilation of entire manuscript for the Nematocera (Diptera) volume of the *Zoological Catalogue of Australia.*

23 Progress on the CD-ROM *Beetles of the World* (completing the character list, bulk of character-taxon matrix and development of taxon and character illustration) for publication mid 1996.

24 Fully revised text and illustrations for a new edition of a technical handbook on the Australian fauna of butterflies.

25 Completion of curation evaluation of all Australian National Insect Collection (ANIC) holdings, including pinned, alcohol and microslide mounted collection.

Find and assess potential biological control agents for important native and introduced weeds in Australia. Subsequently to release, establish and evaluate selected control agents. Integrate biological and other methods to improve the overall level of weed control in agricultural and conservation areas. (21%)

26 Biological control strategies for weeds of agricultural importance including skeleton weed, Paterson's curse, common heliotrope, nodding thistle, slender thistle, scotch and related thistles, horehound, doublegee, sida and caltrop.

27 Biological control strategies for weeds important in conservation including mimosa, bitou bush, bridal creeper, scotch broom and certain aquatic weeds.

28 Collaborative projects to establish biological control of water hyacinth, salvinia and mimosa in developing countries.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$14,316,000
External funds	$12,422,000
Total Expenditure	**$26,738,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
41%	46%	50%

*estimates as at June 1994

29. Division of Forest Products (IPPP)

Objective

The Division's objective is to benefit Australia by increasing the quality and value of forest products.

Strategy

The Forest Products industry has a turnover in excess of $9 billion per annum. The market for Australian forest products is largely domestic, but there are opportunities for the Division to contribute to overcoming the trade deficit of $1.4 billion per annum. The Division works closely with forest-based industries and the Division of Forestry in conducting research to:

- Increase profitability through efficient use of wood resources and technologies for new products and processes.
- Develop environmentally improved practices and processes.
- Optimise use of residues and options for recycling or utilising spent forest products.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Program:

Improving Forestry - MDP25

Specific Objectives & Planned Outcomes

To assess resources for pulp and papermaking, understand the relationships between wood, fibre, pulp and paper properties, and develop processes that increase pulp and paper quality with reduced environmental impact. (33%)

1 Capacity of the existing Silviscan instrument to analyse the fibre structure of pine samples developed to 100 samples per week.

2 With NIR analysis, errors in the prediction of pulping properties reduced and procedures for the assessment of the compounds of recycled paper mixes initiated.

3 Advanced sequences for extended delignification and bleaching, combined to produce pulp with no loss of yield or quality with effluents containing reduced total organic chlorines.

4 Opportunities identified for exploiting differences in fibre properties within and between trees, and in recycled paper mixes.

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. (22%)

5 Development of realistic expert procedures using termites, fungi, and marine borers and assessment of potential biocides for the preservation industry.

6 Natural durability of timbers determined-particularly comparing regrowth and mature forest resources.

7 Improved understanding of mechanisms for improving surface and dimensional stability of timber.

8 Novel remedial and initial preservative treatment systems.

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. (22%)

9 Products developed from waste paper and other fibres.

10 Pilot plant constructed to produce reformed cellulose fibres using a novel solvent system, and data generated to assist in assessing the economics of SIRON production.

11 Improved adhesives for reconstituted wood products designed, synthesised and developed.

12 Assessment of opportunities for commercialising our activated carbon technology.

Assist the timber industry to improve efficiencies and values in processing Australian hardwood and softwood resources. (17%)

13 Basic wood cell knowledge used to investigate various methods of collapse amelioration.

14 An examination of the potential for value-added products from both native forest and plantation-grown Australian hardwoods.

15 A better control system and improved efficiencies of high temperature softwood dryers.

16 Improved understanding of the performance of wood based panels in cycling environmental conditions.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$6,573,000
External funds	$2,718,000
Total Expenditure	**$9,291,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
27%	31%	31%

*estimates as at June 1994

Objective

To increase economic and environmental benefit to Australia by improving the productivity and management of the nation's forests.

Strategy

Following the ratification of the National Forest Policy Statement by the Commonwealth and all States (except Tasmania) the requirements and opportunities for industry development are now well understood. The policy includes the establishment of the Forestry and Wood Products Research and Development Corporation which will enhance coordination and priority setting and create new research opportunities.

- Develop advanced methods of tree breeding for improving economically important characteristics.
- Improve silvicultural and operational systems for increased and sustained productivity.
- Evaluate and select trees for wood production, for the amelioration of land degradation, and investigate the diversity of Australia's trees and their symbionts.
- Establish relations with FWPRDC to optimise funding opportunities and to keep research priorities closely aligned with industry needs.
- Improve communication and cooperation with forest industry and develop, where appropriate, commercial opportunities which arise from research.
- Develop long-term business relationships with the major forest land management agencies to facilitate R&D support.
- Implement outcomes of the Strategic Planning workshop and Human Resources Planning study to improve Divisional performance.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Conserving Biodiversity for Australia's Future - MDP18

Improving Forestry - MDP25

Climate Variability and Impacts - MDP29

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

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. (26%)

1 Collation and analysis of results from 20 international provenance trials of *Casuarina equisitifolia.*

2 Descriptions of the environmental requirements of six commercially important native tree species and compilation of site data required to predict their performance at several hundred locations in Australia and overseas.

3 Enhancement of the Multi Purpose Tree Data Base to allow prediction of tree performance on a range of sites including degraded lands.

4 Publication of three books: Multipurpose Australian Trees and Shrubs (major revision), an annotated bibliography of four acacia species and a monograph on *Styrax tonkinensis.*

5 With Aboriginal groups and other interested parties review the projects for commercial production of acacia seed for the bush tucker industry as a dry land tree crop.

Provide options for the sustainable management of native forests for wood production. (17%)

6 A strategy for the extension of new technologies for increasing the productivity of young regrowth eucalypt forests from the experimental to the semi-operational scale. (Eval)

7 An evaluation of the ability of the PC-based 'National Bushfire Model' to predict the behaviour of selected January 1994 wildfires in NSW. (EN3)

8 Incorporation of the 'National Bushfire Model' in the SA Emergency Services Operational Warning System for the Adelaide Hills. (EN3)

9 Prototype, computer-based system for harvest planning, developed in collaboration with the State Forests of NSW.

10 A major review for the Intergovernmental Panel on Climate Change (IPCC) on the impact of climate change on the world's forests. (EN1)

11 Determination of the incidence and distribution of double stranded RNA elements in populations of *Phytophthora cinnamomi* in Australia. (PP3)

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. To determine design parameters and management strategies for plantations for disposal of effluent as a sustainable land use practice. (27%)

12 Achievement of significant progress towards detection of genes controlling early growth wood density and other traits in *Pinus radiata.*

13 A report on the effects of inbreeding depression on growth, and how inbreeding depression impacts on breeding strategies for the improvement of *P. radiata.*

14 Final project plan, agreement with collaborators and layout of a major study on the management of later aged stands in the Mt Gambier region. Conduct a national workshop on thinning and fertilisation. (Eval)

15 A report on phase I of the site management study in Tasmania. Establishment of phase II examining the impact of harvesting and site management on soil and tree growth.

16 Publication of the first technical report outlining the basis for the "best practice" for establishing and managing effluent irrigated plantations of commercial species. (ED2, ED3)

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 site and stand management techniques. (30%)

17 Utilisation of the completed linkage map of the genome of *Eucalyptus nitens* to locate one or more important quantitatively linked loci, for example those genes controlling early growth and wood density.

18 Guidelines for industrial collaborators for the irrigation of *E. globulus* and *E. nitens* to increase wood production.

19 Guidelines for the establishment of plantations in sub-tropical climates that optimise rates of growth and enhance wood properties consistent with efficient use of fertilisers.

20 Completion of transfer of technology for the inoculation of eucalypts with ectomycorrihizal fungi to collaborators in China.

21 Establishment of plots in native forests in WA for the assessment of the effects of management practices on the biodiversity of ectomycorrihizal fungi.

22 Specific probes for the unequivocal identification of selected mycorrihizal fungi (*Laccaria* spp.) present on roots of eucalypts.

23 Completion of project on the estimation of productivity of short rotation plantations of *E. globulus* across climatic gradients in WA and submission of final report to RIRDC. (Eval)

Summary of Planned Expenditure 1994-95*

Direct Appropriation	$10,532,000
External funds	$4,200,000
Total Expenditure	**$14,732,000**

External Earnings as a Proportion of Total Income*

1993-94	1994-95	1995-96
37%	30%	28%

*estimates as at June 1994

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 $3b 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 Divisions'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

Active Packaging - MDP12

Specific Objectives & Planned Outcomes

Develop superior new varieties of horticultural crops to enhance productivity and quality. (45%)

1 Performance data on virus specific promoters. (PP3)

2 cDNA preparations from developing grapeberry samples.

3 New markers for grapevine DNA typing.

4 Hop DNA typing system.

5 Expression of genes associated with cell wall softening in ripening peaches described.

6 Transgenic citrus tissue tested for stable integration of male sterility gene.

7 Performance of seed abortion genes with various promoters in embryogenic citrus culture.

8 Measure of pollen parent effects on kernel quality of macadamia.

9 Plan for development of pistachio selections.

Develop better crop management systems to enhance productivity and quality. (30%)

10 Better estimates of Sultana vine water use.

11 Nutrient standards for Sultana vines redefined.

12 Framework developed for grapevine model linking growth, light interception and photosynthesis.

13 Juice factors with potential as indicators of Shiraz wine quality assessed.

14 Water use of mango trees determined in relation to crop load.

Develop improved strategies for postharvest performance based on an identification of factors controlling ripening, senescence, pests, disease and disorders. (25%)

15 Optimum fruit temperature and moisture content determined to maintain dried fruit quality in storage.

16 Combined condensation control and SO_2 release evaluated for table grapes in static containers. (RM2)

17 Prototype circulating hot air disinfestor for treating pallet-size quantities of fruit.

18 Senescence in Geraldton waxflower investigated as basis for developing treatments to extend postharvest life.

19 Effects of postharvest water relations and calcium treatments on mango storage life determined.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$5,703,000
External funds	$3,429,000
Total Expenditure	**$9,132,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
29%	35%	36%

*estimates as at June 1994

32. Division of Plant Industry (IPPP)

Objective

To apply strategic research in the plant sciences to promote sustainable agriculture, develop novel plant products and improve natural resource management.

Strategy

The agricultural sector is diversifying into a range of businesses based around production and commodity processing, and research for these industries needs to be responsive to market pressures and opportunities. Agriculture and natural resource management need to be based on the best possible biological research. There is increasing emphasis on the interdependence of rural and natural ecosystem functions in total landscape management. The Division must be adequately financed to enable it to focus on priority issues and to address the constantly changing needs of industry and stakeholders.

- Selective application of a range of basic and applied plant sciences to strategic objectives in plant-based industries and native ecosystem management.
- Fostering partnerships with other research institutes and industry for economic and community benefit.
- Implementing a communication and technology transfer plan aimed at ensuring that research is meeting end-user needs and that research outcomes are adopted.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Novel Management Techniques for Plant and Plant Product Pests - MDP2

Climate Change - MDP17

Conserving Biodiversity for Australia's Future - MDP18

Improving Forestry - MDP25

Climate Variability and Impacts - MDP29

Specific Objectives & Planned Outcomes

To diversify the range of crops and to improve the performance of rainfed crops and pastures in southern Australia. (16%)

1 Determination of how drought severity and duration affects the survival and growth of pasture species.

2 Development of collaborative arrangements with State wheat breeding programs to test our advanced lines with improved yield potential.

3 Instrumentation of the pastoral management experimental site at Wagga with Time Domain Reflectrometry (for continuous soil water assessment) and that at Narrogin with Energy-Bowen Ratio systems (for water vapour loss).

4 Evaluation of field performance of potential rust-resistant replacements for the winter wheat variety Lawson.

5 Determination, using diverse species, whether the magnitude of photosynthetic acclimation to elevated atmospheric CO_2 concentrations is a function of the light quality under which plants are growing.

To provide Australian rural industries with integrated crop and pasture management systems and new pasture plants to ensure profitable and sustainable agriculture. (18%)

6 Selection of Head Licensee for BP52 phalaris, a cultivar bred for land care functions, particularly salinity mitigation in recharge areas in southern New South Wales and Victoria. (ED6)

7 Evaluation of the impact of better management on the level of N-fixation by pasture legumes and its subsequent mineralisation and transfer to crops. (ED6)

8 Release for commercial testing in the Riverina rice industry of maNage rice, a decision support system to predict yield response to topdressed nitrogen in relation to risk of injury from cold temperatures, crop-N status and water depth.

9 Completion of the specification and demonstration of a working prototype of the Aus-Farm decision support system for integration of whole-farm management. (ED6)

10 For a wide range of wheat genotypes, determination if the relationship observed between aluminium tolerance and malate excretion in near isogenic wheat lines of differing aluminium tolerance exists. (ED6)

To develop economically viable and ecologically sustainable systems of cotton production for Australia. (8%)

11 Commencement of investigations of the physiology of cotton compensation for pest damage by compiling carbon and nitrogen budgets for damaged and intact plants.

12 Completion of calibration of the carbon, nitrogen and water stress functions in the latest version of the OZCOT/CERCOT crop model.

13 Enhancement of the scope of the entomoLOGIC pest management package by the incorporation of the OZCOT crop model to provide yield prediction, irrigation scheduling and simulation capabilities using the entomoLOGIC database. (ED6)

14 Refinement of genetic transformation technologies for cotton and identification of new genes for resistance to insect pests and diseases. (PP3)

To provide a basis for biological conservation, management and use of the Australian flora and vegetation. (11%)

15 Completion of analysis of field results of barley lines with different genotypes for scald resistance.

16 Publication of a new edition of 'Rare or Threatened Plants' (ROTAP) now including infraspecific taxa, revised conservation codings, geographic distributions and reserve data. (EN4)

17 Analysis of variation for resistance to *Rhynchosporium secalis* in naturalised populations of *Hordeum leporinum* and H. *glaucum* (wild barley grass).

18 Completion of systematic studies and preparation of *Flora of Australia* treatment for the 10 northern Australian genera of *Rhamnaceae*, including revision of *Alphitonia*.

To create novel germplasm for increasing the market value of grain products. (14%)

19 Demonstration of stable inheritance of two introduced marker genes in transgenic wheat, and obtaining primary transformants of wheat with antisense constructs against a seed protein and starch biosynthetic enzyme.

20 Isolation of major low molecular weight glutenin subunit proteins for mixing experiments as well as the production of recombinant and monoclonal antibody libraries. New antibody libraries for high molecular weight glutenin subunits to be prepared at the same time.

21 Establishment of a quantitative model to describe quality changes resulting from the application of nitrogen fertiliser during grain filling and the storage of rain damaged grain.

22 Collaboration with the Bread Research Institute to establish an automated interpretation of the electrophoretic identification of cereal grain using an image analyser.

23 Purification of a protein from the sulphur-rich group of wheat endosperm proteins for N-terminal sequence analysis and cloning.

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. (14%)

24 Cloning and characterisation of a gene critical for male fertility.

25 Cloning and characterisation of three homeotic genes from Eucualyptus.

26 Development of barley transformation method for routine production of transgenic plants.

27 Generation of dehydrin-deficient transgenic pea plants and assessment of tolerance to dehydration.

28 Optimisation of ribozyme structure for catalytic efficiency *in vitro*. (PP3)

To analyse key processes and provide molecular strategies for improving productivity, disease resistance and quality in crops and pastures. (19%)

29 Establishment of a small-scale field trial of transgenic subterranean clover containing genes encoding phosphinothricin acetyle transferase and sunflower seed albumin. (PP4)

30 Establishment of the stem-specific expression of the promoter of a lucerne gene encoding s-adenosyl homocysteine hydrolase.

31 Establishment of field trials in more than one State of transgenic potatoes containing a gene encoding the coat protein of potato leaf roll virus. (PP3)

32 Determination of the structure and DNA sequence of the L^6 rust resistance gene in flax. (PP3)

33 Measurement of the effects of photosynthesis of anti-sense gene constructs in *Flaveria bidentis*.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$23,960,000
External funds	$13,022,000
Total Expenditure	**$36,982,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
36%	33%	35%

*estimates as at June 1994

33. Division of Soils (IPPP)

Objective

To contribute to the sustainable and profitable management of soil and land resources through high quality, targeted research and technology transfer to Australian industry.

Strategy

In view of the rural recession and an urban and government sector which seeks to implement environmentally aware practices, the Division will address the increasing demand for soil information and more sustainable land management by:

- Improving awareness of the capacity of soils information to contribute to solving land management problems through research, education, training and problem solving which focus on client needs and contribute to well informed discussion and policy development.
- Focussing on the development of profitable and sustainable systems of soil and land management for specific industries which have the interest and ability to implement improved systems.
- Expanding flexible information bases of soil data, especially within geographic information based systems, which can be used by a range of industries to address diverse production and environmental management issues.
- Working with clients and other research providers and funding agencies to deliver soils information which can be implemented in an efficient and timely way.
- Concentrating research on those areas able to maximise the return to Australia, and organising our research in an efficient and cost-effective manner.

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

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. (33%)

1 Identification of soil constraints to sustainable sugar cane production in northern Queensland.

2 Assessment of potential bioindicators of soil health.

3 Assessment of the impact of land management practices on the diversity, abundance and activity of functional groups of the soil biota. (EN4)

4 Continued evaluation of management practices, environmental conditions and biocontrol agents for controlling soil-borne root diseases in dryland farming and nursery production systems. (PP5)

5 Establishment of links between spatial variations in grain yield and site-specific soil properties.

To provide methods to measure, predict and manage the impact of agricultural, urban, mining and industrial land use including waste disposal on soils, landscapes and water quality and to rehabilitate contaminated land. (39%)

6 Process models and soil classification systems for diagnosis of management strategies to combat dryland salinity, waterlogging and water quality problems in soil landscapes. (ED6)

7 Identification of processes governing the mobility of heavy metals in soils, and development of suitable models for predicting transport of heavy metals through soil and uptake by crops. (HE1)

8 Integrated methodologies for evaluating the effects of land use on the nutrient load of catchment systems, and improved land use options which will minimise contaminant and sediment loss and their impact on estuarine and coastal environments. (ED6, ED2)

9 Sustainable methodologies for land applications of sewage wastes on pasture and tree plantations, to maximise the effectiveness of waste re-use schemes and reduce nutrient and heavy metal pollution of Australia's inland and coastal waters. (ED3)

10 Development of methodologies for successful minesite rehabilitation. (ED7)

11 National and International Standard Methods for X-ray fluorescence analyses of iron ores and mineral sands in order to increase Australia's advantage in marketing and quality control. (ED6)

12 Amelioration of sodicity in agricultural soils and improvement in tillage practices to increase sustainability of cropping systems. (ED6)

13 Identification of South Australian clays suitable for commercial development.

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. (28%)

14 Development of new methods for land and soil resource assessment, data analysis and land evaluation using remote sensing, digital terrain models and conventional data to improve the availability and utility of land resource data in land use policy decision making and land management for federal and state agencies and consultants. (ED6)

15 Development of methods and models to quantify the processes and impacts of land degradation on the sustainability of production and other land uses, particularly assessment of the impact of land management practices to decrease land degradation and increase profitability and improve policies of federal and state agencies for use by catchment management authorities, Landcare groups and land managers. (ED6)

16 Delivery of advanced methodologies for the spatial prediction of soil properties to state government agencies in NSW and WA based on a rule-based system and digital terrain modelling. (ED6)

17 Transfer of existing data in the Divisional soils database into the INGRES relational database format and the development of methods to link soil property data in INGRES to map polygons on the digital Atlas of Australian Soils. (ED6)

18 Integration of soil surface structural measurements, soil water movement and spatial variation of soil properties into a framework used to predict impacts of land management procedures on erosion, nutrient and pollutant fluxes and water quality focussed within the Dryland Farming for Catchment Care MDP. (ED6, PP5, ED2)

To provide strategic planning, resource management and communication for the Division and its clients.

19 Improvement of recording, invoicing and reporting on externally funded activities, including an assessment of the "Sponsorship" module. Implementation of new policies on access by non-CSIRO staff to Divisional facilities.

20 Implementation of new Divisional policies for charging total costs to research projects for services provided by Divisional support services.

21 Implementation of a staff training and development strategy.

22 Rationalisation of administrative and site services at the Urrbrae campus.

23 Improvement of business plans for each project to allow more efficient forward planning, to increase the value of applications for external funding.

24 Development of improved computer facilities and access via compatible services between sites.

25 Co-location of library services on the Waite Campus and implementation of agreed access policies.

26 Improved communication plans for research projects to promote the work of the Division to defined stakeholders.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$11,094,000
External funds	$4,864,000
Total Expenditure	**$15,958,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
31%	29%	31%

*estimates as at June 1994

34. Division of Tropical Crops and Pastures (IPPP)

Objective

To increase the international competitiveness of the beef, grains, and sugar industries of northern Australia by improving the efficiency and sustainability of the production systems, and product quality.

Strategy

The three 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. The three largest industries (beef, grains and sugar), have a combined GVP of about $4b pa. Much of the production is exported to highly competitive markets which are demanding specific product quality. The community and industry are increasingly concerned about the long term sustainability of the production systems, and about the off-farm effects on the natural resources. The Division collaborates extensively with other CSIRO Divisions and organisations. Reduced Government funding to one of our major RD&E partners, the Queensland Department of Primary Industries (DPI), is reducing our capacity to deliver outcomes. The Divisions strategies are to:

- Improve our understanding of the underlying business systems of the beef, grains and sugar industries.
- Foster participatory planning with industry to identify and prioritise issues requiring R&D.
- Develop new and improved mechanisms for technology transfer, in the light of changing industry structures, changes within DPI, and the policies and priorities of the Rural Industry R&D Corporations.
- Develop a Centre of Excellence for the application of molecular biology and genetic engineering to the improvement of plants and rumen micro-organisms.
- Integrate new skills in molecular biology, microbiology, and information technology with traditional skills in plant sciences, ecology, and livestock production, and assemble multi-disciplinary teams to conduct research.
- Commercialise and market plant products and information technology developed by the Division.
- Continue to set new standards of excellence in research management, including work-force planning, research prioritisation, and concentration of effort on critical issues.

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

Specific Objectives & Planned Outcomes

More profitable and sustainable livestock production through improved nutrition. (43%)

1 Confirmation of quantitative broadly-based resistance to anthracnose in *S.scabra* by evaluation of material in South America, collaboratively with EMBRAPA.

2 Identification of effective root nodule bacteria for *S.* sp. *aff. scabra*, which is demonstrating adaptation to subtropical clay soil conditions.

3 Seed production of Siran increased four-fold to 10t and development of marketing plan with Heritage Seeds.

4 Identification for commercial release of two lines of *S.hamata* with superior anthracnose resistance.

5 Development of a gene transfer system for *S.scabra* and/or *S.hamata*. (PP2)

6 Suppression of a lignin biosynthetic enzyme in transgenic *Stylosanthes* plants.

7 Insertion of a gene conferring enhanced cellulose digestion into the rumen bacterium *Butyrivibrio fibrisolvens*. (PP2)

8 Techniques to monitor populations of transformed *B.fibrisolvens in vivo*.

More profitable cropping industries producing a range of marketable product. (30%)

9 Production of advanced generation backcross lines of soybeans, incorporating the long juvenile trait, for further evaluation.

10 Potential sugarcane production in the Burdekin and Herbert regions quantified and impact of seasons and crop class assessed.

11 Efficiency of sugarcane breeding improved in the Herbert region by optimising the selection of cane families and testing sites.

12 Production of a series of transgenic sugarcane plants which over express a foreign plant gene, encoding a key enzyme (sucrose phosphate synthase) involved in sucrose synthesis. (PP1)

13 Commercial registration of the biofungicide codenamed P2.

Adoption of land management practices and cropping systems that are economically and environmentally sustainable. (27%)

14 Spatial and temporal trends in groundwater nitrate concentrations in the Bundaberg sugarcane growing district determined. Community involvement in considering the implications of the results achieved.

15 APSIM technology for modelling chopping system employed in at least ten applications-oriented projects in Australia.

16 Guidelines for managing native pastures and legume-augmented native pastures in South East Queensland produced in conjunction with DPI and graziers and widely publicised.

17 Release of the final prototype version of the LANDASSESS decision support system to Northern Territory collaborators.

Organise and manage Divisional resources to facilitate effective research, enhance individual performance and promote adoption of the products of research.

18 Performance evaluation of the Division by IPPP establishes it as a pacesetter in research management in CSIRO. (Eval)

19 Performance evaluation of the *Stylosanthes* improvement projects. (Eval)

20 Final commissioning of the Controlled Environment Facility and furthering its development with industry funds.

21 Refinement and articulation of requirements for the capital works program for the Cunningham Laboratory to enable presentation of plans to the PWC in mid-1995.

22 Implementation of planned research and resource development opportunities flowing from the sale of land at Lansdown.

23 A Divisional policy on postgraduate students developed, implemented and communicated to other CSIRO Divisions.

24 Future of APSRU determined following a review of achievements and assessment of opportunities for exploitation of the technology. (Eval)

25 Strong Divisional participation in an outcomes-focussed CRC for Sustainable Sugar Production.

26 Linkage of the Division's ongoing research in tropical woodland management with the CRC for Tropical Savannas.

27 Enhancement of IPPP Human Resource Management by the part-time deployment of DTCP staff.

28 Re-prioritisation of DTCP projects and establishment of external funding targets for individual research projects.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$12,190,000
External funds	$6,260,000
Total Expenditure	**$18,450,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
29%	32%	33%

*estimates as at June 1994

35. Biometrics Unit (IPPP)

Objective

Promote the effective and efficient use of experimental resources by CSIRO Biological Divisions, through improved experimental design, and better methods of statistical analysis.

Strategy

The Unit pursues new opportunities to add value to the work of client Divisions through the development and application of advanced techniques for statistical analysis and design. In an environment of increasing demand for limited resources it is more important than ever that CSIRO maximise the information obtained from research data. In pursuit of its objective the Unit will:

- Collaborate in Divisional Research Programmes.
- Conduct biometrical research relevant to Divisional programs.
- Provide statistical consultancy for Biological projects.
- Train Divisional staff in basic statistical methods, and in the use of statistical computer packages.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Program:

Climate Variability and Impacts - MDP29

Specific Objectives & Planned Outcomes

Develop a collaborative research contribution to at least six biological Division projects, ensuring that the Biometrics involvement provides substantial benefits to the projects, either by increasing the efficiency of resource utilisation, or by providing novel methods of solving research problems. (60%)

1 At least six publications in the biological literature, in which the Biometrician acts as senior author, demonstrating the impact of collaborative research.

2 At least four publications in the statistical literature, demonstrating statistical innovation of collaborative research.

Improve the effectiveness of biological research through timely and relevant statistical consultancy. (35%)

3 Consulting reports which clearly demonstrate the value of the statistical contribution, and joint authorship of papers arising from the projects supported.

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

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

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$517,000
Total Expenditure	**$517,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
10%	13%	13%

*estimates as at June 1994

36. Institute of Natural Resources and Environment

Objective

Provide the scientific knowledge required for the effective management and conservation of Australia's natural resources and environment, particularly in relation to the conservation and protection of natural heritage and sustainable use of natural resources.

Strategy

The scope of the Institute's research activities provides unmatched capacity to contribute knowledge that is essential to understanding our natural resources and, consequently, to continuing and extending national development and to maintaining healthy natural environments. The Institute is addressing major issues including air pollution, marine and freshwater pollution, urban water and wastewater, water catchment management, land degradation, climate change, and maintenance of biodiversity. Through this work, the Institute is able to provide expert scientific information and advice to Government, as the basis for developing Government policy, and to industry, to enable sustainable development of Australian industry across all sectors. This work also underpins Australia's capacity to meet its international obligations on environmental issues, and its ability to access the results of international research that potentially affects Australia.

- Consult with key stakeholders to target research and to help ensure its uptake, with particular reference to the INRE, CSIRO Agricultural Sector and Divisional Advisory Committees.
- Apply the CSIRO methodology to assist in setting research priorities.
- Assess and evaluate rigorously the benefits of current and proposed research.
- Increase the focus on winning major international environmental contracts.
- Maintain effective relationships with the tourism industry to help in determining research needs for that industry.
- Continue to develop and effectively manage major multi-Divisional programs intended to provide holistic solutions to large complex issues - climate change and climate variability, coastal zone management, waste emissions, conservation of biodiversity, algal blooms, aquaculture, air quality, urban water systems and catchment care.
- Maintain close liaison with federal government departments and organisations and increase liaison with state and local government agencies.
- Promote and reward excellence in undertaking and managing science, in transferring our results and in communicating their significance.
- Market our skills and promote their worth to national and international governments and organisations.
- Ensure the effective operation of the Institute and Divisional Advisory Committees.

Planned Outcomes

1 Reassessment of Institute wide research priorities by December 1994.

2 Cost-benefit analyses selected and developed.

3 Assessment of the total CSIRO effort in environmental research (environmental knowledge, environmental aspects of economic development, environmental policy and management frameworks).

4 Review of the Division of Oceanography completed by October 1994 and a new Chief in place by March 1995.

5 High quality briefings for Ministers, other politicians, senior Departmental staff, and CSIRO management on environmental issues of national importance; expert briefings on developments in environment research increased for all levels of government and for a wide range of private sector bodies.

6 Implementation of a program of contact with senior staff in State and Local Government sectors.

7 Completion of National Pulp Mills Research Program including conduct of a final conference and promulgation of research outcomes.

8 Enhanced role for the INRE Project Office to obtain and manage large and complex contracts for environmentally-based projects.

9 Establishment and implementation of policies and procedures across the Institute to give effect to the new CSIRO Commercial Practices Manual.

10 High public profile maintained for CSIRO environment research, through involvement in events and exhibitions, and update of the INRE Outlook.

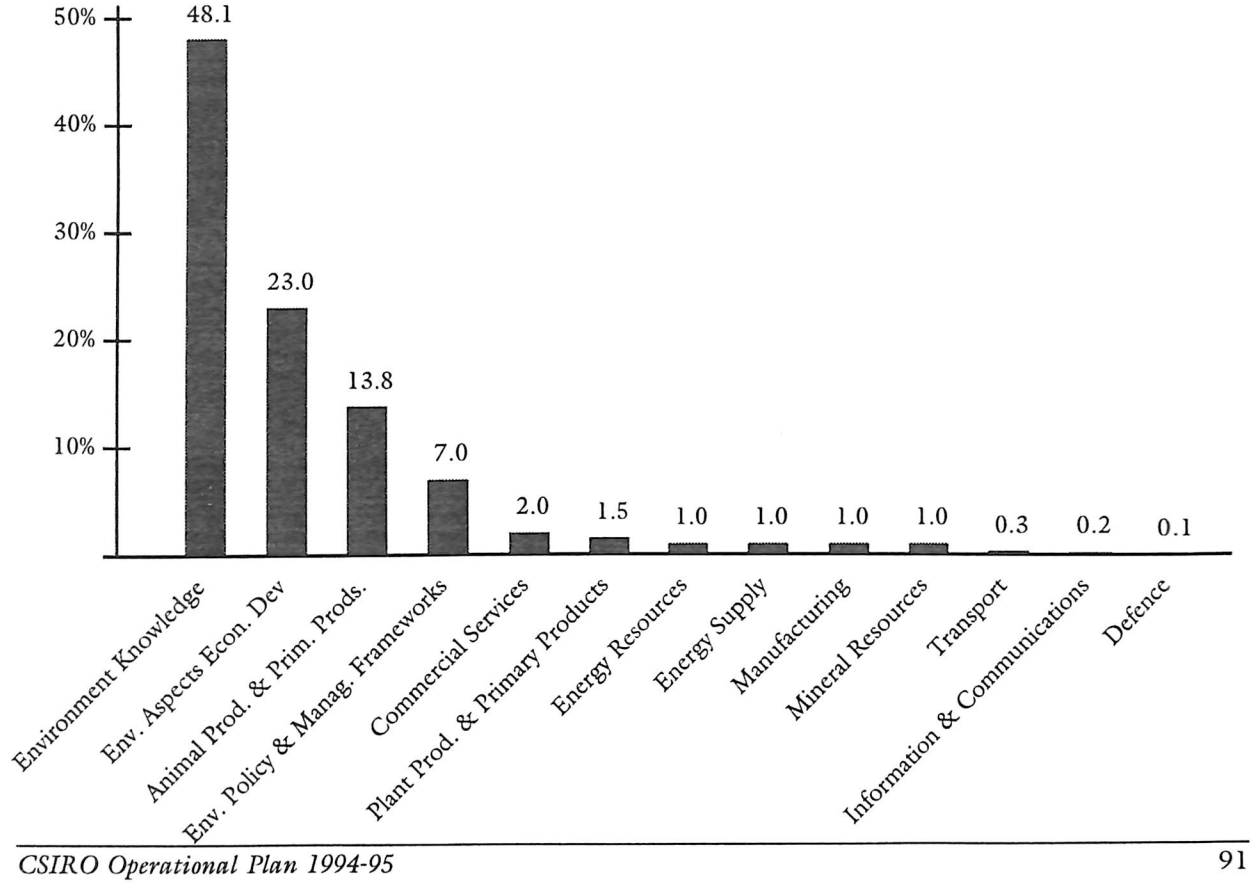
SUMMARY OF RESOURCES, 1994-95

(estimates as at June 1994)

Division	Staff by Functional Classification (EFT units)[1]				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Atmospheric Research	85	48	8	140	9,194	4,580	13,774
Fisheries	127	64	7	199	12,329	6,700	19,029
Oceanography	53	36	6	94	5,300	1,600	6,900
RV *Franklin* (A National Facility)	2	8	0	10	3,946	100	4,046
Water Resources	148	121	7	275	12,620	6,200	18,820
Wildlife and Ecology	160	81	3	244	14,515	8,348	22,863
Environmental Mechanics	20	18	1	39	2,629	546	3,175
CSIRO Office of Space Science and Applications	5	5	1	11	2,380	120	2,500
INRE Projects Office	0	4	2	6	82	600	682
Biometrics Unit	7	0	0	7	528		528
Institute specific funds	0	21	0	21	4,080	34	4,114
INRE Institute Headquarters	0	5	3	8	555	5	560
TOTAL	607	411	38	1054	68,158	28,833	96,991

[1]Equivalent full time units. Research staff includes the Research Scientist/Engineer and Research Projects classifications; Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1994-95



37. Division of Atmospheric Research (INRE)

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

- Solve a range of practical problems associated with urban and regional air pollution, and apply increased knowledge of surface, orographic and boundary-layer processes to the improvement of modelling systems.
- Determine the causes of current atmospheric concentrations and predict future trends in climatically-active and ozone-destroying gases and aerosol influenced by human activity.
- Undertake studies of processes controlling atmospheric behaviour and apply this knowledge to problems concerning Australia's weather, climate, atmospheric pollution and water resources.
- Describe and quantify the radiative aspects of the earth's atmosphere and surface, especially the interaction of radiation with clouds and water vapour.
- Develop and maintain a hierarchy of climatic models capable of addressing current and perceived developing environmental issues of regional and global concern.
- 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

Data Acquisition and Utilisation - MDP19

Climate Variability and Impacts - MDP29

Air Quality - MDP30

Specific Objectives & Planned Outcomes

Investigate factors which influence urban and regional air quality and identify sources of pollution and the way in which it is formed, tranported and dispersed. (17%)

1 Modelling study of shoreline fumigation of pollutants.

2 Theoretical calculation of concentration statistics and comparison with wind-tunnel data.

3 Laboratory simulation of g.l. concentration statistics due to buoyant plumes in connective boundary layer.

4 Development of improved method for predicting dry deposition of acid gases.

5 Specific air quality consultancies, including conclusion of the Sydney Metropolitan Air Quality Study.

6 Commencement of study of visibility reducing aerosols in Perth.

7 Continuation of field studies of rain-water acidity in NSW and Malaysia.

8 Continuation of a project to survey concentrations of toxic synthetic chemicals in urban air.

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

9 Improved representation of severe storms in limited-area models.

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. (22%)

11 Operation of the Geophysical Data Processing Facility and expansion of data sets.

12 Field and satellite studies of land surface temperatures and radiation fluxes.

13 Completion of the second field phase of the Southern Ocean Cloud Experiment.

14 Investigation of the mechanisms and causes of large-scale atmospheric disturbances designed to improve climate model simulations.

Incorporate into climate models improved descriptions of dynamical systems and of the interaction of radiation with clouds and the earth's surface. (5%)

15 Completion of study identifying factors influencing short wave fluxes and net radiation in climate models.

16 Cloud climatology collaborative study with Western Australian and New Zealand colleagues.

17 Improved surface specification, particularly snow representation.

Apply recent developments in remote sensing instruments to research and commercialisation. (5%)

18 Development of the prototype satellite-borne atmospheric pressure sensor.

19 New three-wavelength lidar used during the Southern Ocean Cloud Experiment and the Perth Airshed Study.

20 Decisions made regarding commercialisation of the Airborne Hazards Detection System.

Develop powerful computer climate models of the global atmosphere and of the combined atmosphere-ocean system to investigate climate variability including drought, climate change associated with the enhanced greenhouse effect. (17%)

21 Development of a Mark II version of the 9-level general circulation models, involving improved coupled atmospheric, oceanic, biospheric and sea-ice sub-models.

22 Application of the Mark I coupled ocean-atmosphere model, to transient growth carbon dioxide, including sea-ice and advanced land-surface schemes used in a major greenhouse modelling experiment.

23 Drought research expanded to include sea surface temperature anomalies in other oceans. (EN2)

Assess regional extent and impact of future climate change caused by changing atmospheric composition. (13%)

24 Development and application of new methodologies for analysis of climate change data.

25 Annual reports to WA, NT, Queensland, NSW and Victoria on relevant regional climatic impacts.

26 Further assessments of the likely impact of the enhanced greenhouse effect on phenomena such as extreme events.

Investigate the past, present and future sources, sinks and budgets 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. (16%)

27 Analyses of a range of radiatively active and ozone-depleting gases and their isotopes.

28 Analysis of the historical changes of the concentrations of gases in air extracted from Antarctic ice cores and from the Division's archived air.

29 Numeric models of atmospheric transport and exchange for interpretation of observations and predictions of future trends of radiatively active and ozone-depleting gases.

30 Global and national budgets of greenhouse and ozone-depleting gases will continue to be examined.

31 Participation in international Airborne Southern Hemisphere Ozone Expedition.

32 Ongoing scientific support provided for the Australian Baseline Air Pollution Station.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$9,194,000
External funds	$4,580,000
Total Expenditure	**$13,774,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
36%	41%	41%

*estimates as at June 1994

38. Division of Fisheries (INRE)

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 a climate of increasing demand for seafood products, marine fisheries resources world wide are under threat from over-exploitation and the loss or degradation of important coastal habitats. Expanding production within the mariculture industry is meeting part of this increased demand. The sustainable development of the Australian marine fisheries sector will require the development of new approaches to the management of marine living resources and exploitation practices that minimise impacts on marine ecosystems.

- 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 to assist with the assessment and management of the impacts on the marine environment of resource exploitation, economic development and climate variability.
- 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

Algal Research Program - MDP20

Coastal Zone Program - MDP21

Management of Marine Living Resources - MDP23

Climate Variability and Impacts - MDP29

Specific Objectives & Planned Outcomes

To understand the ecology and dynamics of Australia's tropical fisheries and to use this knowledge to assist government and industry manage these resources for ecological and economic sustainability. (18%)

1 Demonstration of the key role of seagrass and mangrove habitats in determining the long-term sustainable productivity of prawn populations in the Northern Prawn Fishery.

2 Scientific assessments of the state of the stock for the Northern Prawn Fishery, Tropical Rock Lobster Fishery, Northern Demersal Trawl Fishery, Torres Strait Islander traditional fishery and Torres Strait sea-turtle populations provided to resource managers.

3 New fish trawls designed, developed and their effectiveness in maintaining catch rates while reducing by-catch and minimising the damage to the bottom scientifically demonstrated.

4 Information provided to management authorities on biological communities in trawled and untrawled areas as part of a long-term study of the impacts of prawn trawling on the Great Barrier Reef.

To determine the ecological principles needed for managing Australia's temperate and deepwater fishery resources for ecological and economic sustainability, and to assist government and industry to apply these principles. (21%)

5 An assessment of the significance of large-scale climate forcing on Australian temperate marine ecosystems based on an analysis of historical meteorological, oceanographic and fisheries information.

6 Completion of biomass surveys for principal commercial deepwater fish stocks and provision of estimates of stock size for incorporation into management strategies.

7 Development of spatially-resolved population models of southern shark species and an analysis of implications for stock recovery plans.

8 Resolution of the stock structure and larval identification of the introduced Northern Pacific Seastar, and development of more accurate models of its rate of spread.

To determine the ecological principles needed for managing Australia's pelagic fishery resources for ecological and economic sustainability, and to assist government and industry to apply these principles. (21%)

9 A scientific assessment of the present state of the southern bluefin tuna stocks provided and effectively presented at international scientific and management meetings. (AP6)

10 An archival (data storage) tag designed, developed, field tested on southern bluefin tuna, and a business plan developed for its commercialisation. (AP6)

11 A modular fishery simulation model, incorporating environmental influences, developed and applied to the interpretation of tuna distributions. (AP6)

To develop and apply methods for designing and evaluating management strategies for renewable resources and environmental systems; to integrate environmental, resource and economic modelling for assessment and management. (5%)

12 Aerial survey methodology developed and applied to the estimation of abundance of juvenile southern bluefin tuna. (AP6)

13 Completion of a quantitative analysis and a risk interpretation of the biological consequences of ocean dumping of jarosite.

To develop the scientific and technological basis necessary to expand and improve the performance of the mariculture industry. (10%)

14 Assessment of a variety of natural isotope incorporation and insect gene-insertion techniques as part of the development of novel biological tags for penaeid prawns.

15 Examination of trophodynamic pathways in aquaculture ponds and measurement of assimilation efficiencies of formulated aquaculture diets using stable isotopes.

16 Development of formulated penaeid prawn diets which enhance reproductive performance by increasing egg hatching rates and larval viability.

17 Assessment of the utility of supplemental feeding with unicellular algae as a method of increasing 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. (25%)

18 Development and implementation of methods to document the relationships between biological activity, small scale transport and the fate of nutrients in coastal sediments.

19 SeaWIFS ocean colour data received and processed in support of fisheries and environmental applications.

20 Completion of the Joint Global Ocean Flux Study (JGOFS)/optics cruise in the Subtropical Convergence Zone.

21 Identification of molecular markers specific for toxic/non-toxic strains and species-specific markers for the bloom-forming species of cyanobacteria in Australian waters.

22 Completion of studies to evaluate the key processes affecting filter feeders, seagrass epiphytes and phytoplankton, and the potential and realised impacts of nutrient loading on these processes.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$12,329,000
External funds	$6,700,000
Total Expenditure	**$19,029,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
38%	35%	35%

*estimates as at June 1994

39. Division of Oceanography (INRE)

Objective

To provide a scientific basis for the efficient conduct of national activity relating to the Australian regional oceans, seas and estuaries, including resources, environmental management, technology and the prediction of climate.

Strategy

National needs for physical and chemical marine expertise are very diverse, and will be further extended by the declaration of the marine Exclusive Economic Zone. These needs are best met by integration of core research capability into programs defined by requirements of the users.

A major government requirement is advice for marine environmental protection policy. 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 are needed for transport and defence. Fishing additionally needs nutrient status. A primary impetus for larger scale oceanographic observation and research is 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.

The oceanographic research requirements for the foregoing purposes are combined by:

- Developing generic capability 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.
- Enhancing 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.
- Providing direct marine research service and scientific advice to industry, and federal and state bodies on issues of environmental management and industrial development; developing marine products in collaboration with industry.
- Operating the RV *Franklin* and maintaining 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

Specific Objectives & Planned Outcomes

Describe and quantify physical processes in the oceans and incorporate them in predictive models of climate variability in the Australian region (el Nino Southern Oscillation and Indian Ocean related effects in particular) and of "greenhouse" induced climate change. (35%)

1 Documentation of results from TOGA-COARE, which have shown that the target of 10 watts/m^2 accuracy for the ocean mixed layer heat budget has been clearly bettered. (EN2)

2 Deployment of current meters to estimate the flow of water from the Pacific, to the Indian Ocean, through the Indonesian Archipelago.

3 Documentation of interannual variation of heat storage and volume transport of Indonesian Throughflow in the eastern Indian Ocean. (EN2)

4 Pacific domain high resolution Ocean General Circulation Model for study of ENSO . (EN2)

5 Accurate estimates of mass, heat, freshwater and nutrient transports from the Indian to the Pacific Ocean south of Australia.

6 Implementation of a Southern Ocean Model with increased resolution in the Australian sector (Antarctic CRC).

7 Simulation of oceanic CFC by the CSIRO coupled ocean-atmosphere model. (EN1)

8 Global ocean model developed for coupling with the CSIRO T63 Atmospheric Global Circulation Model. (EN1)

9 Model assessment of sea surface temperature (SST) sensitivity to interannual wind variations in the Indian Ocean.

10 A prototype numerical model of the Tasman and Coral Seas with resolved eddies suitable for studies of impacts of climate variability on the coastal ocean.

11 Demonstration of the need to advect heat and tracers with the quasi-Lagrangian velocity rather than with the Eulerian velocity.

12 Estimates of altimeter-derived momentum fluxes in the Southern Ocean.

Describe the physics of estuaries and coastal seas, by modelling and measurement, for application in pollution dispersal, fisheries management and offshore engineering. (25%)

13 Applications of an advanced three dimensional hydrodynamic model to coastal and estuarine environmental studies and current and sea-level prediction for offshore engineering design.

14 Description of the physical processes likely to be important in the development of management strategies for marine living resources (MDP - Marine Living Resources).

15 Development and application of a general purpose solute and sediment transport model for an $11M environmental study of Port Phillip Bay.

16 An assessment of the environmental effects of the ocean dumping of jarosite waste southeast of Tasmania, using a range of observational and modelling techniques.

17 Development and verification of models of the turbulent dynamics under storm-wind conditions, with emphasis on tropical cyclones on the Northwest Shelf and their implication for offshore engineering.

18 Description of the currents which carry prawn larvae from their spawning beds in Albatross Bay (Gulf of Carpentaria) into the fringing estuaries, so influencing the following year's prawn harvest.

19 Proposal with Vietnamese colleagues for physical, chemical and biological oceanography studies of the South/Central Vietnam continental shelf with application to fisheries, the oil industry and Mekong River pollutants.

Undertake directed research on the chemistry of the oceanic, coastal and estuarine environment and provide impartial advice to Government and Industry. (20%)

20 An evaluation of the factors controlling the carbon cycle in the western Equatorial Pacific (JGOFS).

21 Determination of the seasonal variability in the chemical forms of carbon dioxide and transport of carbon in the Southern Ocean (JGOFS - WOCE - Antarctic CRC).

22 A compilation of chemical data from the Derwent Estuary (Coastal Zone Program).

23 An evaluation of Antarctic lakes as proxy systems for biogeochemical processes in the marine environment (Antarctic CRC)

24 Analytical techniques for the measurement of environmentally important chemical species.

25 Determination of markers for sewage, primary producers and bacteria in sedimentary organic matter in Port Phillip Bay.

26 Quantification of the degradation rate of the faecal biomarker coprostanol and its relationship to other faecal indicators.

27 Application of biomarker techniques to determine the sources of hydrocarbon inputs to coastal waters and sediments.

28 Determination of the extent and distribution of sewage and pulp mill contamination in the Derwent Estuary and transfer of relevant information to state and local authorities.

Promote the development of marine products, resources and instrumentation in collaboration with Australian marine industries. (20%)

29 Transfer to Australian industry of sewage tracer technologies (e.g. coprostanol) developed by the Division.

30 A process to purify polyunsaturated fatty acid-rich marine oils from Australian species and seeking of industry partners to exploit this resource.

31 A survey of the concentration of essential polyunsaturated fatty acids in cryptomonads, bacteria and yeasts used in aquaculture feeds.

32 A survey of selected natural and artificial feeds, and determinatiom of dietary effects on muscle composition as pilot investigations into the lipid requirements of abalone.

33 Commencement of operations for the Tasmanian Earth Resources Satellite Station (TERSS), developed with the University of Tasmania and other partners.

34 Completion of SEASOAR upgrades to enable electric motor drive of wings and simpler tow cable systems.

35 Measurement of levels of commercially exploitable components in Australian shark liver oils.

36 Identification of feeding regimes which result in improved nutritional quality of zooplankton feed intermediates for finfish nutrition.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$5,300,000
External funds	$1,600,000
Total Expenditure	**$6,900,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
21%	30%	25%

*estimates as at June 1994

40. RV *Franklin* (A National Facility) (INRE)

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 (94 days or 46% of the total) in 1994-95. (100%)

1 An investigation of air-sea interaction and the ocean's surface heat budget in the Tropical Indian Ocean.

2 Examination of unusual cold water intrusions onto the Southern West Australian shelf edge and their interaction with the Leeuwin Current.

3 A study of the evolution and eventual dissipation of internal tides on the Northwest Shelf.

4 An Australian contribution to the international WOCE experiment in the Indian Ocean.

5 Measurement of bottom currents in the West Australian Basin of the Indian Ocean with a view to estimating poleward heat flux.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$3,946,000
External funds	$100,000
Total Expenditure	**$4,046,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
5%	2%	2%

*estimates as at June 1994

Objective

To provide the scientific knowledge necessary for the effective management of water resources, particularly in relation to water quality.

Strategy

The natural resource industry in Australia and the agencies responsible for its management are considerable. At Commonwealth, State and Local Government level, there are a significant number of departments and authorities that have policy and direct management responsibilities for natural resources. There is also an increasing number of environmental protection agencies at both State and Commonwealth level.

- Operate within research environment shaped to nurture innovation, anticipate research opportunities, and respond to community and industry needs via a range of consultation processes.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Urban Water Systems - MDP16

Climate Change - MDP17

Algal Research Program - MDP20

Coastal Zone Program - MDP21

Minesite Rehabilitation - MDP24

Climate Variability and Impacts - MDP29

Specific Objectives & Planned Outcomes

To develop a sound technical basis for better managing our groundwater resources, and for remediation of contaminated soil and groundwater. (19%)

1 A sound technical basis developed for carrying out and assessing remediation of soil and groundwater contaminated by organics, non-aqueous and aqueous phases.

2 More effective ways developed for protecting groundwater quality, particularly from intensive rural industries. (ED3)

3 New initiative developed focussing on groundwater flows in large sedimentary basins to provide a better predictive capability on flows/solute transport.

4 A remodelled Centre for Groundwater Studies with a national focus, based in Adelaide and Perth, and a market survey aimed at developing international links conducted.

By ecological research, promote environmentally safe management of surface waters. (17%)

5 Know-how on use of vertical flow wetlands for sewage treatment transferred to the CRC for Waste Management and Pollution Control, Sydney.

6 Integrated methods devised (herbicides, burning, revegetation) for restoration of an urban wetland previously overgrown with introduced aquatic weeds (Alligator Weed, Primrose Willow).

7 Methods devised for assessing the health of floodplain vegetation (Black Box) in relation to flooding frequency. (ED6)

8 The impact of carp in damage to irrigation infrastructure and in nutrient export from irrigation drainage channels quantified. (ED2)

9 Molecular ecology of microcystin-degrading bacteria investigated using gene probes and PCR techniques (with CSIRO Division of Tropical Animal Production and University of Queensland).

10 Bioaccumulation and biodegradation on cyanobacterial paralytic shellfish poisoining (PSP) neurotoxins demonstrated. (ED2)

11 The extent of pesticide contamination of irrigation drainage water from the Murrumbidgee and Coleambally Irrigation Areas (MIA, CIA) determined.

12 The toxicity of pesticides used in the MIA, CIA to *Ceriodaphnia cf. dubia* determined and their potential biological impact on receiving waters predicted.

Develop land and water use strategies in irrigated areas to reduce salinisation, increase productivity and maintain river water quality. (29%)

13 Selected irrigated crop water use and yield models developed and tested to include effects of shallow watertables, waterlogging and salinity. (ED6)

14 SWAGMAN Destiny (a predictive salt and water balance model) released for use in assessing the effect of various land and water management options in improving salinity management in irrigated areas. (ED6)

15 Suitability of soil puddling techniques to reduce deep percolation water losses below ponded rice assessed on-farm and adopted by state agency and industry personnel. (ED6)

16 SWAGMAN Options program further developed and applied to evaluate the economic and environmental consequences of rice, pastures and alternate crop production in irrigated areas for more sustainable development. (ED6)

17 Research project established on alternate uses of sewage effluent for irrigation in collaboration with inland local councils. (ED3)

18 First stage assessment completed of shallow sub-surface drainage under agronomic crops and a collaborative project on above and below groundwater management of vines and citrus established.

19 Potential for salinisation of groundwaters in mallee areas of the Murray Basin investigated.

20 Management of saline disposal basins maximised for their usefulness for salt storage.

21 The impact of floodplain management on riparian vegetation health and salinisation of the River Murray floodplain assessed.

22 Vegetation water use with salinisation processes in a regional groundwater discharge zone linked.

23 Recharge under a variety of dryland agricultural systems investigated.

24 Risk analaysis for dryland salinity development in the Murray-Darling Basin developed.

25 Progress made on indicators of catchment health.

26 Hydrogeomorphic mapping using GIS technology for rehabilitation of degraded catchments developed.

Identify sources and the fate of nutrients and sediment reaching water supplies, and predict the impact of climate variability and change on water resources. (19%)

27 Impact of climate variability and change on water yield assessed. (EN1)

28 Development and use of stable and unstable isotope techniques and mineral magnetics to trace water and sediment movement in the landscape. (ED7)

29 Sources determined of nutrients responsible for water eutrophication, algal blooms, degradation of water quality in the Murray-Darling Basin and, in particular, explicit tracing techniques for phosphorus. (ED2)

30 Respective roles of nutrient and anthropogenic phosphorus in eutrophication determined.

31 Strong collaboration maintained with authorities responsible for water catchment management by working with them in their planning and operational activities to ensure the use of our methods and results.

To develop and evaluate techniques in the information, social and economic sciences and apply them to the resource and environmental issues faced by scientists, managers and users of water and land, with particular emphasis on catchment management, water allocation and urban water systems. (16%)

32 A software program developed and implemented, for the prediction and management of nutrient flows from intensive rural industries including piggeries and feedlots.

33 A spatial expert system to predict vehicle trafficability in Northern Australia developed for Department of Defence.

34 The land management software developed for the Australian Army to assist in training range management and installed at the Pukapunyal Army Base modified to run under a new operating system.

35 The CMSS (Catchment Management Support System) installed in the Environmental Management Unit of the Sydney Water Board. A generic version of CMSS disseminated to users around Australia through workshops. There are currently around 50 user groups. (CS1)

36 An open-modelling version of CMSS developed.

37 A hypertext based generic model of algal blooms occurrence and management developed. (ED2)

38 On behalf of the Water Forum of SCARM, the Australian Research Centre for Water in Society established a Steering Committee of Industry representatives. Work progressed with projects in six areas: protection of water resources, equity and allocation issues, risk management, community change and rural adjustment in response to water policy changes, levels of service and institutional/community decision-making.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$12,620,000
External funds	$6,200,000
Total Expenditure	**$18,820,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
25%	30%	30%

*estimates as at June 1994

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 and techniques, resource management principles and guidelines and technical and management support systems.
- Communicate research results through scientific publications, consulting, conferences and the public media.
- Adopt an innovative approach to exploring the potential for utilizing unique features of Australia's biota.

Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17

Conserving Biodiversity for Australia's Future - MDP18

Data Acquisition and Utilisation - MDP19

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

Specific Objectives & Planned Outcomes

To determine the ecological principles needed for managing the nation's rangelands for ecological and economic sustainability; and to assist government and other land managers to apply these principles. (22%)

1 A model to assist decision making on rehabilitation of rangelands by constructing new habitats with local materials.

2 A book on the landscape ecology principles underpinning a new approach for the management of semi-arid weakened rangelands.

3 A major contribution to the development of the National Rangeland Strategy Plan.

4 Completion and delivery to the N.T. Conservation Commission of a geographic information system for tourism and conservation planning for the MacDonnell Ranges area.

5 Initiation of a research program on drought with LWRRDC, state agencies and other CSIRO divisions.

6 Initiation of a program of research on the impact of grazing on fauna.

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. (18%)

7 Completion of project on the use of ants as bioindicators. (ED7)

8 Completion of field studies on fire at Kapalga. (EN3)

9 Evaluation of extinction prospects for northern Australian mammals in relation to groundwater levels. (EN4)

10 Completion of major book on dingoes.

11 Completion of magpie goose monitoring program.

12 Development of models to predict occurrence of cassowaries for determining conservation areas. (EN4)

13 Publications on survival and dynamics of small mammals and specialised rainforest trees in relect forest fragments.

14 Publication on the expansion of the rainforest area in North Queensland over the last 50 years.

15 Completion of the first stage of a survey of distribution of key biota in wet sclerophyll forest in North Queensland.

16 Publication on use of fire as a management tool amongst pastoralists in North Queensland. (EN3)

17 Publication on re-evaluation of the distribution of North Queensland rainforest in the late Quaternary.

18 Publication of seasonal variation in leaf area index in rainforest secondary chronosequences.

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%)

19 Identification of possible agents for biological control of foxes and rabbits using an integrated ecological, virological, reproductive and molecular biological approach. (ED1)

20 A systems analysis of the rabbit-fox-myxoma-endangered species complex. (ED1)

21 Begin island trials of rabbit callici virus as new biocontrol agent.

22 A field release on the Darling Downs, Queensland of *Capillaria hepatica* for preventing plagues of house mice.

23 Field trials for mouse control in Victoria.

24 Development of a collaborative project with Malaysia, Indonesia and the Philippines for control of rats in rice crops.

25 Commencement of trials of microbial agents as pathogens of cane toad at AAHL.

26 Promotion of completed AUSPLAGUE for State and federal managers for enhancing feral pig control.

To develop principles for conservation biology and genetics, and to assist in the application of these principles to the conservation of Australia's biological diversity. (18%)

27 A Geographic Information System for the central wheatbelt of Western Australia as the first stage of developing a model for integrating nature conservation and agricultural production.

28 Release of burrowing bettongs in areas on Heirisson Prong, Shark Bay outside the secure compound. (EN4)

29 A book on birds of south western Australia: an atlas of changes in distribution and abundance.

30 A series of alternative forecasts of landcover change for the entire Australian continent for the period 1990-2040.

31 A land-use and management allocation model for integrating conservation and development in south-eastern Australian forests.

32 A marine mammal report of Mawson's Antarctic expeditions.

33 Action plans for bat and seal conservation in Australia.

To develop and transfer computer-based packages to assist decision makers responsible for inventory, evaluation, allocation and operational management of Australia's natural resources at a range of scales; and to assist in the management and conservation of forests, woodlands and other ecosystems in temperate Australia by predicting the patterns of distribution of vegetation and fauna, and their response to fire, logging, tourism and climatic change. (16%)

34 Development of the Coastal and Marine Resources Information System (CAMRIS) to address natural resource management issues in Australia's coastal and marine environments.

35 Development of the rationale for a project examining the impact of future Australian human population on the key environmental resources: water, air, biodiversity, soils and amenity.

36 Demonstration of a prototype GIS resource accounting system for NSW for assessing biodiversity, land degradation and the economic implications of various policy instruments.

37 Development of a 'Biodiversity and GIS' package to assist in the communication of the learning and application of various spatial decision support systems in relation to biodiversity.

38 Preliminary models of interrelationships between nutrients, chemical defences and arboreal fauna.

39 A modified BRIND model of incorporating prediction of stags (hollow trees) to assist in prediction of distribution and abundance of arboreal fauna in response to disturbance.

40 A relational database of plotbased environmental, floral and faunal data of southeastern temperate eucalypt forests.

41 A development of cost-effective survey methodology for biological data.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$14,515,000
External funds	$8,348,000
Total Expenditure	**$22,863,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
32%	34%	25%

*estimates as at June 1994

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

There is an increasing need for integrated, scientifically innovative approaches to complex problems in the Australian physical environment.

- Combine field investigations, laboratory experiments and theoretical analysis.
- Produce quantative 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

Algal Research Program - MDP20

Coastal Zone Program - MDP21

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, mircoclimates, surface energy balances and dispersion in heterogeneous or hilly terrain; and trace gas exchanges between the biosphere and atmosphere. (40%)

1 First OASIS field experiment on surface energy balances and trace gas exchanges in a heterogeneous landscape, with preliminary analysis of results.

2 Development and appliction of techniques for trace gase (CO_2, CH_4, N_2O) flux measurement at patch and regional scales, including eddy correlation and CBL budget methods.

3 Further analysis of air-sea interaction data from TOGA-COARE, leading to integration with mesoscale convection and ocean mixing processes in the west Pacific warm pool.

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

5 Wind tunnel studies of microclimate processes around windbreaks, particularly of scalar transfers and three-dimensional effects; collaboration with State agencies in field studies.

Devise realistic, physically-based descriptions of the processes which determine the distribution and flow of water, solute, gas and heat in soils and porous materials; develop *in situ* techniques for measuring the relevant properties required by these descriptions; apply these descriptions to problems arising in the management of the environment and agricultural production, or in cognate industrial processes. (30%)

6 Contributions of real and imaginary parts of the dielectric constant to the TDR determination of the water content of electrically conducting soils determined. (ED6)

7 Changes in soil physical properties and soil respiration due to sustainable crop management described. (ED6)

8 Data from remote hydrologic station measuring acid drainage from estuarine lands analysed. (ED6)

9 Applications to salinity disposal identified for model of the groundwater dynamics of salt plumes. (ED6)

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. (15%)

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

Communicate results of Division's research to users in the community, industry and government agencies. (15%)

11 Biennial Report published.

12 Strengthened interactions with the media.

13 Internet and World Wide Web presence developed.

43. Centre for Environmental Mechanics (INRE)

Summary of Planned Expenditure 1994-95[*]

Direct Appropriation	$2,629,000
External funds	$546,000
Total Expenditure	**$3,175,000**

External Earnings as a Proportion of Total Income[*]

1993-94	1994-95	1995-96
25%	25%	25%

[*]estimates as at June 1994

44. CSIRO Office of Space Science and Applications (INRE)

Objective

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

Strategy

Opportunities to contribute to international space research have increased significantly over the past year, partly as a consequence of the conversion of military technologies to civilian use. Contributions to the international space programs are essential for Australia to access Earth Observation data. In recognition of Australia's reliance on other countries for our Earth Observation data and space communication systems the challenge is to define the extent and nature of our role in space information systems. 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 Austrtalia.
- Enhance relationships within CSIRO, between CSIRO and international space agencies, and between CSIRO and other space science and technology stakeholders.
- Collaborate with the Australian Space Council and Space Office 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.

Multi-Divisional Collaboration

The Office participates in the following Multi-Divisional Program:

Data Acquisition and Utilisation - MDP19

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. (45%)

1 Divisional commitment to the rolling Strategic Plan for Space Science and Applications in CSIRO.

2 Analysis and action on opportunities arising from the Australian Space Council's Five Year Plan.

3 A CSIRO strategy for the design and operating parameters of Australian space instrumentation with applications to environmental monitoring and resource management.

4 Completion of the Australian Airborne Imaging Spectrometer Phase A Study and an assessment of the potential to develop an indigenous system.

5 Together with the private sector, enhanced promotion of the economic potential of the Daedalus airborne scanner, particularly with reference to the utilisation of the thermal channel.

6 A Five Year Plan for the effective use of resources for CSIRO's access to research aircraft facilities.

7 Assessment of satellite data reception needs for CSIRO in the context of program requirements and the effective use of resources.

Strengthen the participation by CSIRO and its scientific, technological and industrial collaborators in international space projects and global space programs. (30%)

8 Completion of the workshop phase of the Australian component of the 1993 NASA DC8 Synthetic Aperture Radar/SIR-C Calibration Program.

9 Assessment of the feasibility of a future mission to deploy specialist aircraft and instrumentation from NASA in pursuit of CSIRO and stakeholders research objectives.

10 Identification of project objectives for the NASDA (Japan) Global Research Network System (GRNS) and facilitation of Australian scientific participation in other European, Japanese, and other international earth observation and space science missions relevant to CSIRO's research requirements.

11 Contribution to Australian participation in regional initiatives such as the United Nations Economic and Social Commission (ESCAP) Space Applications Program, through staff exchanges, workshops and other means.

12 Representation of CSIRO and Australian interests at the international fora such as the Committee on Earth Observations Satellites (CEOS) plenary session in September 1994, and supporting related activities such as the Working Group on Calibration and Validation meeting in Canberra in December 1994.

13 Commencement of planning for the Australian-hosted CEOS plenary for 1996.

14 Commencement of planning for the Australian-hosted International Spectral Research Symposium (ISSSR) in 1995.

15 In collaboration with the Division of Atmospheric Research the completion of the second flight campaign to test the ability of the improved CSIRO Airborne Hazards Detector to discriminate volcanic ash from meteorological cloud.

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. (14%)

16 Continued timely publication and promotion of CSIRO Space Industry News (SpIN) magazine in order to communicate CSIRO and other Australian achievements.

17 Transfer of the resource centre and library to a new location, consolidating resources in order to meet more effectively the needs of COSSA staff and other users for information about global science and engineering.

18 Revision of public information material about COSSA.

19 Contribution to the Commonwealth Spatial Data Committee's finalisation of an Australian policy for the exchange of environmental data.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$2,380,000
External funds	$120,000
Total Expenditure	**$2,500,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
22%	50%	20%

*estimates as at June 1994

Objective

To promote the effective use of statistical methodology in CSIRO's agricultural, biological and environmental Institutes.

Strategy

CSIRO's agricultural, biological and environmental Institutes require advanced statistical methodology in support of their national priority research. Biometrics Unit staff support this effort by performing and promoting efficient design of experiments and effective data analysis and modelling, and by maintaining a high level of collaboration and communication both inside and outside CSIRO.

- Collaborate in Divisional and Multi-divisional research programs, both appropriation and externally funded.
- Provide high quality statistical consulting.
- Assist Divisional staff in their use of basic statistical methods and statistical computer packages.
- Contribute to the planning and evaluation of CSIRO's research.
- Perform biometrical research relevant to Divisional programs.
- Undertake direct external consultancies consistent with the objectives of IAPP, INRE and IPPP.

Specific Objectives & Planned Outcomes

Collaborate in Divisional research projects and provide high quality statistical consulting. (65%)

1 Staff located part-time or undertaking regular visits in major locations of Divisions, as required for collaboration and consulting.

2 Full statistical analysis and reporting of major projects.

Assist Divisional staff in the use of basic statistical methods and statistical computer packages. (10%)

3 The short courses "Design and Analysis of Experiments", "Introduction to Genstat 5", "Introductory Statistics" and "Regression Modelling" offered at least once in Adelaide and Canberra, and in other locations as required.

4 Maintenance of organisational licences for Genstat 5.

Contribute to the planning and evaluation of CSIRO's research. (5%)

5 Divisional research proposals and drafts of publications and reports refereed when requested.

6 Participation in reviews of Divisions, programs, projects and subject areas by direct involvement when requested, and by making submissions when relevant.

Perform biometrical research relevant to Divisional programs. (10%)

7 Methodological publications, including one on non-linear functional relationships.

Undertake external consultancies consistent with the objectives of IAPP, INRE and IPPP. (10%)

8 Two consultancies in risk assessment.

*Summary of Planned Expenditure 1994-95**

Direct Appropriation	$528,000
Total Expenditure	**$528,000**

*External Earnings as a Proportion of Total Income**

1993-94	1994-95	1995-96
0%	0%	0%

*estimates as at June 1994

46. Corporate Services Department

Objective

Provide high quality, timely and responsive corporate policy advice and management services in support of CSIRO's goals.

Strategy

CSIRO's Corporate Services provides support to CSIRO in a number of functional areas such as financial, human resource, property and information technology and services management, etc. This support is focussed on meeting CSIRO's organisational needs in these areas. Typically, it includes developing policies for the Executive Committee, providing specialist advice to line management, and coordinating and delivering services best handled centrally. The Department operates under a set of principles set out below. More details about the Department's objectives and projects can be found in the Department's five year plan, *Supporting Science in the Nineties* (December 1993).

- CSIRO's core business requirements must drive all Corporate Services' activities.
- Corporately, CSIRO only undertakes activities that affect the Organisation's core business, accountability or effectiveness.
- Corporate Services' main activities will be undertaken in close consultation with line management and will be restricted to areas of strategic importance to the conduct of the core business.
- Corporate Services will advise the Chief Executive on organisational performance and compliance in key policy and statutory areas.
- Corporate Services will advise and support the Chief Executive, the Institute Directors and the Chiefs of Divisions on issues of organisational significance.
- Corporate Service will provide services to CSIRO best delivered centrally on the basis of their strategic significance to the Organisation's efficiency and effectiveness or for which a clear demand exists and full costs can be recovered from users.
- Except in cases covered by the preceeding point, services that are available from Australia's private sector or from elsewhere in the Organisation generally will not be provided by Corporate Services.
- All services provided by Corporate Services will be fully costed and these costs recovered or identified through one of the following means:
  - client billing, ie charging the full costs of the service to the service user;
  - broad attribution at Institute or Division level of costs of services performed on behalf of Institutes and/or Divisions;
  - attribution at corporate level for services or costs most efficiently provided or charged corporately.
- Corporate Services will review regularly with the Organisation's line management the nature, level of resources and requirement for the activities it conducts centrally.

Specific Objectives & Planned Outcomes

Provide professional advice and services to support financial planning and financial management within CSIRO. (4%)

1 Support for the Chief Executive and Board through the development of financial planning options for the next triennium consistent with the Organisation's priorities.

2 Improved financial planning in CSIRO, by enhancing the periodic budgeting system and accounting practices for both Revenue and Expenditure.

3 Preparation of the Organisation's budgetary documentation to meet Government timetables in the prescribed format for Commonwealth Budget Papers.

4 Monitoring of CSIRO's financial position and production of financial performance reports to the Executive Committee (monthly) and Board (quarterly), and CSIRO statutory financial reports.

5 Development, formulation and communication of commercial "accrual" based accounting policies, procedures and systems ensuring accounting standards are upheld.

6 Promulgation of CSIRO Financial Directions that are current and consistent with business and statutory requirements.

7 Implementation of full accrual accounting based management and reporting practices in all divisions using commercial accounting systems by 30 June 1995.

8 In consultation with Institutes, development of a program of continuous improvement of financial management skills for finance managers.

Specify and implement financial systems to meet the Organisation's needs. (3%)

9 Provision of support for UNIBIS and financial systems in general which meets the needs of users at all levels.

10 Provision of programming/analysis to resolve problems and improve financial systems and reports in response to users' requests.

11 Provision of acceptance testing, training and support services for new releases of UNIBIS.

12 Provision of access to integrated summary and detailed financial data.

13 Provision of finance advice and testing to facilitate the transfer of the ADABAS/NATURAL finance systems from the Fujitsu M760 to the new Unix server.

14 Provision of advice on finance requirements and testing to facilitate the implementation of a central corporate general ledger.

Provide a central contact point, co-ordination, analysis and quality control for CSIRO's corporate external interactions with the Minister for CSIRO, other Ministers as appropriate, Government departments and other parts of the Australian R & D System. (2%)

15 Awareness of issues being considered by Government and provision of regular summaries to alert senior staff to opportunities for input on relevant items.

16 Liaison with Government Departments and agencies, and other parts of the research system, through liaison committees and individual contacts, to provide input on issues relevant to CSIRO and achieve collaboration when appropriate.

17 Preparation or coordination of corporate submissions and other input to external inquiries which arise during 1994-95.

18 Provision of timely and high quality correspondence and briefings to the Minister.

19 Provision of briefings for the Chief Executive, particularly for participation on high level councils and committees and for meetings with portfolio Ministers.

20 Awareness of national and international developments in S & T policy and provision of advice to senior staff when relevant to CSIRO.

Assist line management to implement the Human Resources Plan and associated policies to attract, retain, develop and deploy high quality staff; provide professional human resource management advice to line managers. (18%)

21 Proposal of new structures for HR management to take account of CSIRO's changed business focus and outcomes of 1994 Review of HR in CSIRO. (Eval)

22 Provision of consultancy service to senior corporate managers and business units on organisational change, interactive strategic planning, team building and human resource management.

23 Development of a comprehensive strategic remuneration policy to provide line mangers with flexibility to attract and reward key performers in line with business needs.

24 Development of proposals for team-based rewards and awards to recognise scientific and commercial success in team-based activities.

25 Through enterprise agreements, provision of maximum flexibility in employment and conditions arrangements for staff plus salary packaging and other appropriate private sector employment arrangements.

26 Provision of strategic and operational support to business units on industrial relations issues including representing CSIRO before the Australian Industrial Relations Commission.

27 Completion of review of current CSIRO competency standards and provision of new tools for managers to apply in classifying, rewarding and developing staff.

28 Review of training and development architecture and identification of appropriate corporate programs for middle and senior staff.

29 Conduct of two Research Management courses, six Project Leaders courses and development and trial of a new development program for CSOF 5 & 6 administrative and research staff.

30 Completion of 1993/94 Leadership Development program, review program with a view to implementing changes agreed by Executive Committee for the 1994/95 round.

31 Assistance given in identifying and providing training and development opportunities for Chiefs, Directors and the Chief Executive.

32 Completion of major policy review of appointment and promotion arrangements for CSOF 7/8 non-research staff by August 1995.

33 Review of all current corporate HR manuals and documentation. Development of consolidated, plain English material to supplement or replace existing material wherever possible.

34 Completion of review of existing OHS policies and publication in consolidated form by September 1994.

35 Development of HR performance indicators, compare and analyse CSIRO's performance through appropriate benchmarking studies. (Perf)

36 Review of current EEO strategies and programs including disability and EEO scholarships. Continue introduction of ATSI strategy in partnership with DEET.

37 Development, in conjunction with Enterprise Bargaining partners, of policies to improve workplace flexibility for staff with family responsibilities and those who carry out work from home.

38 Management of Consultative Council and its associated Sub-Committees and the Corporate OHS Committee.

39 Introduction of policy and procedural changes flowing from 1993 Review of Travel.

40 Provision of support services to business units relating to payroll, workers compensation, superannuation, redundancies and redeployment, appeals and grievances, advertising and recruitment selection processes.

41 Management on behalf of Institutes and Divisions of the network of Health & Safety Advisers and the Apprentice Coordinator.

Specify and implement human resource systems to meet the Organisation's needs. (3%)

42 Identification of system development needs through interaction with human resources systems users. Determination of appropriate service levels and priorities for HR systems development. Supervision of contract with ITSB to provide maintenance and enhancements.

Assist in the transfer of research results through the provision of an information infrastructure for science and technology within CSIRO, and in Australia, which is engaged in the active publishing, collecting, disseminating and communicating of science information through a variety of media. (32%)

43 Publication of the twelve Australian Journals of Scientific Research, *Australian Journal of Experimental Agriculture* and *Australian Journal of Astrophysics.*

44 Publication of at least twenty-five CSIRO monographs.

45 Development of new products and services using emerging technologies such as multimedia, electronic transfer of files, networks and CD-ROMs.

46 Quarterly issues of the science magazines *Ecos* and *Rural Research* and bi-monthly issues of the business magazine *CSIRO Business.*

47 Production of science and research in progress databases on behalf of external customers and CSIRO.

48 Communication of CSIRO's research through multimedia displays, corporate videos and printed publications.

49 Active marketing of CSIRO's science publishing through a Bookshop service.

50 Dissemination of science information through online networks, inquiry services, consultancies and advice.

51 Provision of cost savings in centralised acquisition of library journals and management of the CSIRO library network catalogue.

52 Effective preservation and dissemination of CSIRO research publications and organisational records.

Specify and implement library and information dissemination systems to meet the Organisation's needs. (2%)

53 Implementation of Voyager as a replacement for the GEAC library system by September 1994.

Provide a professional, cost effective and efficient information technology service to CSIRO. (31%)

54 Planning for and management of corporately required information technology services and contracts for CSIRO.

55 Replacement of the Fujitsu mainframe with Unix servers by August 1994. Provision of and support of the Unix operational environment for corporate applications.

56 Provision of and maintenance of the Corporate network infrastructure for the transmission of voice, data and image Australia wide. Continued replacement of PABXs.

57 Integration of the voice and data networks and establishment of a single CSIRO network utilising AARNet.

58 Management of the relationship with AARNet and continued installation of links for research managers to e-mail, corporate administrative systems, and information and resource discovery services.

59 Maintenance of all existing systems providing for statutory and corporately required changes and maintenance of existing user manuals and communications systems for CSIRO's IT client community Australia wide.

Provide a corporate property management service to ensure adequate and cost effective research accommodation and facilities. (5%)

60 Facilitation of the revised Property Management Strategy emphasising rationalisation, consolidation and the exploitation of collaborative opportunities, and completion of ongoing projects at Parkville, Clayton, Werribee, Black Mountain and Merbein.

61 Management of the Approved Capital Investment plan of $115 million over the Triennium, excluding externally funded items.

62 Implementation and management of the internal leasing scheme for CSIRO's accommodation.

63 Coordination of Stage 1, North Ryde redevelopment with Business Plan through executive participation in Project Control Group.

64 PPWC approval for redevelopment of Gungahlin site.

65 PPWC approval for the relocation of the Food Laboratories, Highett to Werribee.

66 PPWC approval for the relocation of Mineral Products from Port Melbourne to Clayton.

67 Implementation of a self funding strategy for the relocation of Animal Health facilities from Werribee/Maribyrnong to State Agriculture land.

68 Completion of master planning studies for Clayton, Gungahlin, Werribee, St Lucia and Pinjarra Hills.

SUMMARY OF RESOURCES, 1994-95

(estimates as at June 1994)

Branch/Unit	Staff by Functional Classification (EFT units)[1]			Expenditure Estimates ($'000)		
	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Corporate Finance	22	2	24	2,287	40	2,327
Government Business and Policy	3	2	5	441	17	458
Human Resources	45	4	49	4,622	62	4,684
Information Services	106	2	108	4,518	5,795	10,312
Information Technology Services	66	2	68	5,527	198	5,725
Corporate Property	13	2	15	1,291	17	1,307
Corporate Library & Information Services	4		4	251	13	264
Site Administration - Limestone Avenue	22		22	2,090	103	2,193
Director CSD	2	3	5	479	17	495
Central Funds				1,880	180	2,060
TOTAL	283	17	300	23,386	6,442	29,825

[1]Equivalent full time units. Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

47. Corporate Business Department

Objective

Advance the achievement of CSIRO's goals by promoting good commercial practice at all levels of CSIRO and by strengthening CSIRO's relations with stakeholders and clients, in particular the business community, both in Australia and abroad.

Strategy

Recognising both the fundamental importance of science and technology in enhancing the competitiveness of Australian industries, and the critical role of good commercial practice in maximising effective interactions between CSIRO and the business community, the Corporate Business Department will:

- provide a professional corporate legal service for CSIRO
- inspire interest in, and support for, CSIRO's research among key stakeholders and the general community
- identify and assist in developing international alliances of advantage to Australian business and scientific communities
- provide planning and evaluation services for CSIRO managers
- strengthen and expand CSIRO's relationships with the Australian business community.
- promote good commercial practice at all levels in CSIRO
- manage the administration of the CSIRO Head Office

Specific Objectives & Planned Outcomes

Provide professional legal services to CSIRO. (7%)

1 Provision of advice to the Chief Executive, the Board, Directors, Chiefs and General Managers on all legal aspects of their management and commercialisation responsibilities including compliance with legislation, administrative and general law, safeguarding the legal interest of CSIRO and avoiding unnecessary exposure to legal risks.

2 Management of litigation and administrative law proceedings on behalf of CSIRO

3 Provision of drafting and advisory services (including revison and development of model agreements) to support Cooperative Research Centres and other substantial contract negotiations.

4 Provision of drafting, instruction and interpretation services in relation to the Science and Industry Research Act and other legislation.

5 Fulfillment of CSIRO's responsibilities under administrative law (Freedom of Information, Administrative Decisions, Judicial Review, Ombudsman, Privacy) and Income Tax Assessment Act for Approved Research Institutes.

6 Provision of legal educational services to CSIRO.

7 Ongoing review of the CSIRO Commercial Practice Manual.

Promote CSIRO to stakeholders and the general public. (27%)

8 Positive media coverage of CSIRO, with an increase in radio coverage of approximately ten per cent in 1994-95.

9 Opportunities created for interaction of CSIRO staff with parliamentarians, industry and government officials. Increasing emphasis on meetings with, and publications for, industry.

10 Public exhibitions of CSIRO work including travelling displays on CSIRO food and nutrition research and, for remote areas, on CSIRO generally.

11 Provision of information about CSIRO and scientific/technical matters through a customer-focused service from regional offices handling approximately 40,000 enquiries per year.

Promote interest in science among school children. (13%)

12 Twelve media items about CSIRO's education programs including the Double Helix Science Club, Student Research Scheme, CSIRO Science Education Centres and the BHP Science Awards.

13 By July 1995, Double Helix Club membership of 27,000 with total sales of The Helix magazine of 30,000.

14 Visitors to the CSIRO Science Education Centres of 60,000 per year; 450 students in the CSIRO student Research Scheme; 1100 students in the BHP Science Awards; 1200 students undertaking CREST projects.

15 Student project enquiries handled through the development of curriculum-related science information packs and publication of topic books.

Provide an effective corporate communications service. (4%)

16 Preparation and delivery of the CSIRO Annual Report according to parliamentary guidelines and EC decisions.

17 Production of the staff magazine "CoRe-search" and its extension to partial electronic delivery.

18 Testing and establishment of new electronic forms of staff communication.

19 Production of corporate promotional documents to assist in relations with stakeholders and the public.

20 Regular meetings of CSIRO's Divisional communicators on a regional basis to promote internal communication and a corporate approach to CSIRO's communication.

21 Provision of media skills, presentation skills and receptionist skills training for CSIRO staff on a cost recovery basis.

Support CSIRO's corporate and statutory responsibilities in relation to international matters. (8%)

22 Provision of advice to the Chief Executive and Directors and support for the development of corporate policy on international matters.

23 Fostering of CSIRO's contributions to international scientific collaboration and technical cooperation.

24 Representation of CSIRO and Australia at international meetings, conferences and government missions.

25 Review of the role and function of the International Affairs Group. (Eval)

Provide services to assist Institutes and Divisions in their development of international activities. (5%)

26 Establishment and coordination of an international strategy group of representatives of Institutes and Divisions to collate information and experience about international activities.

27 Development of close relationships with Austrade, DIST and various Industry councils and associations with the objective of making more effective use of their services.

28 Provision of specialist skills and knowledge to Institutes and Divisions to assist them in developing international collaborations.

29 Arrangement and management of training and study tours for UN and other aid agencies and promotion of training opportunities to those agencies.

Coordinate preparation of corporate planning documents. (2%)

30 CSIRO Operational Plan 1995-96 completed by June 1995

31 Revised CSIRO Strategic Plan completed by June 1995

32 CSIRO Evaluation Plan completed by October 1994. (Eval)

33 CSIRO input to the Science and Technology Budget Statement completed by April 1995.

Support development and implementation of the CSIRO planning process. (3%)

34 Updated documentation of the CSIRO research priorities process including elements of "best practice".

35 Contributions to and/or facilitation of the research priorities process for Divisions and selected clients.

36 Further development of indicators of Organisational performance. (Perf)

37 Trial applications of scenario planning in selected Divisions and Branches.

Provide data and analytical services to support planning and evaluation throughout CSIRO. (2%)

38 Maintenance of data on the distribution of CSIRO's research effort and provision of same in response to both internal requests and statutory reporting requirements.

39 Revisions and additions to the CSIRO Research Priorities Data Compendium; and provision of data for the Executive Information System and CSIRO Data Book.

40 Analyses of data and information on pertinent topical issues provided for members of the Executive Committee, the Board and line managers.

Promote new business opportunities for CSIRO. (14%)

41 Investigation of market opportunities for new industry areas in Australia or overseas.

42 Liaison with clients and other stakeholders to maximise the opportunities for new commercial agreements.

43 Development of the information resources needed for effective management of CSIRO's internal activities and to support the investigation of new business opportunities.

44 A review of the management of CSIRO's intellectual property portfolio. (Eval)

Promote the continued development of quality commercial practices at all levels in CSIRO. (5%)

45 Distribution of the CSIRO Commercial Practice Manual - 3 updates per year.

46 Management of the Organisation's needs for effective risk management and commercial practice audits.

47 Investigation of the value of a quality management approach to commercial practices.

48 With Institute and Divisional commercial managers, development and optimal use of good corporate commercial practices.

Develop and maintain effective Head Office facilities and administrative services. (9%)

49 Timely and informative financial reporting to enable efficient budget management by the units located within Head Office.

50 Provision of cost-effective services to enable the staff located at Head Office to work efficiently and effectively.

SUMMARY OF RESOURCES, 1994-95

(estimates as at June 1994)

Branch/Unit	Staff by Functional Classification (EFT units)[1]			Expenditure Estimates ($'000)		
	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Corporate Business	4	3	7	1,422		1,422
International Affairs	5	2	7	934	30	964
Public Affairs	30	1	31	2,002	1,277	3,279
Strategic Planning and Evaluation	4	2	6	507		507
Legal Affairs	7	2	9	523		523
HO General	7		7	651		651
TOTAL	57	10	67	6,039	1,307	7,346

[1]Equivalent full time units. Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

Objective

Support the Chief Executive in managing the Organisation and protecting the Organisation's assets; and assist the Chairman and Board members in the efficient conduct of their responsibilities.

Strategy

To enhance the development and implementation of corporate policies and procedures for Australia's largest and most diverse research and development organisation, the Chief Executive's advisory units will:

- Provide an effective and efficient system of liaison between the Chief Executive and the Board, Corporate Departments, Institutes and Divisions, through the Office of the Chief Executive and the Corporate Executive Office, Canberra.
- Enhance interaction and high level communication with external agencies and stakeholders.
- Maintain awareness of relevant scientific, technological, social, political and management developments in Australia and overseas.
- Evaluate the adequacy and effectiveness of the Organisation's systems of internal control and of the performance of Organisational programs and functions.

Specific Objectives & Planned Outcomes

Develop and/or coordinate briefings or action advice on all meetings, correspondence and events involving the Chairman or Chief Executive. (37%)

1 Full, timely and coordinated briefings on all meetings, correspondence and interactions involving the Chief Executive and/or Chairman.

Facilitate interactions of the Chairman and Chief Executive with Australian industry, governments and international organisations. (11%)

2 A strategy to enhance the interaction of the Chief Executive, Chairman and the Board with outside agencies and stakeholders.

Maintain and improve the effectiveness of the Board and Executive Committee, and ensure coordination of their activities. (11%)

3 Smooth progression of the Organisation's business to Executive Committee and the Board with an increased emphasis on integrated attention to major and strategic issues.

Manage the Melbourne and Canberra offices of the Chief Executive and the Office of the Chairman and the Board. (8%)

4 Coordinated, timely and comprehensive support for the Chief Executive, Chairman and Board members.

Conduct a comprehensive audit program encompassing reviews of compliance, effectiveness and efficiency. (26%)

5 Review of administration of 18 organisational units / Divisions. (Eval)

6 Review of five CSIRO systems or functions. (Eval)

7 Provision of computer based tools and facilities in support of audit processes. (Perf)

8 Analytical and sampling regime conducted in support of the assurance function. (Eval, Perf)

Enhance the Organisation's systems of information management and internal control. (6%)

9 Participation in Information Technology Steering Committee.

10 Participation in design of significant administrative systems.

11 Development of Administration Guide.

12 New corporate procedures reviewed for internal control implications.

48. Chief Executive Advisory Units

SUMMARY OF RESOURCES, 1994-95

(estimates as at June 1994)

Branch/Unit	Staff by Functional Classification (EFT units)[1]			Expenditure Estimates ($'000)		
	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Office of the Chief Executive	3	3	6	1,526		1,526
Corporate Executive Office	2	2	4	759		759
Corporate Audit Group	9	1	10	1,095		1,095
Senior Staff Arrangements				1,000		1,000
TOTAL	14	6	20	4,380	0	4,380

[1]Equivalent full time units. Research Support includes the Technical Services, Communication and Information, Administrative Services and General Services classifications; Management includes the Research Management, Corporate Management and Senior Specialist classifications.

STRATEGIC PLAN IMPLEMENTATION

This annex reproduces the major planned outcomes published in the CSIRO Strategic Plan 1991-92 to 1995-96. The planned outcomes are grouped and numbered by research purpose. In the left hand column the research purpose is identified by a two letter code. The right hand column includes references to planned outcomes in the present document which represent specific progress towards the Strategic Plan planned outcomes.

For example, the fourth Strategic Plan outcome for the research purpose Environmental Aspects of Economic Development is shown below as:

ED4	Solutions to environmental and technical issues to ensure the effluent from proposed kraft pulp mills will not have a detrimental impact.	**14**:27 (DCET/IMEC)

The code "**14**:27 (DCET/IMEC)" refers to entry number 14, outcome number 27, (Division of Coal and Energy Technology/Institute of Minerals, Energy and Construction). The cross reference is shown in the Division's entry as:

27	Evaluation of effect of chlorine-free bleaching methods on toxicity of pulp mill effluent. (ED4)

Strategic Plan Planned Outcomes

PLANT PRODUCTION AND PRIMARY PRODUCTS

PP1	New varieties of sugar cane with a 10 percent higher yield of sugar worth more than $100m a year to the sugar industry.	**34**:12 (DTCP/IPPP)
PP2	Genetically modified rumen micro-organisms to improve the digestion of low-quality tropical forages worth around $120m a year to the livestock industries.	**24**:23,24,25 (DTAP/IAPP) **34**:5,7 (DTCP/IPPP)
PP3	A range of options including genetically engineered plant varieties and biological control systems together with diagnostic kits for detecting chemical residues, for reducing the dependence of intensive agriculture and horticulture on pesticides by up to 50 per cent.	**MDP25**:2 **28**:1,2,3,4,9,10,11,15, 16,17,18 (DE/IPPP) **30**:11 (DFo/IPPP) **31**:1 (DH/IPPP) **32**:14,28,31,32 (DPI/IPPP)
PP4	Genetically engineered high sulphur protein pasture legumes with the capacity to lift wool production from improved pastures by 20 per cent.	**32**:29 (DPI/IPPP)
PP5	Cropping management systems that minimise disease and improve soil water availability to improve yields by 10 per cent in southern NSW and northern Victoria.	**33**:4,18 (DS/IPPP)
PP6	Automated techniques for assessing small wood samples to enable important properties for industrial use to be incorporated into tree-breeding programs.	

Annex

ANIMAL PRODUCTION AND PRIMARY PRODUCTS

AP1	Improved sheep-breeding techniques to control fibre diameter and other qualities in Australian merino wool.	**21**:10,11,12,17,18,20,21, 22 (DAP/IAPP)
AP2	Genetic markers for meat quality attributes to enable rapid genetic improvement in the quality of Australian beef - a project estimated to be worth around $800m a year to Australia when fully adopted.	**MDP26**:1,2,3,8 **24**:12,13,14 (DTAP/IAPP)
AP3	Genetic markers for disease resistance in sheep and cattle to enable breeders to supply rams and bulls highly resistant to specific diseases without the loss of other desirable attributes such as fleece and meat quality and productivity.	**MDP26**:1,2,3,4,5,6,7,8 **21**:13,16,19 (DAP/IAPP) **24**:12,13,14 (DTAP/IAPP)
AP4	New or improved vaccines against cattle ticks, tick fever, sheep nematodes and sheep blowflies - parasites estimated to cost Australia $650m a year.	**20**:4 (DAH/IAPP) **24**:2,3,4,6,31,32 (DTAP/IAPP)
AP5	Anti-hormone vaccines designed to enhance meat quality and production efficiency including the reduction of weight loss in cattle resulting from poor dry-season pastures.	**21**:7 (DAP/IAPP)
AP6	Quantitative predictive models for the sustainable management of the tuna fishery.	**38**:9,10,11,12 (DF/INRE)

RURAL-BASED MANUFACTURING

RM1	Expansion of export markets for Australian food manufacturers based on information on the sensory preferences of a range of Asian markets and practical methods of evaluating food to meet these preferences.	**22**:14 (DFST/IAPP)
RM2	Active packaging systems for perishable goods which will oped up export markets (especially for horticultural products) of over $100m a year.	**MDP12**:1,2 **31**:16 (DH/IPPP)
RM3	Automated beef-carcass boning procedures incorporated in new versions of FUTUTECH.	
RM4	Specifications and processing techniques for a new high-value segment of the Australian textile industry involving the processing of superfine wool into high-quality products using a wool type in which Australia has a virtual world monopoly.	**25**:5,6,7,13 (DWT/IAPP)
RM5	Support for the food industry in developing new fibre-enriched foods and implementing corporate strategies on nutrition.	**23**:1,2,5,6,7,8,11,12 (DHN/IAPP)
RM6	Preservatives that impart durability and appearance qualities to local plantation timber so it can compete with imported timbers in the $100m Australian market.	

MINERAL RESOURCES

MI1	Development of a magnesium metal demonstration production plant industry in Gladstone, in collaboration with QMC, MIM, and UBE Industries - Japan.	16:7 (DMPE/IMEC)
MI2	Establishment of Pinjarra Hills laboratories as a leading centre for mineral and coal mining and processing, mineral waste management and light metals research.	**MDP10**:1,2 10:5 (DMT/IIT) 16:3 (DMPE/IMEC)
MI3	A major research role in the support and development of SIROSMELT technology to achieve a minimum of two new installations per year with an expected benefit of $12m a year.	16:8,9 (DMPE/IMEC)
MI4	Establishment of the G.K. Williams Co-operative Research Centre for Extractive Metallurgy as the major pre-competitive pyrometallurgical research and development institution in Australia.	
MI5	Improved metalliferous mining efficiency by addressing the issues of integration of geology and mine design and of dilution during the mining process.	

ENERGY RESOURCES AND SUPPLY

EX1	Development of Australia's research capacity for an upstream oil and gas industry, with a focus on the prediction of accumulations by fluid-flow modelling and basin evolution and on improving production via reservoir characterisation, stimulation of tight reservoirs, and wellbore engineering; facilities to be initially in Sydney and Melbourne.	18:2,3,4,5,6,7,8,9,10 (DPR/IMEC)
EX2	Establishment of coal-bed methane industry in Australia, especially to support the development of pilot schemes in Queensland with MIM, and in NSW.	18:2,11,12,13,14 (DPR/IMEC)
EX3	Improved underground coal-mining efficiency by realising the potential offered by the longwall mining system.	
EX4	Improved productivity of Australian coal-preparation plants and, in co-operation with industry, improved marketing of Australian coals for new clean coal technologies.	
EX5	Demonstration of the 5KW solid oxide fuel cell system, which has high efficiency and low pollution loads, with a view to widespread commercial uptake.	

MANUFACTURING INDUSTRIES

MF1	A new herbicide and a new insecticide, for world markets, to protect cereal crops to an exceptional standard of environmental safety; development by the CSIRO/Du Pont joint venture company, Dunlena Pty Ltd.	
MF2	An anti-influenza drug, developed in collaboration with Glaxo, Biota and the Biomolecular Research Institute.	8:1,2 (DBE/IIT)
MF3	Process and product improvements in Australia's automotive industry, through partnership in the newly-created Automotive Technology Centre, generating multi-million dollar savings and benefits.	10:1,5 (DMT/IIT)

MF4	Gains in quality and productivity in Australian manufacturing industry through new approaches which synthesise measurement, data capture and statistical sciences.	**MDP15**:2,3 **3**:7 (DMS/IISE) **7**:9,20 (DAP/IIT)
MF5	Development and commercialisation of new systems to achieve effective delivery of antigens and optimum immune responses from vaccines.	**20**:1,11,12,13 (DAH/IAPP) **24**:28,30,31,32 (DTAP/IAPP)

INFORMATION AND COMMUNICATIONS INDUSTRIES

IC1	Australian trials of an integrated system for the delivery of wide-band, networked communication and information services, for example, wireless systems for local area networks and broad-band access to customer premises.	**4**:2,3,4,5,6,7,11,20,26, 27 (DR/IISE)
IC2	Antennas and associated sub-systems for satellite-based, mobile person-to-person communications.	**4**:15,16 (DR/IISE)
IC3	Advanced spatial database systems for improved management of land-related information for applications developers throughout CSIRO, Government and industry.	**2**:1,2,3 (DIT/IISE) **3**:13 (DMS/IISE)
IC4	Transfer of high-performance, interactive visualisation and modelling software to the software and services industry for applications in the resource and environmental management industries.	**2**:10,11,12 (DIT/IISE)
IC5	Transfer of advanced hypermedia tools for navigating complex databases transferred to the information services industry.	**2**:4,6,8,12 (DIT/IISE)

CONSTRUCTION

CO1	Establishment of a Building Research Association and interaction with the newly launched building industry reform process to enhance R&D within the industry.	
CO2	Major research and advisory input to the Better Cities Program.	
CO3	Establishment of the CSIRO Division of Building, Construction and Engineering as Australia's premier research organisation for the building and construction industry.	

COMMERCIAL SERVICES

CS1	Use of CSIRO decision support systems by 75 per cent of water agencies in Australia in developing their catchment management strategies.	**41**:35 (DWR/INRE)

ECONOMIC DEVELOPMENT - ENVIRONMENTAL ASPECTS

ED1	Demonstration of the ability to substantially reduce rabbit and fox populations by means of fertility control.	**42**:19,20 (DWE/INRE)
ED2	A comprehensive set of management strategies to prevent or ameliorate outbreaks of toxic blue-green algae in inland water systems.	**30**:16 (DFo/IPPP) **33**:8,18 (DS/IPPP) **41**:8,10,29,37 (DWR/INRE)
ED3	Widespread adoption of CSIRO's sewage and other waste treatment processes and formulation of guidelines for setting up and managing biologically productive effluent disposal schemes to divert the 4.5 billion litres of sewage and other effluent currently discharged daily into Australian waterways.	**9**:13 (DCP/IIT) **30**:16 (DFo/IPPP) **33**:9 (DS/IPPP) **41**:2,17 (DWR/INRE)
ED4	Solutions to environmental and technical issues to ensure the effluent from proposed kraft pulp mills will not have a detrimental impact.	**14**:27 (DCET/IMEC)
ED5	Plasma technology suitable for high temperature destruction of organic chemical wastes at the plant scale.	**7**:13 (DAP/IIT) **10**:16,17 (DMT/IIT)
ED6	New agricultural systems and management techniques to assist the ecologically sustainable development of Australia's rural industry, particularly in relation to problems of salinity, erosion and restoration of degraded pastures.	**MDP18**:2 **32**:6,7,9,10,13 (DPI/IPPP) **33**:6,8,11,12,14,15,16, 17,18 (DS/IPPP) **41**:7,13,14,15,16 (DWR/INRE) **43**:6,7,8,9 (CFEM/INRE)
ED7	Improved capability to help mining companies in the environmental management and rehabilitation of mine sites.	**14**:32 (DCET/IMEC) **33**:10 (DS/IPPP) **41**:28 (DWR/INRE) **42**:7 (DWE/INRE)

ENVIRONMENT

EN1	Regional forecasts of climate change with certainty sufficient to stimulate governments and the private sector to adopt response and adaptation strategies.	**MDP19**:2,5,6 **30**:10 (DFo/IPPP) **39**:7,8 (DO/INRE) **41**:27 (DWR/INRE)
EN2	Improved drought forecasting ability through participation in a major international exercise studying the interaction between oceans and the atmosphere.	**MDP19**:4 **37**:23 (DAR/INRE) **39**:1,3,4 (DO/INRE)
EN3	Scientific principles for effective fire management regimes to help in the maintenance of Australia's conservation areas.	**MDP19**:5,7 **30**:7,8 (DFo/IPPP) **42**:8,16 (DWE/INRE)
EN4	Methods for identifying Australia's flora and fauna at risk of extinction and the design of reserve networks to best ensure their protection.	**MDP18**:1,3,4 **MDP31**:2 **32**:16 (DPI/IPPP) **33**:3 (DS/IPPP) **42**:9,12,28 (DWE/INRE)

Annex

HEALTH

HE1	Development of nutrition based strategies to reduce genetic damage from environment and chemical exposure and to reduce cardiovascular disease.	**23**:1,2,3,4,7,8 (DHN/IAPP) **33**:7 (DS/IPPP)

The **CSIRO Information Network** provides a free access point to CSIRO for scientific and technical enquiries.

CSIRO Information Network

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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.

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