CSIRO Operational Plan

1993–1994

nce
dia's
Future

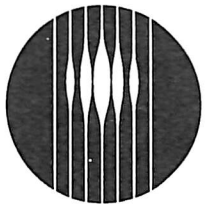
CSIRO's greatest hits

Some major examples of our contribution to Australia's living standards, economic performance and environmental quality:

- **SIROSPUN** — the basis of Cool Wool: a fabric for all seasons
- **'Softly'** — popular fabric softener
- **SIROSMELT** — cleaner and cheaper way of producing tin, copper, lead and zinc
- **forest management** — improving productivity of our native regrowth forest by 30% to 60%
- **Siokra** and **Sicala** — new cotton varieties earning big export dollars
- the **Synchro-Pulse Welder** — winner of Australian design award, winning big market share for developer
- **SIROFLOC** — making water cleaner at home and abroad
- **MicroBRIAN** — processing satellite images to monitor erosion, crops, forests and other vegetation
- **dung beetles** — not glamourous, but reducing fly numbers and producing cleaner pasture for cattle
- the **Parkes Telescope** — discovering quasars, and now part of the internationally recognised Australia Telescope
- **Hardiplank** — fibre cement product to replace asbestos-based building materials
- **biological weed control** — award-winning program to control salvinia, world's worst water weed, at home and overseas
- **atomic absorption spectroscopy** — most significant advance in chemical analysis this century, saved many lives and earned $150 million in export sales
- **myxomatosis** — controlling rabbit numbers for four decades
- **Interscan** — system that allows aircraft around the world to land more quickly and safely

CSIRO Operational Plan

1993-1994



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Foreword

The CSIRO Operational Plan documents the objectives and planned outcomes of activities to be undertaken by CSIRO in the financial year ahead. The activities and outcomes represent an annual step in the implementation of the goals and strategies set out in our Strategic Plan for 1991-1996. The priorities described in the Strategic Plan are reflected in a changing allocation of resources to high priority research areas. The Operational Plan thus not only meets the requirements of the Science and Industry Research Act but is also a working document for use by senior research managers.

During 1993-94 CSIRO will continue to focus research effort on areas of identified strategic importance to Australia. We will continue to exploit CSIRO's unique breadth and depth of skills and experience through the development of Multi-Divisional Programs. As it is the final year of the current triennium, implementation of recent decisions on research priorities for the new triennium will also occur.

In addition to focusing on the right research issues, another factor critical to CSIRO's effectiveness is the degree to which the results of research are ultimately taken up and applied for the benefit of Australia. Our commitment to enhancing interaction with industry and other partners can already be seen in our active participation in the Cooperative Research Centres Program. 1993-94 will see CSIRO explore new and innovative ways in which successful collaboration with industry partners and other users of our research can be encouraged to the advantage of all parties.

In the context of a slow recovery in Australia's economic fortunes, CSIRO will continue to face tight budgetary conditions. This Operational Plan highlights the development and implementation during 1993-94 of a number of initiatives designed to provide more effective and efficient research support services.

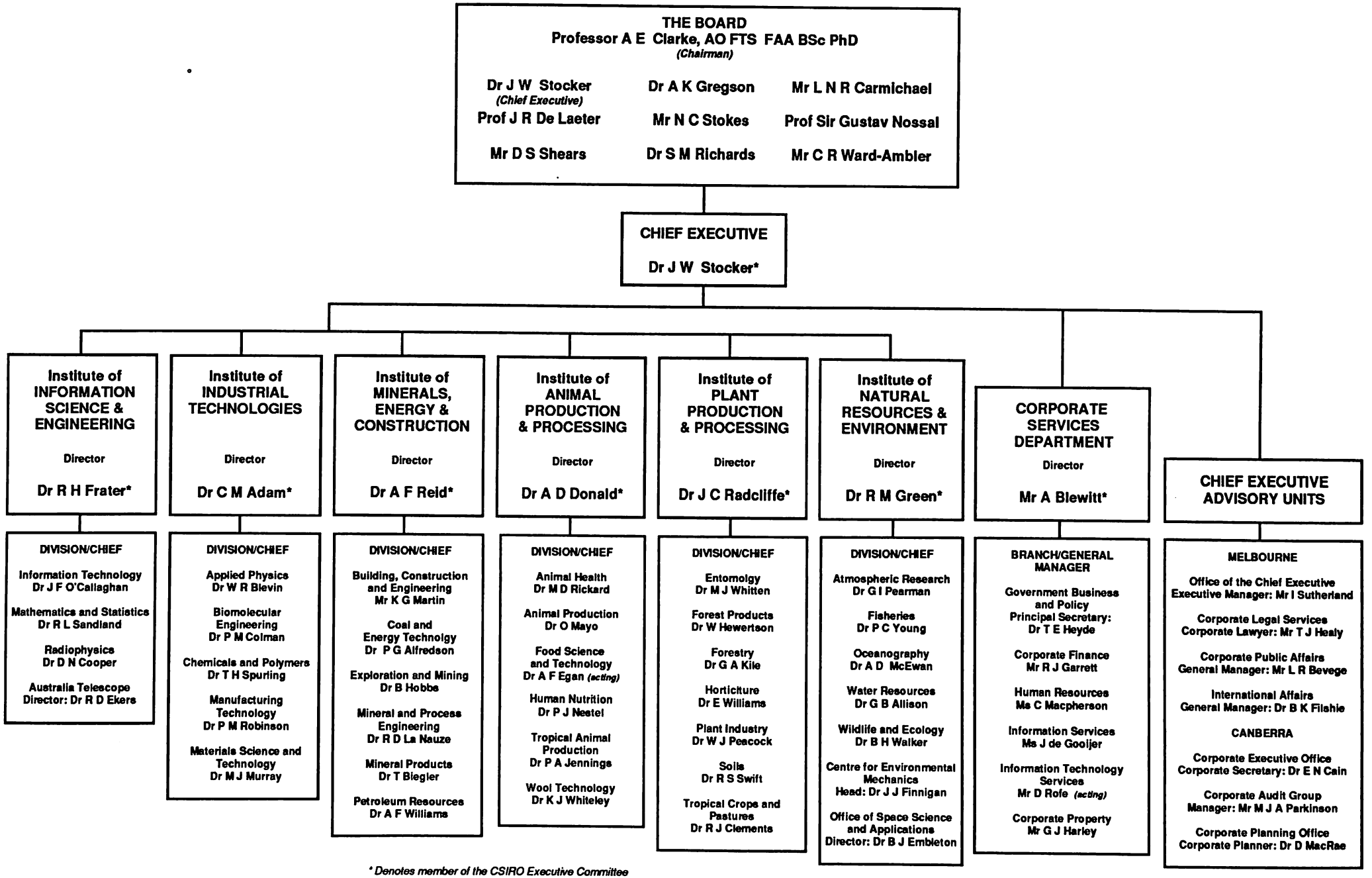
John W Stocker
Chief Executive
June 1993

ACRONYMS AND ABBREVIATIONS

CSIRO	Commonwealth Scientific and Industrial Research Organisation
DITARD	Department of Industry, Technology and Regional Development
IISE	Institute of Information Science and Engineering
IIT	Institute of Industrial Technologies
IMEC	Institute of Minerals, Energy and Construction
IAPP	Institute of Animal Production and Processing
IPPP	Institute of Plant Production and Processing
INRE	Institute of Natural Resources and Environment
CEAU	Chief Executive Advisory Unit
CSD	Corporate Services Department
CRC	Cooperative Research Centre
MDP	Multi-Divisional Program
SEO	Socio-Economic Objective

Figure 1: CSIRO ORGANISATIONAL STRUCTURE

(as at 1 July 1993)



** Denotes member of the CSIRO Executive Committee*

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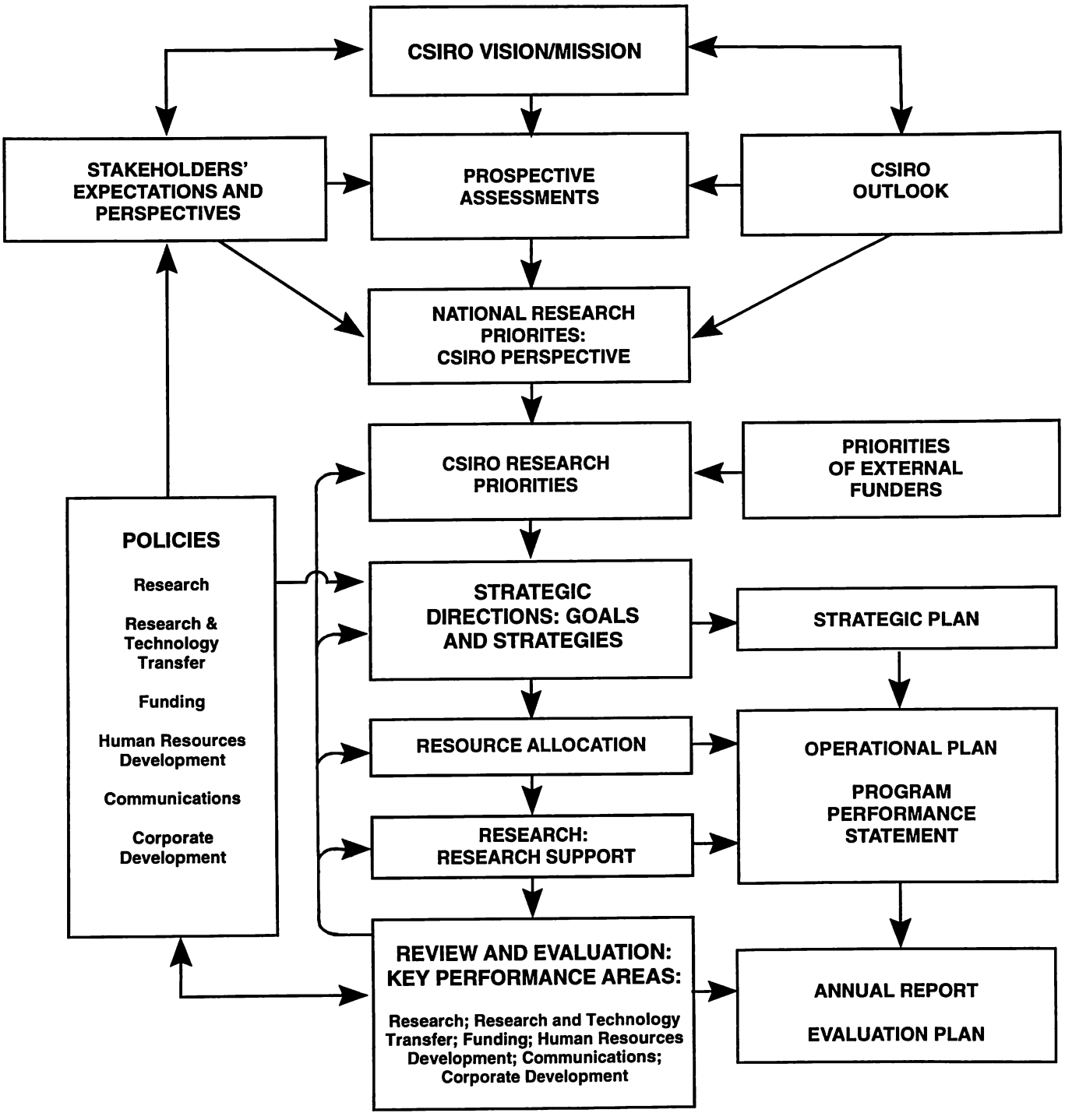
Figure 2: CSIRO CORPORATE PLANNING PROCESS



INTRODUCTION

The Science and Industry Research Act requires CSIRO to prepare an annual Operational Plan and a Strategic Plan. The Strategic Plan provides an overall blueprint for achievement of CSIRO's mission, while the Operational Plan describes how the Strategic Plan is put into effect.

This Operational Plan presents information on the objectives, strategies, major planned outcomes and planned expenditure for each of the Organisation's major management units for 1993-94. It shows the distribution of resources to CSIRO's designated research purposes, identifies links to major planned outcomes in the CSIRO Strategic Plan 1991-92 to 1995-96, and highlights the importance CSIRO places on cooperative research efforts.

THE PLANNING CONTEXT

CSIRO's mission is to give Australians a better future. Toward this end, research in CSIRO is carried out in six Institutes each comprising a number of Divisions. This organisational structure is illustrated in Figure 1. To ensure that its efforts are continually directed toward its goals the Organisation has adopted a comprehensive system of corporate planning and evaluation as shown in Figure 2.

The Strategic Plan and Operational Plan are complemented by the annual Evaluation Plan and a formal staff Performance Planning and Evaluation (PPE) program. The Evaluation Plan for a given year reports the results of evaluations completed in the previous year and includes details of evaluations to be conducted in the current and following two years. PPE 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.

Additional performance related information is available in the CSIRO Annual Report and in the Program Performance Statements published each year in the budget context. Detailed planning and evaluation are also undertaken and reported at Institute, Division, program and project level.

CSIRO GOALS AND STRATEGIES

Research priorities in CSIRO are identified in relation to a set of 'research purposes' which reflect the economic and other objectives of the Australian community. For each research purpose there is a goal and a set of enabling strategies which focus on three key performance areas - research activity, research funding and technology transfer.

Three research support goals 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 competitiveness 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 protect the environment.
- Improve the competitiveness of the information and communication industries.
- Enhance productivity and effectiveness in provision of infrastructure and services.

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.

RESEARCH PRIORITIES FOR 1993-94

CSIRO's research priorities are determined on the basis of a careful assessment of the attractiveness and feasibility of research for each research purpose. The methodology is outlined in the CSIRO Strategic Plan.

Priority decisions at the corporate level are made every three years. For the current triennium a pool of funds for redistribution to high priority research purposes is raised by an annual 1.5% levy applied to CSIRO's recurrent appropriation budget. Institutes are required to match priority

funds allocations dollar for dollar with funds from lower priority activities.

Each year the Executive Committee reviews the original priority decisions and assesses the merits of individual research proposals which seek a share of priority funds available the following year. Final selections are recommended to the Board for consideration and approval.

1993-94 is the final year of the current triennium. Priority funds available for redistribution total $4.7 million. In accord with the original priority decisions these funds have been allocated as follows: 26.3 per cent to strategic research for the Minerals Industry, 26.7 per cent to Environmental Aspects of Economic Development and 47.0 per cent to priority areas among other research purposes. With matching funds from Institutes a total of $9.4 million will be redirected to these high priority areas in 1993-94 as a direct result of the priorities process. Institutes and Divisions will also independently move additional resources into priority research areas.

The priorities framework is also used to allocate non-recurrent Board Initiative Funds. For 1993-94 $4.5 million has been allocated as follows: 29.0 per cent to strategic research for the Minerals Industry, 24.6 per cent to Environmental Aspects of Economic Development, and 46.4 per cent among other research purposes.

The 1993-94 distribution of Priority Funds and Board Initiative Funds by research purpose is shown in Table 1.

The process by which research priorities are decided and implemented is under continual review and development. During 1993-94 further improvements are planned to further streamline the process by which research proposals are developed, assessed and ultimately put into effect.

Note: CSIRO research purposes are based on the Socio-Economic Objective (SEO) component of the Australian Standard Research Classification (ASRC). CSIRO research purposes generally correspond to an SEO Sub-Division. During 1992-93 some amendments to the SEO classification and CSIRO research purposes were agreed. The revised structure has been adopted for planning 1993-94 research. As a result, minor differences may be noted between the list of research purposes used in the 1993-94 Operational Plan and the list used in the CSIRO Strategic Plan 1991-92 to 1995-96.

CORPORATE PLANNED OUTCOMES 1993-94

The ensuing sections of the Operational Plan present the major outcomes planned for 1993-94 at an Institute and Division level. The planned outcomes listed immediately 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 1993-94 research priorities decisions including commensurate resource allocations to priority areas.
- Implementation of revised procedures for allocating priority funds for the triennium 1994-95 to 1996-97.
- Implementation of an expanded set of indicators of CSIRO's performance in establishing and maintaining effective links with research users and receptors.
- Implementation of organisational changes to successfully re-orient CSIRO's business development and commercialisation focus (as a successor to SIROTECH).
- Complete implementation throughout the Organisation of new financial management processes based on accrual accounting principles.
- Completion of several major capital projects (new and refurbished accommodation) worth $50 million at Brisbane, Clayton, Aspendale, Urrbrae, Parkville and other sites.
- Implementation of phase one of Universal Access, a major information technology communications project which includes PABX up-grades and major network expansion to facilitate electronic mail access to the majority of CSIRO sites by the end of 93-94.

1993-94 RESOURCES SUMMARY

CSIRO's sources of funds include direct appropriation funds, 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 30 per cent of total funds in 1993-94.

All resource figures reported in this Plan are estimates of planned expenditure, based upon provisional budget estimates as at 17th May 1993. Final budget estimates appear in CSIRO's Program Performance Statements which are published with the Government's budget related papers.

Table 2 reports planned expenditure for each Institute and the 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 shown graphically in Figure 3. Table 4 provides an estimate of Institute and corporate staffing levels during 1993-94.

Table 1: DISTRIBUTION OF PRIORITY RESEARCH FUNDS AND BOARD INITIATIVE FUNDS, 1993-94

Research Purpose	Priority Funds	Board Initiative Funds	Total Funds
	($'000)	($'000)	($'000)
Plant Production and Primary Products	350	112	462
Animal Production and Primary Products	170	225	395
Minerals Industry	1235	1305	2540
Energy Resources		60	60
Energy Supply		30	30
Rural-Based Manufacturing	200	344	544
Manufacturing	600	860	1460
Construction	125	50	175
Information and Communications	125	62	187
Commercial Services	250	190	440
Health		2	2
Environmental Knowledge	390	153	543
Environmental Aspects of Economic Development	1255	1107	2362
Total Expenditure	4700	4500	9200

Table 2: ESTIMATED EXPENDITURE BY INSTITUTE 1993-94[1]
(Provisional estimates as at 17th May 1993)

	Direct Appropr	External Funds	Total Funds
	($'000)	($'000)	($'000)
Institute of Information Science and Engineering[2]	36,763	12,619	49,382
Institute of Industrial Technologies	66,777	24,540	91,317
Institute of Minerals, Energy and Construction	71,521	35,002	106,523
Institute of Animal Production and Processing	68,752	53,861	122,613
Institute of Plant Production and Processing	92,515	40,592	133,107
Institute of Natural Resources and Environment	73,017	30,906	103,923
Corporate Services Department	24,036	4,488	28,524
Chief Executive Advisory Units	8,090	1,750	9,840
Corporately Managed Funds[3]	5,192		5,192
TOTAL	446,663	203,758	650,421

[1]Excludes Magnesium Industry Development Loan ($12,500K) and North Ryde Redevelopment Loan ($5,310K)

[2]Includes appropriation expenditure for CSIRO Supercomputing Facility

[3]Comprises expenditure (eg insurances, audit fees) of $7,049K, capital works and services of $29,728K and repairs and maintenance of $10,124K, offset by contributions to the capital program from Institutes/Divisions totalling $41,709K.

Figure 3: PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94

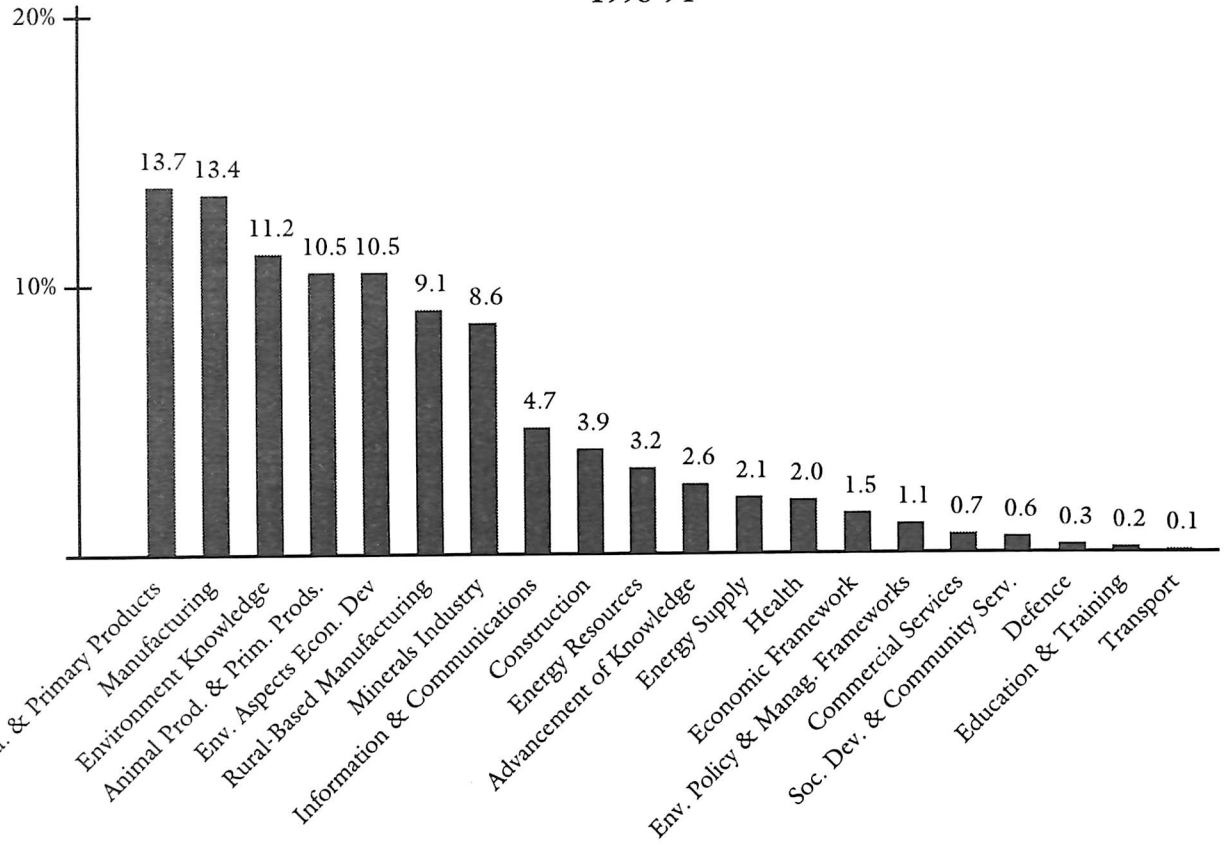


Table 3: PLANNED DISTRIBUTION OF EXPENDITURE BY INSTITUTE AND RESEARCH PURPOSE[1]

(Provisional estimates as at 17th May 1993)

Research Purpose	IISE	IIT	IMEC	IAPP	IPPP	INRE	TOTAL[2]
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
Plant Prod. & Primary Products		460		135	80,947	1,884	89,108
Animal Prod. & Prim. Prods.	46	1,012		40,750	8,787	13,745	68,294
Minerals Industry	2,021	6,071	42,688			1,001	55,936
Energy Resources	597	92	18,211			660	20,813
Energy Supply	276	2,668	8,962	565		245	13,659
Rural-Based Manufacturing		92		47,491	7,056	373	59,188
Manufacturing	4,593	56,666	3,858	12,916	1,464	1,310	87,156
Information & Communications	22,370	3,312	1,172	111	1,464	287	30,570
Environment Knowledge	367	1,288			12,781	52,455	72,847
Env. Aspects Econ. Dev	781	8,003	9,878	9,663	13,314	22,475	68,294
Advancement of Knowledge	11,805				1,331	3,045	16,911
Infrastructure & Services	3,078	12,327	21,792	11,148	5,991	8,987	67,644
TOTAL[3]	45,934	91,990	106,561	122,779	133,136	106,465	650,421

[1]Excludes Magnesium Industry Development Loan ($12.50m) and North Ryde Redevelopment Loan ($5.31m).

[2]These totals include expenditure by the Corporate Services Department, the Chief Executive Advisory Units and Corporately Managed Funds distributed to Research Purposes on a pro-rata basis.

[3]Institute totals differ from those in Table2 due to re-distribution of CSIRO Supercomputing Facility expenditure among user Institutes and Research Purposes.

Table 4: CSIRO STAFF NUMBERS, 1993-94

(Equivalent full-time units, provisional estimates as at 17th May 1993)

Staff	IISE	IIT	IMEC	IAPP	IPPP	INRE	CSD	CEAUs	TOTAL
Research[1]	260	650	622	717	1,083	686			4,018
Research Support[2]	206	260	473	901	438	337	284	73	2,972
Management[3]	26	40	42	38	62	39	17	13	277
TOTAL	492	950	1,137	1,656	1,583	1,062	301	86	7,267

[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 1993-1994

1 Gene Shears
2 Lessening Our Dependence on Chemical Pesticides
3 Fibre Utilisation
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
11 Energy Storage
12 Active Packaging
13 Biomaterials and Medical Devices
14 Boeing - CSIRO Joint Research Effort
15 Process and Maintenance Optimisation in Manufacturing
16 Urban Water Systems
17 Climate Change
18 Conserving Biodiversity for Australia's Future
19 Data Acquisition and Utilisation
20 Algal Research Program
21 Coastal Zone Program
22 Land and Water Care
23 Management of Marine Living Resources
24 Minesite Rehabilitation

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 section of the Operational Plan provides 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 involve a formal agreement between two or more CSIRO Divisions each contributing to a designated program of research. *The Cooperative Research Centres Program* was launched by the Commonwealth Government in May 1990 to fund collaborative research and education programs in the natural sciences and engineering, with a strong focus on applications.

MULTI-DIVISIONAL PROGRAMS

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 following table lists the research objective and participating Divisions for each MDP, with the lead Division named first. The major outcomes and expenditure planned for 1993-94 are also shown. The MDPs have been grouped by CSIRO research purpose.

Plant Production and Primary Products

MDP1 *Gene Shears*

Objective:
To further develop the core technology of the gene shears discovery; its application in plant and animal agriculture, human medicine and to issues of national interest (e.g. pest control); the creation of commercial opportunities; and the further enhancement of molecular biology expertise within CSIRO.

Planned Outcomes:
Further definition of gene shears and minizyme structural and sequence properties.

Testing of immuno-ribozyme activity in plants against infectious viruses and agent-specific gene action.

Isolation of promoters with tissue-specific properties suitable for use in ribozyme-gene constructs.

Modification of metabolic pathways in plants with deployment of ribozymes *in vivo*.

Isolation of host/plant genes responsible for pathogen resistance.

Physical localisation of gene products within sperm cells and on their surfaces, establishing the feasibility of selection for sperm carrying a specific chromosome.

Participants:	***% Share***
Division of Plant Industry	51.1
Division of Biomolecular Engineering	14.4
Division of Tropical Crops and Pastures	9.5
Division of Entomology	6.4
Division of Food Science and Technology	5.2
Division of Tropical Animal Production	5.2
Division of Horticulture	3.8
Division of Animal Health	2.6
Division of Animal Production	1.6

Total Expenditure: $1,570,000

MDP2 *Lessening Our Dependence on Chemical Pesticides*

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

Planned Outcomes:
Completion of the May Statement Program "Lessening our Dependence on Chemical Pesticides": specifically:

- completion of a precommercial evaluation of a termite active strain of *Metarhizium*,
- validation of a predictive model of flystrike incidence.

Initiation of the National Priorities Program "Novel Management Techniques for Plant and Plant Product Pests", focussing on:

- development and deployment of cotton strains resistant to *Heliothis* attack,
- heat treatment disinfestation of fresh fruit for the export market,
- the development of entomopox viruses as biocides against beetles in pastures and sugar cane.

Participants:	*% Share*
Division of Entomology	78
Division of Plant Industry	13
Division of Horticulture	8
Division of Biomolecular Engineering	1

Total Expenditure: $2,852,256

Animal Production and Primary Products

MDP3 *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:
Development of vector systems for the introduction of cellulase genes into rumen bacteria.

Cloning and sequencing of two types of esterases involved in ligno-cellulose degradation, expression of them in *E. coli* to assess benefits to ruminal digestion of fibre before incorporation in a rumen bacterium.

Demonstration and quantitation of digestion of crystalline cellulose and plant material by cloned cellulase enzymes, individually and in combination.

Measurement of the partition of fibre digestion between the stomach and intestines of sheep with and without anaerobic fungi.

Isolation of ruminal bacteria that utilise phenolic compounds.

Development of DNA techniques to describe rumen microbial populations and experimentally induced changes in those populations.

Participants:	*% Share*
Division of Tropical Animal Production	40
Division of Tropical Crops and Pastures	31
Division of Animal Production	29

Total Expenditure: $1,683,000

Minerals Industry

MDP4 *Alumina Production*

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

Planned Outcomes:
Laboratory demonstration of new instruments and techniques for optimising feedwell performance in the industrial thickeners used by the contributors to a multi-client funded project.

Establishment of an industry-funded project on the fundamentals of precipitation of desilication product in alumina refiners, and testing of methods for lowering the soda content of this material.

Participants:	*% Share*
Division of Mineral Products	56
Division of Mineral and Process Engineering	36
Division of Mathematics and Statistics	3
Division of Coal and Energy Technology	3
Division of Building, Construction and Engineering	2

Total Expenditure: $5,662,000

MDP5 *Aluminium Production*

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

Planned Outcomes:
Development of a process for the carbothermic reduction of alumina to aluminium to the stage where it can be offered to industry for further development.

A favourable assessment by the aluminium industry of cokes produced from Ultra-Clean coals for anode production.

Completion of survey and commencement of evaluation of candidate materials suitable for use as inert anodes.

Development and testing of electrolytic and physical properties of low melting point aluminium electrolytes.

Participants:	% Share
Division of Mineral and Process Engineering	24
Division of Mineral Products	66
Division of Materials Science and Technology	10

Total Expenditure: $1,970,000

MDP6 *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:
Commercial implementation of a novel process for the removal of impurities during synthetic rutile production.

Development of an optimised model for the char reduction of ilmenite by the Bacher process.

Determination of the thermodynamics of the reduction of ilmenite in the presence of chromium and magnesium.

Participants:	% Share
Division of Mineral Products	83
Division of Mineral and Process Engineering	17

Total Expenditure: $2,748,000

MDP7 *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:
Completed prototype of 3D data model for geology.

Interfacing of 3D data model with two other models, e.g. deformation modelling and forward modelling.

Completion of the prototype of the forward modelling package, as applied to magnetics and radiometrics within Sandking data.

Prototype geological editor plus requirements for visualisation.

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

MDP8 *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:
Completion of plant trials of on-stream analysers for measuring alumina, phosphorus, manganese and moisture content of iron ores.

Development of an initial model for tunnel loading of trains from stockpiles.

A preliminary assessment of future processing options for iron ore.

Participants:	% Share
Division of Mineral and Process Engineering	96.0
Division of Mathematics and Statistics	1.5
Division of Soils	1.5
Division of Exploration and Mining	1.0

Total Expenditure: $1,855,000

MDP9 *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:
Development of refining and casting technology for high purity magnesium alloy ingots and high value added components.

Development of new magnesium alloys for casting technology applications.

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:
Refinement of physiochemical parameters important to the efficient operation of the AM process for the production of anhydrous magnesium chloride.

Determination of the influence of specific impurity species in magnesium chloride on the performance of electrolysis using Alcan Technology and assessment of magnesium chloride feed produced by the AM process.

Participants:	% Share
Division of Mineral Products	89
Division of Mineral and Process Engineering	11

Total Expenditure: $1,389,000

Energy Supply

MDP11 *Energy Storage*

Objective:
To improve storage batteries to meet society's future needs for cleaner electricity supplies, portable power and road transport.

Planned Outcomes:
Establishment of Australian primary lead as an effective material for the extension of valve-regulated batteries to deep-cycling application.

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

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

Participants:	% Share
Division of Mineral Products	84
Division of Coal and Energy Technology	16

Total Expenditure: $2,249,000

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:
Development, to pilot scale testing, of packaging films which absorb ethylene and films which produce sulphur dioxide for sulphiting foods.

Development of combined function films (permeability/condensation control).

Development of high strength biodegradable packaging.

Completion of trial packaging systems for selected crops.

Participants:	% Share
Division of Materials Science and Technology	46.0
Division of Food Science and Technology	27.5
Division of Horticulture	26.5

Total Expenditure: $285,000

Manufacturing

MDP13 *Biomaterials and Medical Devices*

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

Planned Outcomes:
Identification of functionally important sites in key molecules involved in the biomaterial tissue interface.

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

Evaluation of prototype materials through *in vitro* testing methods.

Testing of selected materials in functional models.

New products for opthalmic and cardiovascular applications.

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

Total Expenditure: $2,600,000

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:
Development of low cost/high performance organic matrix composites, studies on ozone depletion, computer software for airframe component design, ultrasonic non-destructive testing of aerospace materials, corrosion inhibitive materials to replace chromium, and computer software for increasing manufacturing efficiency.

Participants:	***% Share***
Division of Applied Physics	22
Division of Chemicals and Polymers	14
Division of Manufacturing Technology	11
Division of Materials Science and Technology	3
Other Participants (Boeing)	50

Total Expenditure: $1,900,000

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:
A thorough understanding of the needs of a representative set of Australian manufacturing enterprises for information systems to improve the effectiveness of maintenance and other manufacturing operations.

Establishment of a program of research on intelligent maintenance systems with the aim of developing end-to-end information systems to optimise all facets of manufacturing maintenance processes.

Establishment of a program of research into scheduling algorithms and systems focussing on dynamic re-scheduling for flexible manufacturing operations.

Establishment of a program of research into information and materials flows networks to provide tools for the flexible, rapid optimisation of work and materials flow in manufacturing operations.

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

Commercial Services

MDP16 *Urban Water Systems*

Objective:
To transform the ways in which our urban areas are developed and renewed, through the creation of an integrated technology and appropriate design principles for water and wastewater cycle management.

Planned Outcomes:
Greater economic efficiency in infrastructure provision and operation.

Ecologically sustainable patterns of water and wastewater cycle management by amelioration of problems of coastal, estuarine, lacustrine and riverine pollution, and by harmonisation of the design of urban drainage with the natural drainage regime which it partly replaces.

Creation of an external steering/reference committee.

Setting up of a major case study, possibly in the Adelaide metropolitan area.

Establishment of research projects covering urban location, wastewater treatment and disposal strategies, water sensitive urban design, asset optimisation, environmental standards and economics and monitoring systems.

Development of demonstration project with MFP Adelaide.

Participants:	***% Share***
Division of Water Resources	28
Division of Building, Construction and Engineering	18
Division of Chemicals and Polymers	18
Division of Information Technology	14
Division of Mathematics and Statistics	14
Other Participants	8

Total Expenditure: $1,200,000

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:
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.

A rigorous synthesis of global carbon modelling and observational studies.

Complete accurate heat and freshwater budget closures from the Tropical Oceans-Global Atmosphere, Coupled Ocean-Atmosphere Response Experiment.

A comparison of models of atmosphere-biosphere exchange to determine the effects of convective boundary layer schemes in climate models.

An assessment of the impact of plausible scenarios of climate change on water resources in specific catchments and water-use efficiency in 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: $14,864,000

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:
Label data captured from 6000 plant and insect collections.

Framework established for assessing role of soil organisms as biodiversity indicators.

Specific DNA probes developed for monitoring distribution and population genetics of potential indicator taxa of soil fungal diversity.

Codominant PCR-based markers developed from RAPDs in *Eucalyptus nitens* and usability tested across a range of plant genera.

Field trials established in native jarrah forest (WA) and agricultural land (SA,Q) in which impacts of crop and forest management on functional groups of soil microorganisms can be assessed.

Mechanisms of decline under specified conditions determined for developing recovery plans for endangered species.

Predictive models developed for landscape function and process for Western Australian wheatbelt and Central Australian rangelands.

Participants:	***% Share***
Division of Plant Industry	20
Division of Wildlife and Ecology	22
Division of Entomology	16
Division of Soils	16
Division of Forestry	10
Other Participants	16

Total Expenditure: $2,073,000

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 their client and co-operating organisations.

Planned Outcomes:
Completion of the initial data gathering phase of the International NOAA 1km Land Data Project.

Commencement of local higher-level product development.

Establishment of a long-term "Australian Land Research Data Centre", based on the current pilot data centre, at the Division of Wildlife and Ecology.

Commencement of conversion of old, CSIRO-held, Landsat and MOS-1 data to more convenient and durable media.

Incorporation of relevant airborne and ground-based data into the Australian Land Research Data Centre.

Participants:	***% Share***
CSIRO Office of Space Science and Applications	47
Division of Wildlife and Ecology	18
Division of Atmospheric Research	7
Information Services Branch	1
Other Participants	27

Total Expenditure: $670,000

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 the Murrumbidgee weirpool and Swan Estuary, and to increase interaction with Agencies.

Planned Outcomes:
Collection of physical and biological data from suitable weirpools, based on the data development of models of circulation, mixing, cyanobacterial distribution and bacterial growth in weirpools.

Calibration, testing and placement of two Aqualab units for monitoring the water quality of surface and bottom waters. Periodic flights for remote sensing and "ground truthing" with the spectro-radiometer.

Commencement of monitoring and sediment sampling in the Swan River.

Characterisation of toxin degradation by whole bacteria and isolated enzymes.

Integration of instream component into the catchment management support system.

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

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.

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.

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

CAMRIS (scale 1 : 2.5 million) operational.

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

MDP22 *Land and Water Care*

Objective:

A. To provide guidelines for sustainable development of semi-arid rangelands.
B. To help develop productive and sustainable management of irrigated horticulture.
C. To enhance sustainable and productive management of dryland farming systems.
D. To develop methods to ameliorate dryland salinity within total catchment management.

Planned Outcomes:

A1. A portfolio of indicators, and methods for their use, to assess sustainability and productivity of grazing systems for managers and policy makers.

A2. Methods to predict the distribution and spread of woody weeds in the upper Burdekin catchment of NE Queensland.

A3. Methods to describe and monitor soil and vegetation in mulga woodlands of central and eastern Australia.

B1. Identification of constraints on production, efficient use of water in vineyards and other high value crops.

B2. Integrated options for optimising the use of water and fertilizer.

B3. Better water use efficiency; reduced drainage water quantity; and enhanced drainage quality.

C1. A crop, pasture and forestry water-use model that permits the assessment of biological performance in relation to potential performance.

C2. Recommendations relating desirable cultivation and stubble management to soil type and climate in the south-eastern wheat-belt.

C3. Estimates of effects of specific crop, pasture and agro-forestry management on land and water degradation in the south-eastern wheat-belt.

D1. Methods to identify and use landscape indicators to identify the likelihood of dryland salinity, its rate of occurence and its physical consequence within a whole catchment framework.

Participants:	% Share
Division of Soils	14
Division of Wildlife and Ecology	19
Division of Water Resources	17
Division of Tropical Crops and Pastures	16
Division of Plant Industry	11
Centre for Environmental Mechanics	9
Division of Horticulture	6
Division of Animal Production	4
Division of Forestry	3
Division of Exploration and Mining	0

Total Expenditure: $1,850,000

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:

A meeting of staff in the two Divisions to refine the implementation strategy for development of the Program.

Appointment of three new staff to the Program.

A workshop to define initial tasks and sub-projects.

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:

Formalised participation of the Program in the newly established Australian Centre for Minesite Rehabilitation Research (which will be managed on a CRC like model financed entirely by the Australian Mining Industry) to undertake research on strategic issues of minesite rehabilitation in conjunction with joint venture partners the Centre of Mined Land Rehabilitation at the Univ. of Queensland and the Mulga Research Centre at Curtin Univ. of Western Australia.

Completion of the first stages of strategic research projects dealing with the rate of soil formation from coal mine spoil, and rehabilitation strategies for final voids (water-filled mine pits) at BHP Australia Coal Ltd mines in the Bowen Basin of Queensland.

Completion of many industry-funded tactical research projects dealing with experimental construction of self-sustaining ecosystems on waste-rock dumps, microbial enhancement and control of leaching of copper from supergene gold ores, bacterial cyanide destruction in heap leach pads; rehabilitation of mine tailings dams linked with the Program's generic research themes.

Publication of results of recently completed tactical and generic research on ecosystem reconstruction of minesites in the scientific literature.

Participants:	***% Share***
Division of Soils	68.0
Division of Exploration and Mining	11.0
Division of Water Resources	11.0
Division of Wildlife and Ecology	4.0
Division of Coal and Energy Technology	3.0
Division of Tropical Crops and Pastures	1.5
Division of Entomology	1.5

Total Expenditure: $1,975,000

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.

Listed below are all those CRCs in which CSIRO is a core participant. 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 list is derived from the *CRC Compendium* which provides additional information on each CRC including their 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
- Macquarie 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

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

CRC for Vaccine Technology
- Division of Animal Health

Guide to Operational Unit Entries

Each operational unit is uniquely numbered at the top of each page of its entry in this Operational Plan. Each entry consists of an objective, a strategy, a set of planned outcomes, and an estimate of expenditure for 1993-94. Some entries also include other details. The content of 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.

Inter-Divisional Collaboration

This section of the Divisional entries lists the Multi-Divisional Programs (MDPs) managed by the Division and those in which it participates. Each MDP is numbered for ease of reference and details of each MDP are included in the section on 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 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 1993-94 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:

(a) Implementation of the CSIRO Strategic Plan 1991-92 to 1997-98 (AAI)

Where an outcome for 1993-94 demonstrates progress toward one or more of the major planned outcomes highlighted in the Strategic Plan, the link is shown by a code of the form (AAI). An example of how to follow the cross-reference is given in the section on Strategic Plan Implementation.

(b) Planned outcomes with a Focus on Program Evaluation (Eval)

Where a particular planned outcome has to do with the evaluation of a particular research program or potential area of activity, that outcome is followed by (Eval).

(c) Planned Outcomes With a Focus on Performance Indicators (Perf)

Where a particular planned outcome has to do 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), that outcome is followed by (Perf).

1993-94 Resources Summary

Entries for Divisions and the Chief Executive's Advisory Units include a table showing the **planned expenditure** of direct appropriation funds and external funds for the 1993-94 financial year. External funds consist of earned appropriation revenues and sponsored research funds. The figures shown are estimates as at 17th May 1993.

Where relevant the percentage of total 1993-94 planned expenditure from external funds is also shown, together with the comparative (estimated) figure for 1992-93. Where the unit has an external funding target this is shown as a percentage of total expenditure, together with the year in which it is planned to reach the target (or in which the target was reached).

Summary of Resources, 1993-94

Each Institute's entry, and the Corporate Services Department entry, includes a table showing estimates of staffing levels and expenditure for each constituent Division, Branch or Unit. All figures are estimates for the 1993-94 year as at 17th May 1993.

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

Financial estimates are shown as **planned**

expenditure from direct appropriation funds and from external funds. External funds consist of earned appropriation revenues and sponsored research funds.

Planned Distribution of Total Expenditure by Research Purpose 1993-94

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 1993-94 will be allocated between CSIRO's Research Purposes.

Strategic Plan Implementation

This section of the Operational Plan includes a list of major planned outcomes which were highlighted in the CSIRO Strategic Plan 1991-92 to 1995-96. These have been cross-referenced where appropriate to 1993-94 planned outcomes in the Institute and Divisional entries which follow. The example immediately below shows how the cross-referencing works.

The Strategic Plan planned outcomes are grouped according to research purpose. Each research purpose is identified by a two letter code and each planned outcome is numbered. The following planned outcome (IC4) is the fourth listed under the heading Information and Communications Industries.

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 (DIT/IISE) 44:1 (COSSA/INRE)

The code "2:10,11 (DIT/IISE)" refers to the 10th and 11th planned outcomes in entry number 2, which is the Division of Information Technology (DIT) within the Institute of Information Science and Technology (IISE). The first of these is shown below as it appears in the Division's entry with its cross-reference back to the strategic plan.

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

Strategic Plan Planned Outcomes by Research Purpose

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.	34:10 (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.	
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.	28:1,2,3,4,9,10,11,12, 13,14,15,16,17,18 (DE/IPPP) 32:11,12,13 (DPI/IPPP)
PP4	Genetically engineered high sulphur protein pasture legumes with the capacity to lift wool production from improved pastures by 20 per cent.	
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.	

PP6	Automated techniques for assessing small wood samples to enable important properties for industrial use to be incorporated into tree-breeding programs.	**29**:1 (DFP/IPPP) **30**:13 (DFo/IPPP)

ANIMAL PRODUCTION AND PRIMARY PRODUCTS

AP1	Improved sheep-breeding techniques to control fibre diameter and other qualities in Australian merino wool.	**21**:7 (DAP/IAPP) **26**:1,2 (BU/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.	**22**:22 (DFST/IAPP) **24**:13,14,15,25,26 (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.	**21**:5 (DAP/IAPP) **24**:13,14,15 (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**:1,2,3 (DAH/IAPP) **24**:2,3,4,5,6,7,8,27 (DTAP/IAPP) **26**:1,2 (BU/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**:3 (DAP/IAPP) **24**:16,20,21,22 (DTAP/IAPP)
AP6	Quantitative predictive models for the sustainable management of the tuna fishery.	**26**:1,2 (BU/IAPP) **38**:7,8,9,10 (DF/INRE) **44**:4 (COSSA/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**:8 (DFST/IAPP) **26**:1,2,6 (BU/IAPP)
RM2	Active packaging systems for perishable goods which will oped up export markets (especially for horticultural products) of over $100m a year.	**11**:18 (DMST/IIT) **22**:4,5 (DFST/IAPP) **26**:1,2 (BU/IAPP) **31**:14 (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.	**26**:1,2 (BU/IAPP)
RM5	Support for the food industry in developing new fibre-enriched foods and implementing corporate strategies on nutrition.	**23**:1,2,5,6 (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.	**29**:5 (DFP/IPPP)

MINERALS INDUSTRY

MI1	Development of a magnesium metal demonstration production plant industry in Gladstone, in collaboration with QMC, MIM, and UBE Industries - Japan.	**16**:4 (DMPE/IMEC) **17**:14,15 (DMP/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.	**10**:5 (DMT/IIT) **16**:1,3 (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**:5,6 (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.	**16**:7 (DMPE/IMEC)
MI5	Improved metalliferous mining efficiency by addressing the issues of integration of geology and mine design and of dilution during the mining process.	**15**:7,8,9,10,11,22,23 (DEM/IMEC)

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**:5,6,7,8,9,10,11,12,13 (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**:14,15,16 (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.	**14**:5,6,8,12 (DCET/IMEC)
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.	**6**:5 (IIT) **9**:1,2 (DCP/IIT)
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.	**6**:7 (IIT) **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.	**3**:8 (DMS/IISE) **7**:4,8,9,20,21,24 (DAP/IIT) **10**:21,23,28 (DMT/IIT)
MF5	Development and commercialisation of new systems to achieve effective delivery of antigens and optimum immune responses from vaccines.	**20**:8,9,10,11,12,17,18 (DAH/IAPP) **24**:28,29 (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**:1,2,3,4,8,22,28,30 (DR/IISE)
IC2	Antennas and associated sub-systems for satellite-based, mobile person-to-person communications.	**4**:15,16,17 (DR/IISE)
IC3	Advanced spatial database systems for improved management of land-related information for applications developers throughout CSIRO, Government and industry.	**2**:1,3 (DIT/IISE) **3**:14 (DMS/IISE) **44**:1 (COSSA/INRE)
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 (DIT/IISE) **44**:1 (COSSA/INRE)
IC5	Transfer of advanced hypermedia tools for navigating complex databases transferred to the information services industry.	**2**:4,5,6 (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.	**44**:1,3,4 (COSSA/INRE)

ECONOMIC DEVELOPMENT - ENVIRONMENTAL ASPECTS

ED1	Demonstration of the ability to substantially reduce rabbit and fox populations by means of fertility control.	**42**:17,18 (DWE/INRE)
ED2	A comprehensive set of management strategies to prevent or ameliorate outbreaks of toxic blue-green algae in inland water systems.	**41**:7,8,9,13,20,26,30 (DWR/INRE) **43**:14,15 (CFEM/INRE) **44**:1,3,4 (COSSA/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.	**6**:6,9 (IIT) **9**:15,16 (DCP/IIT) **25**:7 (DWT/IAPP) **30**:14 (DFo/IPPP) **41**:2,18 (DWR/INRE) **44**:1,3 (COSSA/INRE)
ED4	Solutions to environmental and technical issues to ensure the effluent from proposed kraft pulp mills will not have a detrimental impact.	**14**:18 (DCET/IMEC) **29**:3 (DFP/IPPP) **38**:16 (DF/INRE) **39**:10 (DO/INRE) **45**:4 (BU/INRE)
ED5	Plasma technology suitable for high temperature destruction of organic chemical wastes at the plant scale.	**6**:8 (IIT) **7**:12 (DAP/IIT) **10**:15,16,17,18 (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.	**29**:10 (DFP/IPPP) **30**:3 (DFo/IPPP) **32**:1,3,6,14,16 (DPI/IPPP) **33**:1,2,3,4,6,11,12,13, 14,16,17,18,19,21 (DS/IPPP) **34**:15 (DTCP/IPPP) **41**:10,14,15,16,17,21 (DWR/INRE) **42**:1,2,3,5,6,7 (DWE/INRE) **43**:1,2,3,5,7,8,9,10,11 (CFEM/INRE) **44**:1,3 (COSSA/INRE)
ED7	Improved capability to help mining companies in the environmental management and rehabilitation of mine sites.	**14**:24 (DCET/IMEC) **33**:10 (DS/IPPP) **41**:25 (DWR/INRE) **44**:1,3,4 (COSSA/INRE)

ENVIRONMENT

EN1	Regional forecasts of climate change with certainty sufficient to stimulate governments and the private sector to adopt response and adaptation strategies.	**37**:3 (DAR/INRE) **38**:17 (DF/INRE) **41**:23 (DWR/INRE) **43**:1,6 (CFEM/INRE) **44**:1,8 (COSSA/INRE)
EN2	Improved drought forecasting ability through participation in a major international exercise studying the interaction between oceans and the atmosphere.	**37**:25,26 (DAR/INRE) **39**:1 (DO/INRE) **43**:4 (CFEM/INRE) **44**:1,8 (COSSA/INRE)

EN3	Scientific principles for effective fire management regimes to help in the maintenance of Australia's conservation areas.	**30**:6 (DFo/IPPP)
EN4	Methods for identifying Australia's flora and fauna at risk of extinction and the design of reserve networks to best ensure their protection.	**32**:18 (DPI/IPPP) **42**:4,8,9,11,24,25,26,27, 32,39 (DWE/INRE)
	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 (DHN/IAPP)

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 and collaboration technology environments and practices. 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 key 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 Market development studies in telecommunications, the computer industry, and commercial services.

2 Implementation of a total quality approach to the management of the Institute.

3 The third set of Institute demonstrator projects selected and launched.

4 A new "lead" publication covering information technology and telecommunications capabilities and achievements across CSIRO.

5 A five-year strategic plan incorporating a fresh assessment of national research priorities.

6 Improved accessibility of the Institute's research to business enterprises through increased effort on near-to-market research.

7 The second set of Program Planning Reviews completed and the results incorporated into plans for 1994-95 and beyond. (Eval)

1. Institute of Information Science and Engineering

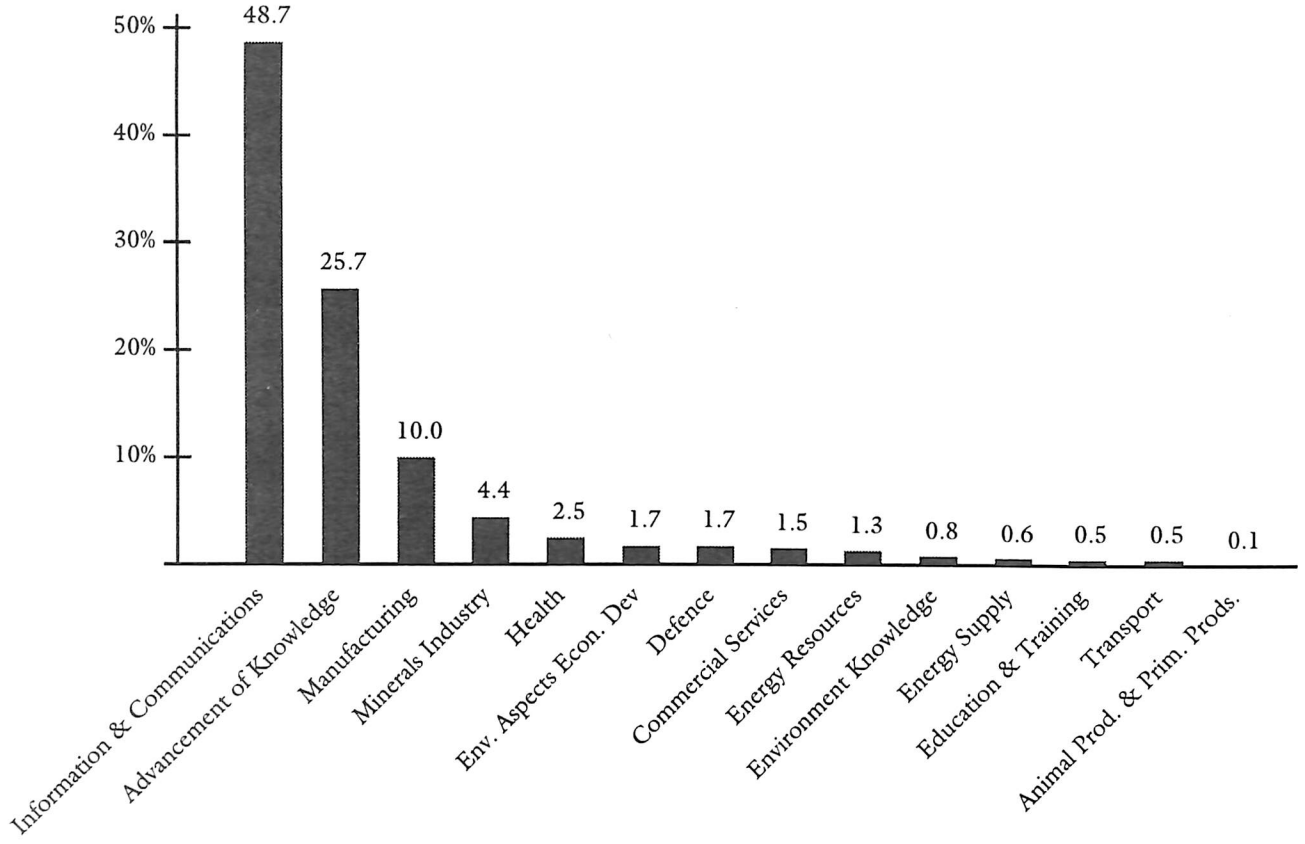
SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Manage ment	Total Staff	Direct Approp	External Funds	Total Funds
Information Technology	67	21	7	95	6,727	2,510	9,237
Mathematics and Statistics	60	15	5	80	5,792	3,159	8,951
Radiophysics	81	78	8	167	8,995	5,950	14,955
Australia Telescope National Facility	50	82	3	135	10,217	1,000	11,217
CSIRO Supercomputing Facility[1]	1	3	0	4	3,582		3,582
IISE Institute Headquarters	1	7	3	11	1,450		1,450
TOTAL	260	206	26	492	36,763	12,619	49,382

[1]The CSIRO Supercomputing Facility's expenditure budget is allocated initially to IISE as shown, but is subsequently reallocated to Divisions throughout CSIRO in proportion to use.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



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

- Focus research on the demonstration and development of advanced information systems and associated services particularly for environmental aspects of economic development, the minerals industry, manufacturing industries and commercial services.
- 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 systems and services.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Integrated Geological, Geophysical, Mine Design-Visualisation - MDP7 (Managed by Division of Exploration and Mining)

Process and Maintenance Optimisation in Manufacturing - MDP15 (Managed by Division of Mathematics and Statistics)

Urban Water Systems - MDP16 (Managed by Division of Water Resources)

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 In collaboration with industry partners, demonstrated integration of geographic data processing in a commercial system for emergency services.

3 Demonstration of integration of 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 Prototype hypertext-based system for intelligent training in defence and commercial services applications. (IC5)

5 Demonstrated systems architecture to support interactive documentation for emergency services on vessels. (IC5)

6 A business feasibility study for distributed interactive multi-media information services. (IC5)

To develop architectures, tools and techniques for enterprise modelling and planning systems. (10%)

7 A business feasibility study for the utilisation of enterprise modelling and planning systems, particularly in manufacturing and transportation.

To demonstrate and develop "open systems" architectures and standards for distributed information systems. (15%)

8 Demonstrated application of open systems standards for electronic directories and related communications services in government and business organisations.

9 An R&D program on "resource discovery" aimed at assisting interactive access to large data sets and other resources over communications networks.

To develop system architectures, tools and techniques for image-based visualisation and interactive user interfaces. (30%)

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

11 Demonstration of techniques for interactive three-dimensional representations in mine planning and mineral exploration, in collaboration with the Division of Exploration and Mining and industry partners. (IC4)

12 An R&D plan on user paradigms for exploiting interactive electronic light tables in geoscience and engineering applications.

1993-94 Resources Summary

Direct Appropriation	$6,727,300
External funds	$2,510,000
Total Expenditure	**$9,237,000**

Percent from external sources	27%
Percent from external sources 1992-93	27%
Target for external earnings	35%
Year planned to reach target	1994-95

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.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Process and Maintenance Optimisation in Manufacturing - MDP15 (6.5% of total Division Resources) in collaboration with Division of Manufacturing Technology, Division of Information Technology & Division of Food Science and Technology

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4 (Managed by Division of Mineral Products)

Iron Ore Processing - MDP8 (Managed by Division of Mineral and Process Engineering)

Urban Water Systems - MDP16 (Managed by Division of Water Resources)

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.

2 Proceedings of the 1993 Mathematics-In-Industry Study Group (MISG) published.

3 The third year's scheduled work on GIRD-funded FASTFLO project, "New Computational Fluid Dynamics Algorithms for Industrial Applications" completed.

4 Models and software for specific applications problems; pulsed combustion, convection in cavides, heat transfer in coke ovens.

5 Optimisation algorithms and software for specific applications; scheduling of trains and airline crew, temperature variation in the distribution of fuel, mineral processing.

6 Particle-based computational algorithms for flow of granular materials and other fluid flow problems implemented.

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%)

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

8 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. (MF4)

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

10 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%)

11 Methods for classifying different grain types in the microstructure of welds.

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

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

14 Methods for assessing, representing and combining the uncertainty in the data layers of a GIS. (IC3)

15 Methods for identifying mineral mixtures from field spectra.

16 Segmentation and classification methods for colour and multispectral imagery.

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

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

19 Decision tree for assessing fetal health from ultrasound data.

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

21 S software for presentation of operations research 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 S-PLUS for Microsoft Windows widely demonstrated.

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

25 A new Help desk system introduced for handling user problems with the computing systems and networks.

1993-94 Resources Summary

Direct Appropriation	$5,792,000
External funds	$3,159,000
Total Expenditure	**$8,951,000**
Percent from external sources	35%
Percent from external sources 1992-93	31%
Target for external earnings	35%
Year planned to reach target	1993-94

Objective

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

Strategy

- Conduct research into generic technologies appropriate to telecommunications and image forming systems (including ultrasonic imaging systems).
- Recognise emerging trends in services relevant to the Divisions's strengths and adapt its technology research to meet the future needs.
- Collaborate with industry, Universities, Government business enterprises and bodies 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 advanced wireless and untethered communications systems for mobile and portable computing networks, telecommunications customer access and other short-haul network links, and investigate enhanced applications for wireless access computing. (10%)

1 Wireless LAN system designs for both high performance and low power mobile computing networks produced in conjunction with university and industry partners. (IC1)

2 Demonstration of wireless links for high bit rate applications such as real time video transfer. (IC1)

3 A system design and prototype mm-wave telecommunications links for telecommunications network reticulation. (IC1)

4 An initial system design and specification for future wireless telecommunications customer access at B-ISDN bit rates. (IC1)

To develop advanced GaAs based semiconductor devices and MMIC's and design tools for application in defence and communications systems. (23%)

5 0.2 micron quantum-well-doped devices and MMICs for low noise and moderate power applications for operation at frequencies up to 90 GHz.

6 Completion of Phase 1 of upgrade for the fabrication of MMICs on two-inch wafers.

7 Implementation plan for use of a quality system in the fabrication of MMICs.

8 Hybrid integrated circuits and MMICs for prototype transceiver for a high-bit-rate wireless local area network. (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. (18%)

9 Demonstrated viability of underwater acoustic vision project.

10 Project with CRC for Cattle and Beef Industry on Ultrasonic Beef Marbling Assessment completed.

11 Effectiveness of large aperture scanning in subcutaneous tissue aberration removal on clinical images demonstrated.

12 Demonstrator version of an "expert assistant" workstation to assist radiologists in the diagnosis of lung disease from chest X-rays.

13 A status report on electromagnetic effects on living tissue.

14 Completed feasibility study on remote interactive diagnosis.

To develop and apply radio-frequency related technologies to L-band mobile communication systems in support of service providers and industries in Australia. (8%)

15 A vehicle-mounted electronically tracking antenna for the Australian L-band mobile satellite system (Optus) and for overseas systems developed and tested by industry partners Mitec Ltd and Codan Pty Ltd with the support of CSIRO. (IC2)

16 Theoretical models and testbeds for the evaluation of the radio-interface characteristics of second-generation digital mobile communications systems and the future third generation system (FPLMTS) currently being specified. (IC2)

17 A marketing report on the L-band mobile communications industry in Australia. (IC2)

To apply advanced signal processing technology in the following areas: digital electronics, telecommunications, communications and mine safety technologies for the minerals industry. (22%)

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

19 Novel methods for improved compression of high resolution images.

20 A readily useable method to assess the condition, and therefore the safety, of a mine roof.

21 A geological imaging system using 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. (8%)

22 Robust modulation for wireless communication schemes. (IC1)

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

24 Echo cancellation in telecommunications systems using adaptive signal processing methods.

25 Demonstration of rapid search of image databases using the mathematics of non linear dynamic systems in the vicinity of phase transitions.

To develop techniques for the design and manufacture of antennas and passive microwave devices for communications systems. (11%)

26 Communications antennas for on-board satellite use through contracts with international partners.

27 Technology for the design and manufacture of dual-band feed systems for earth stations.

28 Antennas for millimetre-wave wireless LANs selected and designed. (IC1)

29 Planar antenna for Electronic News Gathering (ENG) and pay-TV applications.

30 Indoor wave propagation measurements at millimetre-wave frequencies for use in wireless communications. (IC1)

31 A prototype satellite-tracking system for the multibeam earth station antenna that uses feed horn movement only.

1993-94 Resources Summary

Direct Appropriation	$8,995,000
External funds	$5,950,000
Total Expenditure	**$14,955,000**
Percent from external sources	39%
Percent from external sources 1992-93	27%
Target for external earnings	35%
Year planned to reach target	1993-94

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 remnents, galaxies and quasars investigated.

2 Definitive new survey of southern pulsars completed.

3 International agreements for use of ATNF antennas as part of the global VLBI network and the Russian and Japanese space VLBI programs.

To operate the Paul Wild Observatory as a National Facility. (40%)

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

To operate the Parkes Observatory as a National Facility. (20%)

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

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

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

To develop the next generation of instrumentation. (20%)

7 An 80-115 GHz observational capability for the Mopra 22m antenna.

8 Modified feeds and receivers as specified in the NASA-HRMS contract.

9 A new 12-25 GHz receiver system for Parkes and Mopra antennas.

10 All sites outfitted with S2 recorders and tests with the new LBA correlator conducted.

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

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

12 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.

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

1993-94 Resources Summary

Direct Appropriation	$10,217,000
External funds	$1,000,000
Total Expenditure	**$11,217,000**
Percent from external sources	9%
Percent from external sources 1992-93	13%
Target for external earnings	10%
Year planned to reach target	1992-93

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.

- The Institute aims to increase its interaction with the manufacturing sector through research collaboration on strategic projects. This will facilitate the exchange of knowledge and technology and enable the finer focusing of research on industry problems where special opportunities exist. It aims to improve the skills and practices necessary for enhanced interaction with industry while at the same time helping build the scientific knowledge and skill base in industry, which is necessary for internationally competitive performance.
- 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.
- Divisional Scientific and Technology Reviews and Business Area Reviews, and the Project Report system, will be continued as a precursor to Institute resource allocation decisions.

Planned Outcomes

1 Under the MOU with BHP, continued development of joint research activities including steel strip processing, remote sensing, and waste management technology.

2 Finalisation of licensing contracts for worldwide manufacture of CSIRO-AGL Gas Flow Meter.

3 Australian manufacturing and export opportunities with Aerospace Technologies of Australia and Hawker de Havilland supported through continued joint research activities with the Boeing Company, Seattle.

4 Introduction of completed Boeing-related research projects into the CRC for Aerospace structures with Aerospace Technologies of Australia and Hawker de Havilland.

5 Strengthening of joint research with the Du Pont company to support Australian manufacturing and export opportunities in crop protection chemicals and engineering resins. (MF1)

6 Strategic alliances with Sydney Water Board and Pacific Power to support infrastructure development and expansion of export opportunities for waste/water management technology. (ED3)

7 Definition and coordination of joint research project activities with Australian Automotive industry through the newly established Automotive R&D Centre at Preston, Victoria. (MF3)

8 Completion of a commercialisation agreement with commercial partner for the marketing of PLASCON systems in Australia and overseas. (ED5)

9 Coordination of CSIRO wide activities in environmental waste management, notably in urban sewage and water treatment. (ED3)

10 Development of an inter-Divisional program with a leading optical systems manufacturer to exploit several optical systems currently under development within CSIRO.

11 Establishment of an international venture to produce optically variable devices on a range of substrates for security applications.

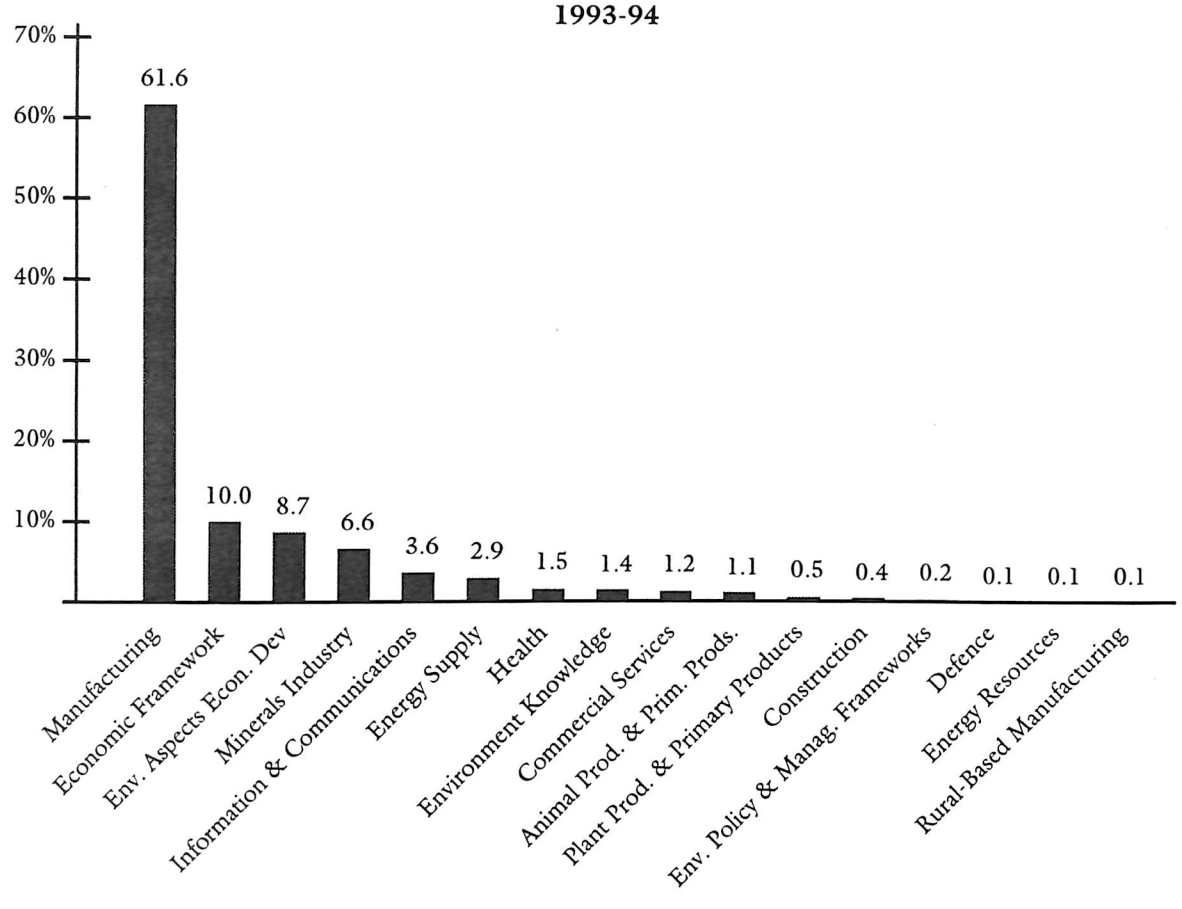
12 Development of new advanced metals/mineral initiatives in conjunction with the Institute of Minerals, Energy and Construction.

SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Applied Physics	203	78	9	290	21,656	6,200	27,856
Biomolecular Engineering	122	46	9	177	10,777	3,350	14,127
Chemicals and Polymers	122	41	8	171	10,898	6,180	17,078
Manufacturing Technology	104	45	3	152	10,640	4,860	15,500
Materials Science and Technology	99	47	7	153	11,506	3,950	15,456
IIT Institute Headquarters	0	3	4	7	1,300		1,300
TOTAL	650	260	40	950	66,777	24,540	91,317

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Biomaterials and Medical Devices - MDP13 (Managed by Division of Biomolecular Engineering)

Boeing - CSIRO Joint Research Effort - MDP14 (Managed by IIT Institute Headquarters)

Specific Objectives & Planned Outcomes

Develop electrotechnology of current or potential value to Australian industry, and provide standards and calibration services for electrical potential and impedance and for time interval and frequency. (19%)

1 Extension and demonstration with an industrial partner of the potential of SQUID-based magnetometers for large-area mineral prospecting.

2 Establishment with an industrial partner and the University of NSW of the feasibility of a high-dynamic-range seismic sensing system for seabed exploration.

3 In collaboration with CSIRO Division of Food Science and Technology and several industrial partners, detection of analytes using a gated ion-channel membrane attached to a solid substrate.

4 Completion and introduction of new measurement systems to upgrade Australia's primary standards of impedance and voltage. (MF4)

5 Establishment with an industrial partner and CSIRO Division of Exploration and Mining of the basis for machine-mounted radar systems targetted at increasing efficiency in coal face mining. (ER3)

Develop magnetic and electromagnetic technology of current or potential value to Australian industry, and provide standards and calibration services for AC electrical quantities, high voltages, magnetic quantities and dielectrics. (18%)

6 Investigation of electrostatic charge tendency in insulating oils under contract to Pacific Power.

7 Development of a prototype electrical induction cooking system with high efficiency, high reliability and low radiated emissions.

8 Development of new ac-dc voltage transfer standards for use at low frequencies. (MF4)

9 Extension of the facility established to calibrate test equipment for the measurement of electromagnetic emissions to include electromagnetic susceptibility. (MF4)

10 Completion of a high-efficiency drive for a solar-powered water pumping system for Bardak Ltd and, in collaboration with Transfield Technologies and Australian Defence Industries, completion of Stage 2 in the development of a novel electromagnetic controller.

Develop plasma and thermometric technologies of current or potential value to Australian industry and ozone assessment models for environmental evaluations; provide standards and calibration services for mass and temperature. (20%)

11 Completion in collaboration with Boeing of a two-dimensional stratospheric model with better chemistry, radiation and dynamics, and improved estimation of the impact of aerosol chemistry on the accuracy of ozone assessment models.

12 Development with the Division of Manufacturing Technology of laboratory-scale processes for the destruction of at least two species of ozone-depleting substances using plasma-based technology. (ED5)

13 Completion of an economic assessment of a new process for the extraction of titanium metal from the tetrachloride.

14 With the Division of Coal and Energy Technology, estimation of the reduced levels of particles, NO_2 and SO_2 released from coal-fired power stations using pulse-energised electrostatic precipitators.

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. (23%)

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 Continuation under the ISTP program of a collaborative research project with AEA Technology, Harwell UK, on the application of non-contact ultrasonic techniques to the inspection of hot metal products.

18 In collaboration with AGL Ltd, implementation of international licensing arrangements for production of a new-generation ultrasonic domestic gas meter, maximising the return to Australia; continuation of small-scale production of meters for environmental and field testing.

19 Further development of overseas marketing arrangements for the Ultra Micro Indentation System and establishment of a contract for manufacture of this system in Australia.

20 Maintenance of an effective national measurement system for Australia in the fields of acceleration, acoustics 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. (19%)

21 Assessment of the potential for frequency standards of hyperfine atomic transitions in laser-cooled ions of ytterbium, including development of a stable superconducting sapphire resonator. (MF4)

22 Production of ultra-round spheres made of single crystal silicon for use by laboratories in Italy and Japan in determinations of Avogadro's number, including intercomparison of measurements of sphericity with those made by laboratories in those countries.

23 In collaboration with DSTO, production and testing of optical components for a daylight (Lyot) filter for use in the Australian Navy's Laser Airborne Depth Sounder (LADS).

24 In collaboration with the Division of Petroleum Resources, development of an optical profiling system for measuring rock-joint orientation and location on exposed highwall in coal mining applications. (ER3, MF4)

25 As part of the Australian Photonics CRC, planning and participation in the production of wavelength-selective filters by introduction of periodic refractive index fluctuations into the cores of optical fibres.

1993-94 Resources Summary

Direct Appropriation	$21,656,000
External funds	$6,200,000
Total Expenditure	**$27,856,000**

Percent from external sources	22%
Percent from external sources 1992-93	20%
Target for external earnings	24%
Year planned to reach target	1994-95

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

- A major 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 major 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).

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Biomaterials and Medical Devices - MDP13 (9% of total Division Resources) in collaboration with Division of Chemicals and Polymers & Division of Applied Physics

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Lessening Our Dependence on Chemical Pesticides - MDP2 (Managed by Division of Entomology)

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 Research Foundation (SRF). The percent resources shown do not include the matching funds from the SRF. (MF2)

2 The anti-influenza compounds developed from CSIRO research in collaboration with BIOTA Holdings continue to proceed through exploratory development by Glaxo, with a decision to be made in 1993 on whether to proceed to human trials. (MF2)

To devise new pharmaceutical agents and diagnostic strategies based on the structural analysis and engineering of proteins 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 Grant agreement with AGEN Biomedical Ltd.

4 Production of mutant antibodies and proteases using rational protein design based on 3-D structure analysis.

5 Isolation of antibodies and processes with modified affinity or activity from complex expression libraries under Generic Grants.

6 New reagents and formulations for enhanced immunogenicity of peptide-based vaccines. Evaluation of fat conjugates for targeted delivery of peptides and nucleic acids and as potential HIV therapeutics.

To develop and exploit an understanding of gene control mechanisms to create novel opportunities in the therapy of human and animal disease. (24%)

7 Development of research directed to delivery of therapeutic molecules - somatic cells and animal systems.

8 Testing of method devised to specifically shut down gene expression in mammalian cells.

9 Acquisition of basic knowledge in gene regulatory mechanisms in eukaryotic and prokaryotic systems (with reference to infectious diseases, cancer).

10 Testing of strategy to allow gender selection in an animal model.

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

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

To elucidate the structure and function of cell surface receptors for the development of new pharmaceuticals and health control strategies. (19%)

12 Identification of glucose binding proteins associated with glucose-induced insulin secretion.

13 Produce milligram quantities of purified insulin receptor eclodomain for secondary structure analyses and crystallization protocols.

14 Elucidation of disulfide bond arrangements in fibronection type 111 domain of the insulin receptor.

15 Continuation of molecular studies into the structure and function of the signalling domains of the insullin receptor.

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

16 Evaluation of *in vitro* trials of new collagen-based biomaterials.

17 Expression of the key genes for collagen biosynthesis.

18 Establishment of design concepts and production of prototype materials with modified surface chemistries for *in vitro* evaluation in artificial cornea trials.

19 Examination of the effects of surface chemistries and cell adhesion factors on the persistence of cells on surfaces after initial binding and spreading.

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

21 Transfer of technical innovation to commercial collaborators in three GIRD supported projects and involvement in two Cooperative Research Centres.

1993-94 Resources Summary

Direct Appropriation	$10,777,000
External funds	$3,350,000
Total Expenditure	**$14,127,000**
Percent from external sources	24%
Percent from external sources 1992-93	21%
Target for external earnings	30%
Year planned to reach target	1995-96

9. Division of Chemicals and Polymers (IIT)

Objective

To create wealth for Australia and enhance the quality of life in Australia through collaboration with enterprises involved in the chemical, polymer, water and wastewater treatment industries by conducting excellent scientific research which leads to commercial products and processes, and by contributing to the formulation of public policy for these industries.

Strategy

- Utilise expertise in chemical synthesis, chemical processing, pesticide chemistry, polymer chemistry and physical chemistry to develop new products and processes for world markets through manufacture in Australia or technology export.
- Utilise skills in physical chemistry, polymer chemistry, microbiology and chemical engineering to develop new processes for the Australian water and wasterwater treatment industry to achieve better environmental outcomes and to provide technology for export.
- Seek collaboration with industry on research projects at as early a stage as possible to provide commercial input to guide research leads and to meet external funding targets.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Biomaterials and Medical Devices - MDP13 (Managed by Division of Biomolecular Engineering)

Boeing - CSIRO Joint Research Effort - MDP14 (Managed by IIT Institute Headquarters)

Urban Water Systems - MDP16 (Managed by Division of Water Resources)

Specific Objectives & Planned Outcomes

Generate novel biologically active chemicals for evaluation in crop protection, and investigate pre-industrial scale production of fine chemicals to determine optimum conditions for maximising outputs. (28%)

1 Scheduled synthesis of over one thousand new compounds for evaluation as environmentally safe insecticides, herbicides and fungicides. (MF1)

2 Selection of several compounds for field trial. (MF1)

3 Staged development of process chemistry to synthesize selected compounds for field trial.

4 New routes to synthesis of fine chemicals based on the use of microwave heating.

Develop separation membranes for processes associated with chemicals production, catalysis, and gas separation. Develop physico-chemical surface modification techniques. Develop novel surface active chemicals to produce thin films and to give specific end-use effects. Develop novel security devices based on concepts involving photochemical and photophysical principles. (17%)

5 Development of integrated membrane reactors to improve processes for chemical synthesis.

6 Development of surface modification techniques in biomedical and chemical applications.

7 Further development of surface cleaners.

8 Development of surfactant aggregates to prepare ordered surfactant or polymer layers for use as particle coatings or in optical/electronic devices.

9 Further development of facility for currency notes.

Develop new high temperature-stable polymer matrices in carbon fibre-based composite materials for aircraft; develop improved polymeric materials for medical implants by means of polymer synthesis or surface modification; and prepare polymers for specific industrial applications using new synthesis techniques. (21%)

10 Development of new, high temperature-stable plastics and blends for polymer matrices in composites.

11 More stable, biocompatible polyurethanes by polymer synthesis and surface treatment, with the establishment of tests for haemocompatibility/stability.

12 Development of engineered resins to meet specific market needs.

13 Polymer blends based on polystyrene and polyolefins.

14 Monomers which polymerize without volume shrinkage.

Develop physiochemical processes based on magnetic particles as coagulants and adsorbents, and flotation systems for treating water, sewage and industrial effluents, plus product recovery from waste streams and sludge treatment; develop microbial processes to remove nutrients from sewage for inland disposal, and anaerobic fermentation of high strength, organic industrial wastes. (24%)

15 A full-scale plant to evaluate process for treatment of "sewage concentrate" using magnetite and study of sludge treatment options. (ED3)

16 Ultra-high rate SIROFLOC pilot for water supply. (ED3)

17 Ion exchange processes to remove organics from drinking water and recover heavy metals from industrial wastewaters.

18 A high rate flotation system for reuse of steel industry wastewater.

19 Laboratory and pilot scale development of processes to treat wool scouring and food industry effluents.

To generate novel antiviral and pharmacologically active chemicals for ultimate use as clinical drugs. (10%)

20 Synthesis of new chemicals based on dideoxy nucleosides, inorganic complexes and organic polyanions for tests with HIV and Hepatitis B viruses.

21 Development of novel acetylcholine synthesis enhancers for treating Alzheimer's disease.

22 Closer links with centres of biological research, especially the Biomolecular Research Institute.

1993-94 Resources Summary

Direct Appropriation	$10,898,000
External funds	$6,180,000
Total Expenditure	**$17,078,000**
Percent from external sources	36%
Percent from external sources 1992-93	32%
Target for external earnings	35%
Year planned to reach target	1993-94

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 ensure complementary resources and skills are exploited in cost effective and efficient research.
- 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 by moving the technology epicentre toward larger companies.
- Maintain effective link with manufacturing industry by participation in specialist industry centres, such as the Automotive R&D Centre, and in industry and professional associations.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Magnesium Alloys - MDP9 (4.7% of total Division Resources) in collaboration with Division of Materials Science and Technology & Division of Mineral and Process Engineering

The Division participates in the following Multi-Divisional Programs:

Boeing - CSIRO Joint Research Effort - MDP14 (Managed by IIT Institute Headquarters)

Process and Maintenance Optimisation in Manufacturing - MDP15 (Managed by Division of Mathematics and Statistics)

Specific Objectives & Planned Outcomes

Develop diecasting processes for non-ferrous metals and alloys, and generic elements of casting and solidification technology. (22%)

1 Investigation of advanced thermal control systems for low pressure diecasting and squeeze casting dies. (MF3)

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

3 Completion of commercial version of 3D solidification modelling software, and application of the model to predict microstructure and static tensile properties in premium quality aluminium-based castings.

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 Initiation of new project activities under the auspices of the CRC for Casting and Solidification Technology. (MI2, MF3)

Develop high productivity processes and consumables in arc welding technology. (18%)

6 Development of basic flux and metal-cored wires for use with pulsed welding, and development of a small diameter self-shielded wire.

7 Development of enhanced welding processes for coated sheet steels, with particular reference to robotic GMA and high-speed robotic GTA technology.

8 Establishment of commercialisation plans for the high current GTA welding process, and facilitation of industry adoption of the narrow-gap welding process.

9 Achievement of all set objectives for new projects in microstructure control, high current GTA welding, numerical modelling and robotic arc welding being conducted under the auspices of the CRC for Materials Welding and Joining.

Develop new processes to enhance the properties of engineering surfaces. (11%)

10 Demonstration of ability of cast bonding process to produce continuously clad wear plate.

11 Solution of all basic operations problems with prototype electroslag surfacing equipment at ANI Perth.

12 Establishment of hot forging die test equipment, and assessment of initial range of die surface coatings.

13 Completion of feasibility study with ADI on in-situ repair and refurbishment of marine components using solid-state laser cladding technology.

14 Demonstration of short-circuit transfer mode of hard surfacing sugar cane crusher rolls at plant operating speeds.

Develop an acceptable method of treating organic liquid wastes and gases using the technology of electrically generated plasmas. (9%)

15 Determination of design and operating parameters for PLASCON pilot plant at the Commercial partner's site for on-site destruction of chlorinated organics, and provision of assistance in obtaining EPA approval. (ED5)

16 Determination of design parameters of a PLASCON system for the destruction of halons and CFC's, and provision of assistance to commercial partner in the construction of a pilot plant. (ED5)

17 Completion of experimental trials on other waste chemicals, such as peb's, to determine the performance of PLASCON for a range of chemicals. (ED5)

18 Completion of commercialisation agreement with commercial partner for the marketing of PLASCON systems in Australia and overseas. (ED5)

Develop new technologies based on electrically generated plasmas for material processing and manufacturing applications. (6%)

19 Determination of critical parameters for the development of a prototype plasma reduction system for direct manufacture of corrosion resistant iron pipe from iron oxides.

20 Development of a laboratory prototype system for the control and diagnostics of automated plasma cutting operations.

Develop new technologies in the areas of assembly automation and production management systems. (20%)

21 Completion of the integration of separate modules of the software for planning assembly operations with Hoover and the Preston Group. (MF4)

22 Completion of the generic software tool for facility design with Boeing.

23 Identification of crucial generic development issues for team based facility designs for smart manufacturing. (MF4)

24 Finalisation of project plans for Concurrent Engineering under CRC agreement.

25 Completion of the hardware interface and software module for the diagnostics of controls in manufacturing systems.

Develop sensing and integrated automation modules and systems for a range of industrial applications. (14%)

26 Completion of a full-scale prototype system for the inspection of sewer pipes with Melbourne Water.

27 Completion of an industrial prototype system for the identification of heavy vehicles with Telecom and RTA New South Wales.

28 Determination of critical parameters for the development of a system for identification of cracks on roads with the Division of Applied Physics and Australian Road Research Board. (MF4)

29 Completion of a machine vision module to control draglines with the Division of Geomechanics.

30 Development of initial designs for flexible fixtures for trimming operations.

1993-94 Resources Summary

Direct Appropriation	$10,640,000
External funds	$4,860,000
Total Expenditure	**$15,500,000**

Percent from external sources	31%
Percent from external sources 1992-93	29%
Target for external earnings	35%
Year planned to reach target	1994-95

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 to capitalise on new market opportunities.
- Maintain an appropriate balance between technological development and strategic research.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Active Packaging - MDP12 (2% of total Division Resources) in collaboration with Division of Food Science and Technology & Division of Horticulture

The Division participates in the following Multi-Divisional Programs:

Aluminium Production - MDP5 (Managed by Division of Mineral and Process Engineering)

Magnesium Alloys - MDP9 (Managed by Division of Manufacturing Technology)

Boeing - CSIRO Joint Research Effort - MDP14 (Managed by IIT Institute Headquarters)

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; to develop quantative analytical techniques for the generation of new commercial opportunities for Australian industry. (21%)

1 Ductile titanium aluminides prepared and evaluated. Initial welding trials of iron aluminides completed. Agreements reached with commercial collaborators for support of aluminide developments.

2 E-beam lithograph brought into full operation for the Pixelgram Project. Commercial arrangements with the Reserve Bank of Australia finalised.

3 Multi-purpose diffractometer for the Australian National Beam Line commissioned at the Photon Factory. Two-dimensional detectors developed and used in X-ray imaging instruments.

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. (16%)

4 Electrostatic precipitator alumina dust evaluated for the production of refractory products.

5 Density mapping technique for green pressed ceramic bodies developed, to assist in near net shape forming.

6 License agreement with Vesuvius concluded.

7 Possible materials for use in inert anode composites evaluated.

To develop solid oxide fuel cells for electricity generation. (18%)

8 Design of laboratory facilities for Ceramic Fuel Cells Ltd completed. (ER5)

9 Two 20-watt cell stacks constructed. (ER5)

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. (23%)

10 Laser cooling and trapping of atoms achieved.

11 Prototype imaging spectrometer constructed and tested.

12 Rare earth conversion coating development for aluminium alloys completed.

13 New waste water sensors developed and licensed to an Australian manufacturer.

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. (18%)

14 Carbon fibres produced from pilot plant. Process conditions for various carbon fibre grades optimised.

15 Feasibility study on compact synthesis gas reactor completed and report delivered (BHP).

16 Engineering feasibility study and report on the development of a new titania pigment process completed.

17 Assessment of metal sulphide extraction completed.

To develop techniques to optimise the packaging atmosphere over fresh horticultural produce and to develop environmentally benign packaging. (4%)

18 Packaging systems tested for selected crops. (RM2)

19 High strength biodegradable packaging developed.

1993-94 Resources Summary

Direct Appropriation	$11,506,000
External funds	$3,950,000
Total Expenditure	**$15,456,000**
Percent from external sources	26%
Percent from external sources 1992-93	23%
Target for external earnings	30%
Year planned to reach target	1994-95

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 technical needs of both present and emerging industries.
- Play a major contributory role in the identification and development of emerging key technologies 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.
- Underpin future technological innovation by ensuring that sufficient strategic research is undertaken against strategic objectives and with multi-benefit outcomes.
- Strengthen synergies between the research efforts 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.

Planned Outcomes

1 A portfolio analysis of the strategic research projects within the Institute to ensure that the right mix of strategic projects are being undertaken to meet the technological needs of the minerals, energy and construction industries. (Eval)

2 Development of enhanced strategic alliances with, among others, BHP, WMC, CRA, MIM, Comalco and the Construction Industry Development Agency. (Perf)

3 A funding base which allows at least 30% of the total research portfolio to be strategic research. (Perf)

4 Advancement of Institute redevelopment planning and activities for the establishment of new accomodation at North Ryde, Clayton, Highett and Floreat Park. (Perf)

5 Continued monitoring of industry needs in research and technology, and, where attractive and feasible, establishment of research programs. IMEC will be undertaking a major evaluation on the emergence of biotechnology in the minerals industry. (Eval)

6 Promotion of activities of the newly formed Divisions of Exploration and Mining and Petroleum Resources, ensuring that their research programs are aligned with their industry's needs. (Perf)

7 A human resources strategy for the Institute. (Perf)

12. Institute of Minerals, Energy and Construction

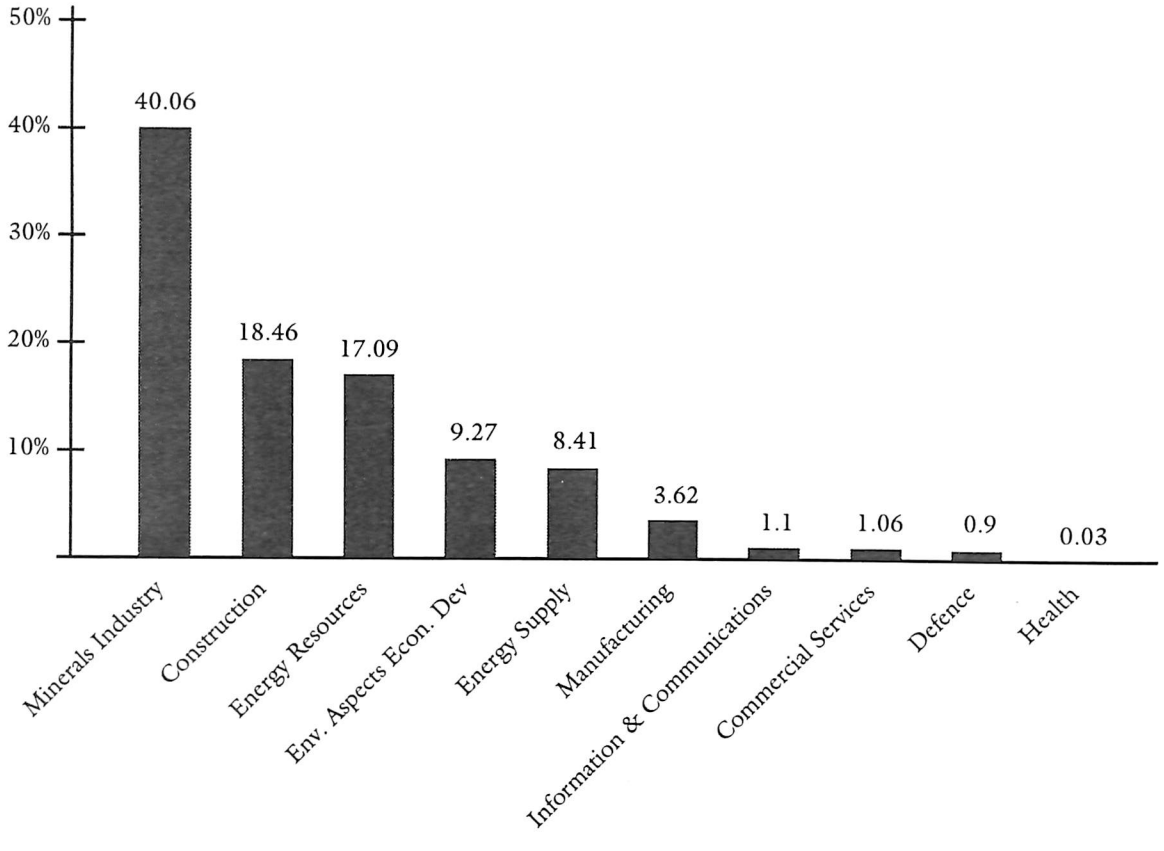
SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Building, Construction and Engineering	175	128	7	310	18,804	8,500	27,304
Coal and Energy Technology	119	78	5	202	12,439	6,400	18,839
Exploration and Mining	97	100	9	206	12,558	6,762	19,320
Mineral and Process Engineering	128	63	5	196	10,378	5,500	15,878
Mineral Products	87	67	6	160	8,695	4,640	13,335
Petroleum Resources	16	28	6	50	3,800	3,200	7,000
Director's Office	0	9	4	13	1,461		1,461
Administered Funds[1]	0	0	0	0	3,386		3,386
TOTAL	622	473	42	1137	71,521	35,002	106,523

[1]Funds administered on behalf of Divisions, includes $0.9m for QCAT extension.

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



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 for new construction and 15% including operation, servicing, maintenance and refurbishing. It addresses more than 70% of total fixed capital investment (much of it on the public sector) and is rapidly increasing its export of goods and services particularly to the growing economies of SE Asia. Activities have declined during the recession which has coincided with restructuring and reform of the industry including more R&D to bring it to international competitiveness. It will be a major contributor to the nations recovery.

- Develop strong collaborative research ties with industry through the Construction Industry Development Agency (CIDA); with Universities through the Australian Building and Construction Researchers Association (ABCRA); and with governments through the Australian Housing and Urban Research Institute (AHURI) and the Building Regulations Future Directions program.
- Establish effective communication and technology transfer links to businesses that service the industry through development of collaborative R&D projects and consultative investigations for industry; 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 through CIB- the Council for International Building, RILEM- the Union of materials and structures laboratories, and with Government agencies for export aid and scientific agreement programs.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4 (Managed by Division of Mineral Products)

Urban Water Systems - MDP16 (Managed by Division of Water Resources)

Specific Objectives & Planned Outcomes

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

1 Procedures to estimate microclimate in wall cavities relating to performance of timber and steel components and to give early diagnosis of resistance of metal products to marine environments.

2 Commissioning of a clean air facility and development of procedures to identify sources of indoor air pollutants.

3 Application of surface engineering expertise to formulate composites of recycled particulate rubber and plastics.

4 Formulations of blended cement systems and high performance concretes for application in SE Asia and structural concretes using either brown coal ash or high volume black coal ash in Australia.

5 Identification procedures and formulations to minimise effects of alkali aggregate reaction in concrete.

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

6 Development of a commercial heat exchanger with ADI and a panel cooling system for electronic equipment in AWA.

7 Completion of a laboratory prototype of a personal cooling system and development of a commercial prototype with ADI.

8 Measurement and numerical prediction of the three dimensional flows in a slurry pump (AMIRA Project).

9 A model of fluid flow in plumbing products and investigation of the phenomena of plumbing noise.

10 A model of the fluid dynamics of thickeners (AMIRA Project).

11 A probe to measure gas and particle flows in hostile environments (AMIRA Project).

12 Software and experimental facilities for analysis of building heating, cooling and air quality.

13 Low NO_x pulse burner systems and laser diagnostic combustion tools.

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

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

15 Completion and commissioning of the Dynamic Weather Testing Facility, and maintenance of current facade testing and consultancy service to industry.

16 Modelling of timber structural properties to provide a basis for international harmonisation of timber standards and collaboration with industry on in-grade structural properties of radiata pine.

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

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

Improve planning and management procedures in the building and construction industry. [Planning and Management Systems Program] (20%)

19 Contributions to operational structure and research program for Australian Housing and Urban Research Institute (AHURI).

20 Enhanced dynamic land-use transport and communication planning model based on TOPAZ developed in collaboration with industry partners. Extension to urban water systems.

21 Development of tools to assist Telecom optimise coverage of mobile telecommunications system and assist planning of broad band networks and their applications.

22 Production of a network version of BCAider integrating with CAD and linking to product databases.

23 Model of construction as a flow process developed with overseas expert.

24 Extension of AI software for sewer inspection system to second stage of commercial prototype.

25 Completed reports for DHHCS of costs of land development and housing options and export potential.

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

26 Identification of the relevant parameters in smoke behaviour and their impact for subsequent development of computational field models.

27 Validation of a mathematical model on a range of masonry structures for prediction of their behaviour under fire.

28 Development of the research program on room fire initiation and growth for input to the Fire Code Reform Project.

29 Completion of the third mission as UNIDO Chief Technical Adviser to China Academy of Building Research on fire research strategy equipment and training.

30 Continued measurement of fire reaction of materials and components and advice to suppliers and regulators.

1993-94 Resources Summary

Direct Appropriation	$18,804,000
External funds	$8,500,000
Total Expenditure	**$27,304,000**
Percent from external sources	31%
Percent from external sources 1992-93	28%
Target for external earnings	35%
Year planned to reach target	1994-95

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

The Division's main stakeholder, the coal industry, is maintaining its export level, worth over $6 billion to the Australian economy, but increased world competition is reducing profits. Other stakeholders, who previously funded research on alternative fuels, are withdrawing from this area in Australia, as further oil and natural gas finds are made. The minerals and energy sector as a whole, however, is putting increased funding into environmental management which will increase efficiencies and reduce environmental impact.

- Develop closer 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.
- Re-direct research effort in the liquid and gaseous fuels program towards providing environmental process technologies which will benefit and gain financial support from industry.
- 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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4 (Managed by Division of Mineral Products)

Energy Storage - MDP11 (Managed by Division of Mineral Products)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

Enhance the marketing and supply of Australian coal through advanced methods based on new analytical and spectroscopic techniques and instrumentation. (13%)

1 Demonstration of rapid method for evaluating coking coal.

2 Initiation of project to develop tests for coal blending.

3 Publication of findings on uptake and retention of water by bituminous coals.

4 Completion of CSIRO/NEDO study on brown coal dewatering.

Generate new and improved preparation technologies and products to enhance the yield and quality of coal recovered in preparation plants. (17%)

5 Establishment of pilot-scale, multi-process pilot plant for R&D on improved dewatering. (EX4)

6 Completion of first stage of projects on new technologies for mixing fine coal and for phosphorous reduction in coking coals. (EX4)

7 Development and evaluation of an innovative method of coal fines agglomeration.

Demonstrate the suitability of Australian coals for new, high efficiency power generation technologies in support of future coal exports. (11%)

8 Extension of coal gasification facility for high pressure performance evaluation. (EX4)

9 Establishment of methods for combustion and gasification modelling and automated testing.

10 Establishment of projects on advanced use of coal in metals production.

11 Completion of current work on control of gaseous (NO_x) and particulate emissions.

12 Commencement of new projects on high temperature, high pressure gas cleaning. (EX4)

Develop coal-related products and technologies to increase the profitability of Australian industry. (7%)

13 Successful operation of apparatus for evaluating thermal stress on carbon materials.

14 Demonstration of hot centrifuge method for refining pitch materials.

15 Demonstration of techniques for generation and alignment of carbon "nanotubes".

Develop improved processes and technologies to ensure the efficient and environmentally sound use of Australia's liquid and gaseous fuels. (16%)

16 Completion of work on co-production of hydrogen during oil shale retorting.

17 Production of a reaction model for the conversion of natural gas to methanol.

Develop improved environmental monitoring techniques for assessing the impact of pollutants on the environment. (24%)

18 Validation of bioassays for testing toxicity in effluents from proposed paper mills. (ED4)

19 Assessment of the fate of copper from mine wastes in receiving water.

20 Automation of a rapid test for identifying presence of faecal coliforms in waters.

21 Quantification of the contribution of open-cut coal mining to atmospheric methane emissions.

22 Measurement and modelling of traffic-generated pollution from major roads and highways.

23 Preparation of the CSIRO Outdoor Smog Chamber photochemical smog data set for inclusion in the USEPA certified smog-modelling data base.

Develop process technologies for managing the impact of pollutants on the environment. (12%)

24 Assembly of portfolio of techniques for cost effective strategies for decommissioning tailings dams at coal mines. (ED7)

25 Design of demonstration-scale unit for soils contaminated with hydrocarbons.

26 Commencement of project for regeneration of transformer oils and destruction of PCB contaminants.

27 Building of bench-scale unit to demonstrate removal of residual chromium in effluent from textile mills.

1993-94 Resources Summary

Direct Appropriation	$12,439,000
External funds	$6,400,000
Total Expenditure	**$18,839,000**
Percent from external sources	34%
Percent from external sources 1992-93	31%
Target for external earnings	35%
Year planned to reach target	1993-94

15. Division of Exploration and Mining (IMEC)

Objective

To improve Australia's international competitiveness in the production of minerals & 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 by (2) developing new technologies for mine design, stability and safety, rock drilling and blasting and ore evaluation so as to increase mine productivity and decrease mining costs.

Strategy

Steadily declining commodity prices for minerals and coal over the last eight years has meant production and export volumes have had to continually increase and costs have had to decrease. The exploration and mining industries are now both lean and highly productive. Increases in exploration success and mine productivity have been achieved by the introduction of technology, and indications are that further productivity gains can be achieved by even more extensive use of advanced technologies.

- Develop concepts and technologies to optimise the identification of prospective areas by the integration of geological and geophysical data.
- Develop concepts and technologies to detect primary or modified mineralised environments and to locate anomalous areas of mineralisation.
- Develop more effective concepts and technologies to establish the location and evaluate economic viability of mineral deposits and to delineate economically mineable reserves.
- Develop technologies and products to design, monitor and predict the stability of coal and metalliferous mine excavations and rock support and reinforcement systems.
- Increase research effort into mining processes, including: rock cutting and drilling, equipment, monitoring and mine communication.
- Develop concepts and technologies to design and monitor environmentally responsible mining strategies, to prevent, rectify or minimise damage to surrounding lands and to restore mine sites to acceptable conditions.
- Increase the transfer of technology to industry through development of strong commercialisation strategies.
- Build strategic alliances with selected mining companies and equipment manufacturers.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Integrated Geological, Geophysical, Mine Design Visualisation - MDP7 (5% of total Division Resources) in collaboration with Division of Information Technology

The Division participates in the following Multi-Divisional Programs:

Iron Ore Processing - MDP8 (Managed by Division of Mineral and Process Engineering)

Land and Water Care - MDP22 (Managed by Division of Soils)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

To develop more effective concepts and technologies that will optimise the exploration industries capabilities to identify prospective ground, and select tenements with high potential for economic mineralisation. (28%)

1 Concepts and technologies upon which effective ground selection and exploration strategies for world-class magmatic nickel deposits can be based.

2 An assessment of Australia's Archaean terrain as a host for world-class volcanogenic base metals deposits.

3 Criteria enabling the prospectivity of cratons for diamond/bearing lamproites and kimberlites, to be assessed.

4 An assessment of the use of selected resistate minerals as geochemical guides to the ore environment (Cu/Au base-metals deposits).

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 through interaction with the Austalian Mineral Exploration Technologies CRC. (30%)

5 Improved methods in exploration for gold, base metals and iron ore deposits in areas of deep weathering or transported overburden.

6 New methods in exploration for concealed world-class base metal and gold deposits beneath the margins of sedimentary basins.

To develop new and extend existing capabilities in geology modelling, computer visualisation and database management (GIS) so as to effectively integrate geological and geophysical systems for the purposes of better defining the geology and orebody geometry. (8%)

7 Software defining geoscientific data structures, object-oriented geological data model and public interfaces. (MI5)

8 Computer program for interactively assembling and modifying 3D models of geology. (MI5)

9 Software to simulate and visualise geological deformation events associated with mineralisation and the formation of orebodies. (MI5)

10 Software systems to capture, store, manipulate, model, visualise a wide format of geoscientific data and use in interactive 3D graphics. (MI5)

11 A 3D fractal interpolation package and application of parallel processing to 3D image generation, rotation, sectioning and rendering. (MI5)

To develop new technologies for detecting and assessing geological boundaries, chemical and mineralogical constituents, mechanical properties and structural changes in rock masses by remote means and in-situ analysis. (8%)

12 Down-hole systems and borehole tools for cross-hole and in-hole tomography.

13 Nuclear borehole logging technology using quasi-zero source intensity for estimation simultaneously of density, major ore constituents and major impurities.

14 Environmentally friendly mine-face analyser, for use in mines for estimation of major ore constituents and/or major impurities.

15 Knowledge of geological factors controlling ore deposition to predict the location of ore, and to assess viability of deposits.

16 Methods to detect properties of host rocks denoting prospectivity, proximity and direction to ore.

In conjunction with the Australian Geodynamics CRC to develop new technologies for imaging the 3D structure of the Earth's crust. (4%)

17 2D Seismic profiles and 3D seismic tomographic images of continental scale sections of the Australian crust.

18 Tectonic and geochronological analyses of major sections of the Australian Crust.

To develop an integrated approach to excavation design and mining engineering for optimum production and long term mine stability and rehabilitation. (9%)

19 An integrated method for the design and operation of Deep Open Pits.

20 Integrated approach to rock reinforcement practice in the Australian mining industry.

21 Technologies for in-situ enhancement of material mechanical properties.

22 Improvement of technical standards of excavation design in the mining industry through the provision and support of computer programs for computational rock mechanics. (MI5)

23 Development of software links between stress analysis codes and mine planning packages including expert systems to facilitate modelling for the excavation design process. (MI5)

24 Methods to predict the strength and fracturing characteristics of coal to better design coal mine pillars and to control run-of-mine fragment size distribution.

25 Designs of mine layout for effective introduction of highwall mining in Australian coal mines.

As part of the CRC for Mining Technology and Equipment, to develop an understanding of rock fracture and the performance of rock cutting devices with the objective of developing new rock breakage and comminution equipment. (9%)

26 Description of the damage zone in rock tool interaction - a critical parameter for all modelling exercises for rock cutting.

27 Control and automation techniques to optimise dragline swing and dump operations in surface coal mines.

28 Realtime monitoring and reporting of mine ground conditions utilising microseismic emissions from within the rock mass.

To design, build and deliver image analysis systems for gathering data on rock fragment sizes and rock structure orientation and location in mining environments. (4%)

29 Development of a laser scanning and image analysis system for mapping joint structures in highwalls of surface coal mines and fragment sizes in muck piles.

30 Commercialisation of SIROSIZE system of fragment size measurement on moving conveyors.

1993-94 Resources Summary

Direct Appropriation	$12,558,000
External funds	$6,762,000
Total Expenditure	**$19,320,000**

Percent from external sources	35%
Percent from external sources 1992-93	42%
Target for external earnings	40%
Year planned to reach target	1994-95

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.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Programs:

Aluminium Production - MDP5 (3% of total Division Resources) in collaboration with Division of Mineral Products & Division of Materials Science and Technology

Iron Ore Processing - MDP8 (11% of total Division Resources) in collaboration with Division of Mathematics and Statistics, Division of Soils & Division of Exploration and Mining

The Division participates in the following Multi-Divisional Programs:

Alumina Production - MDP4 (Managed by Division of Mineral Products)

Heavy Mineral Processing - MDP6 (Managed by Division of Mineral Products)

Magnesium Alloys - MDP9 (Managed by Division of Manufacturing Technology)

Magnesium Production - MDP10 (Managed by Division of Mineral Products)

Specific Objectives & Planned Outcomes

Develop new and improved mineral beneficiation and primary processing methods to add value to Australia's mineral resources. (33%)

1 Completion of a major AMIRA project aimed at optimising the methods and benefits of fine grinding. (MI2)

2 Plant testing of methods for counteracting the adverse effects of metal hydroxides on flotation separations.

3 Enhancement of QEM*SEM to measure oxygen concentrations and introduction of new methods for data visualisation. (MI2)

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

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

5 Demonstration of the technical feasibility of the production of blister copper using Isasmelt technology. (MI3)

6 Completion of construction and commissioning of a high temperature pilot smelting facility at Clayton. (MI3)

7 The G K Williams CRC for Extractive Metallurgy brought up to full strength with 12 staff members and 25 post-graduate students. (MI4)

To improve the productivity of the mineral, energy and process industries by developing and applying new and improved instrumentation and control strategies. (20%)

8 Field assessment of mass flow meter for oil, water and gas mixtures completed.

9 Commencement of commercialisation of gauges for the on-line determination of coal mass flow in power stations and smelters and for determination of hydrogen fluoride in aluminium smelter pot-room atmospheres.

10 Industry trials of instruments for on-line measurement of aluminium, phosphorus, iron and moisture in iron ores completed.

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

11 Operation of the CRC for New Technologies for Power Generation from Low-Rank Coals commenced.

12 An initial version of a computational fluid dynamic code for circulating fluidized bed systems developed and validation by large-scale physical modelling commenced.

16. Division of Mineral and Process Engineering (IMEC)

1993-94 Resources Summary	
Direct Appropriation	$10,378,000
External funds	$5,500,000
Total Expenditure	**$15,878,000**
Percent from external sources	35%
Percent from external sources 1992-93	34%
Target for external earnings	35%
Year planned to reach target	1993-94

17. Division of Mineral Products (IMEC)

Objective

To develop products and processes that will generate added value and new markets for Australia's mineral resources and, in so doing, satisfy the needs of its stakeholders.

Strategy

The Division performs 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 such as those related to the Kunwarara magnesite deposit. 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 genuinely need the outcomes of the Division's research and are committed to their 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.
- Commercialise successful projects through collaborative development arrangements with industry.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Programs:

Alumina Production - MDP4 (27% of total Division Resources) in collaboration with Division of Mineral and Process Engineering, Division of Mathematics and Statistics, Division of Coal and Energy Technology & Division of Building, Construction and Engineering

Heavy Mineral Processing - MDP6 (19% of total Division Resources) in collaboration with Division of Mineral and Process Engineering

Magnesium Production - MDP10 (10% of total Division Resources) in collaboration with Division of Mineral and Process Engineering

Energy Storage - MDP11 (14% of total Division Resources) in collaboration with Division of Coal and Energy Technology

The Division participates in the following Multi-Divisional Program:

Aluminium Production - MDP5 (Managed by Division of Mineral and Process Engineering)

Specific Objectives & Planned Outcomes

Improve the productivity, product quality and product range of Australian alumina refineries. (27%)

1 Laboratory demonstration of new instruments and techniques for optimising feedwell performance in the industrial thickeners used by the contributors to a multi-client funded project.

2 Establishment of an industry-funded project on the fundamentals of precipitation of desilication product in alumina refiners, and testing of methods for lowering the soda content of this material.

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. (19%)

3 Commercial implementation of a novel process for the removal of impurities during synthetic rutile production.

4 Development of an optimised model for the cher reduction of ilmenite by the Becher process.

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

Develop processes, products and product applications that will expand existing, and create new, market opportunities for Kunwarara magnesite. (20%)

6 Development of a commercial magnesia slurry for environmental and industrial waste-treatment applications.

7 Generation of a process for the commercial production of magnesium hydroxide from magnesite for use as a flame retardant.

8 Development of appropriate formulations for self-levelling floorings, adhesives and waste immobilisation using magnesium oxide based cements.

Improve storage batteries to meet society's future needs for cleaner electricity supplies, portable power and road transport. (15%)

9 Establishment of Australian primary lead as an effective material for the extension of valve-regulated batteries to deep-cycling application.

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

11 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. (7%)

12 Identification and evaluation of candidate materials for use as inert anodes in aluminium smelting in collaboration with the Division of Materials Science and Technology.

13 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. (10%)

14 Refinement of physiochemcial parameters important to the efficient operation of the AM process for the production of anhydrous magnesium chloride. (MI1)

15 Determination of the influence of specific impurity species in magnesium chloride on the performance of electrolysis using Alcan Technology and assessment of magnesium chloride feed produced by the AM process. (MI1)

Assess and control the impact of pollutants on fresh and marine water systems. (2%)

16 Demonstration of the commercial viability of novel microelectrode arrays as detectors for environmental monitoring.

1993-94 Resources Summary

Direct Appropriation	$8,695,000
External funds	$4,640,000
Total Expenditure	**$13,335,000**
Percent from external sources	35%
Percent from external sources 1992-93	40%
Target for external earnings	35%
Year planned to reach target	1993-94

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 new Division.
- Continue to make technology available to industry for assessment and use.

Specific Objectives & Planned Outcomes

Generation and improvement of play concepts using geochemical and petrological sciences to determine source rock potential, migration pathways and reservoir charge by 1997.

1 An assessment of a pilot study of organic parameter relationships. (Eval)

2 Completion of testing and commissioning of fluorescence microprobe for coals.

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

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

Development of tools for characterising and interpolating reservoir heterogeneity for use in petroleum reservoir development and management.

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 Completion of the development of the reservoir simulation code SIMED, application of the code to specific problems within Australia, and marketing of the code overseas. (EX1)

8 Determination of the factors associated with attractive permeabilities for coalbed methane and guidance for coalbed methane exploration. (EX1)

9 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.

10 A stress orientation map of the NW offshore quadrant of Australia. (EX1)

11 Completion of agreement to have stress orientation software available through industry service groups. (EX1)

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

13 Extended version of analytical procedure developed to assess stability and analyse risk. (EX1)

Establishment of a commercial well testing service, based on Divisional innovative wireline testing technology, focussed on specific requirements of the emerging coalbed methane industry in Australia, by December 1994.

14 Field proven prototype of two-phase well testing tool. (EX2)

15 Completion of technology transfer to a commercial well testing service. (EX2)

To develop a fundamental understanding of, and verify by field and laboratory investigation, a range of stimulation technologies for use in the oil and gas and coalbed methane industries.

16 An interim report of the understanding of the nature and distribution of secondary mineralisation in coal seams. (EX2)

1993-94 Resources Summary	
Direct Appropriation	$3,800,000
External funds	$3,200,000
Total Expenditure	**$7,000,000**
Percent from external sources	46%
Percent from external sources 1992-93	52%
Target for external earnings	35%
Year planned to reach target	1994-95

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 its people and the wise long-term use of its natural resources for these purposes.

Strategy

The livestock and food and fibre processing sectors generated value-added wealth of almost $14 billion in 1989/90 with a very strong export orientation. In the same year health service expenditures were $26 billion. Together these represented around 10% 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 our 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 mainly appropriation-funded and short-term applied research largely supported by external funds where the benefits are of a private, marketable type.
- Maintain good working relationships with rural research and development corporations, commercial firms and public bodies competitively funding research.
- 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 companies, industry organisations and government Department customers.

Planned Outcomes

1 Completion of marketing strategies for our beef and wool business areas and initiation of strategies for food processing and veterinary products.

2 Development of MDP's involving IAPP Divisions particularly in CSIRO priority research areas.

3 Establishment of the Co-operative Research Centres in Premium Quality Wool, Meat Quality, Vaccine Technologies and Food Industry Innovation.

4 Establishment of the Tropical Beef Centre at Rockhampton in collaboration with the Queensland Department of Primary Industries and the University of Central Queensland.

5 Development of plans for moving some Institute activities (Division of Food Science and Technology's Dairy Research Laboratory, and Division of Animal Health's Werribee and Maribyrnong operations) onto the Werribee Technology Park Precinct in collaboration with Victorian Department of Agriculture.

6 Implementation of plans for relocationg McMaster Laboratory to the Prospect site.

7 Corporate acceptance of plans for rehousing the Food Research Laboratory on the North Ryde site.

8 Establishment of a private company to take over part of the activities of the Meat Research Laboratory.

9 Establishment of an Agri-Food Industry Task Force involving CSIRO, industry and government representatives to co-ordinate CSIRO's research response to the 1992 Agri-Food Industry Policy.

10 Appointment of a Chief to the Division of Food Science and Technology and implementation of new strategic directions in accordance with the accepted recommendations of the 1992 Review.

11 Accommodation of decreased wool funding and particularly the down-sizing of the Division of Wool Technology.

12 Promulgation of an organisation policy on the acceptance of RIRF funding.

13 Development and implementation of standard design for information sheets.

14 Selection of appropriate areas for industry sector reports and production of first set of reports.

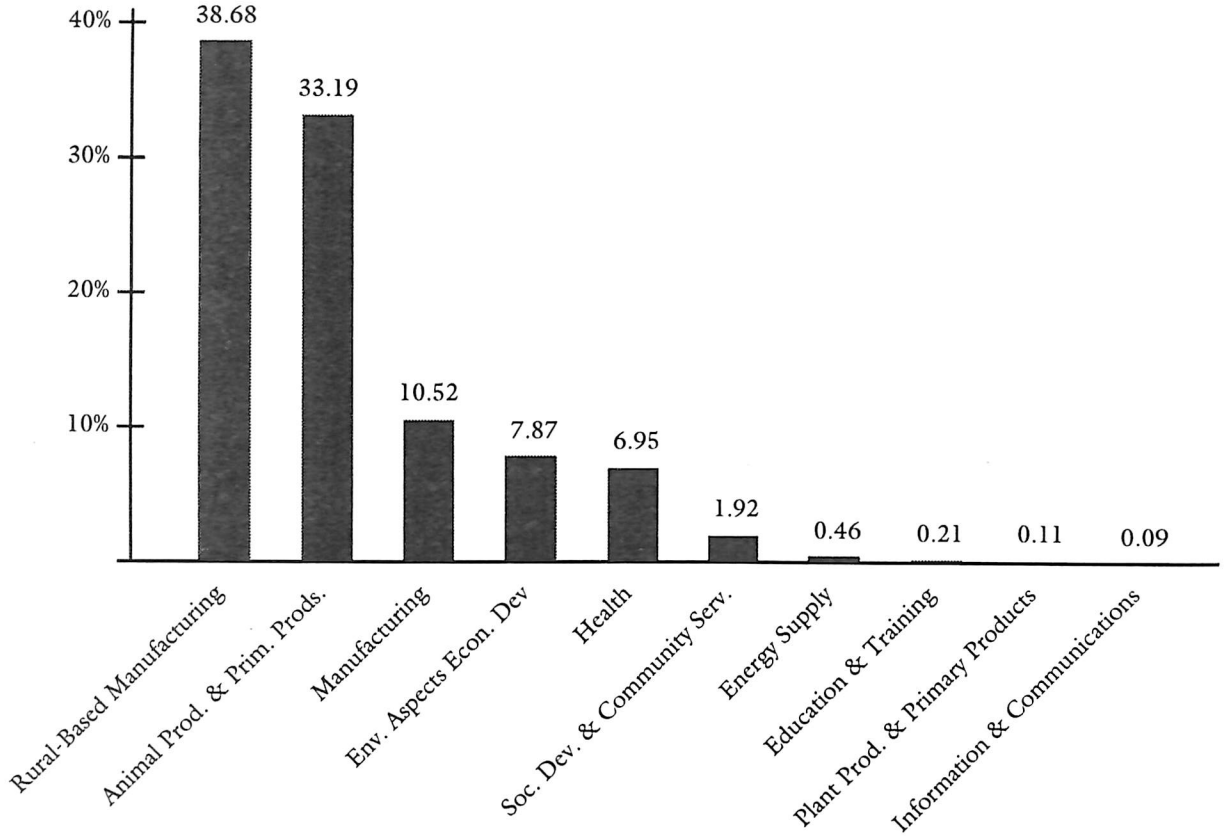
19. Institute of Animal Production and Processing

SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Animal Health	97	113	7	217	8,400	7,754	16,154
Australian Animal Health Laboratory	35	157	1	193	5,770	7,272	13,042
Animal Production	103	161	3	267	12,043	5,667	17,710
Food Science and Technology	127	138	7	272	13,048	10,252	23,300
Human Nutrition	39	68	5	112	5,755	2,518	8,273
Tropical Animal Production	76	70	3	149	7,974	3,928	11,902
Wool Technology	231	180	7	418	11,000	16,440	27,440
Biometrics Unit	7	0	0	7	540	20	560
Institute Headquarters	2	14	5	21	1,815	10	1,825
Institute Specific Funds	0	0	0	0	2,407		2,407
TOTAL	717	901	38	1656	68,752	53,861	122,613

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



20. Division of Animal Health (IAPP)

Objective

To discover and develop methods and products for the diagnosis, control or eradication 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 gross value of production for the beef, poultry and pig meat industries are expected to increase in the medium term whereas that for wool is likely to be static. Concerns about food quality and chemical residues are likely to increase. As a consequence of decreased expected external and appropriation funding there will be some reduction over the next five years in overall research effort and a shift in effort with a reduced proportion in sheep and an increased proportion in beef cattle and food safety.

- 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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Program:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Specific Objectives & Planned Outcomes

Develop new or improved vaccines and diagnostic tests to control or eradicate the economically important bacterial diseases of farm livestock. (9%)

1 Efficacy of a bacterial vector carrying genes for parasite antigens in immunising sheep against infection established. (AP4)

2 Licensing agreement for a footrot diagnostic test and commercialisation of a fleecerot/flystrike vaccine for sheep. (AP4)

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

3 Prototype recombinant vaccine against Barbers Pole worm of sheep finalised. (AP4)

4 Control of pasture populations of sheep nematodes by nematophagous fungi assessed.

5 Commercial agreements for novel anthelmintic formulation for sheep and cattle finalised, and technology for the larval development assay for anthelmintic resistance transferred to commercial partner.

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%)

6 Development of an immunological assay for detecting hepatotoxic pyrrolizidine alkaloids in items of food and herbal medicine.

7 Agreement for commercialisation of lupinosis vaccine finalised.

Develop new and improved vaccines and diagnostic tests to aid in the control of economically important diseases of poultry. (10%)

8 A vaccine against Infectious Bursal Disease of poultry delivered by a viral vector evaluated. (MF5)

9 Effects of cytokines on disease resistance of chickens evaluated. (MF5)

10 Agreement with a commercial partner for research on chicken cytokines finalised. (MF5)

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

11 A bacterial vector for delivery of vaccine antigens evaluated in pigs and cattle. (MF5)

12 Two commercial agreements for developing improved vaccines of pigs and sheep finalised. (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%)

13 Australia's capability to detect exotic disease increased by the development of diagnostic procedures for African horsesickness, maedi-visna, equine influenza, porcine reproductive and respiratory syndrome and African swine fever.

14 Proposals for collaborative research on fish diseases, within the CRC for Aquaculture finalised.

Devise and assess new techniques for the identification and characterisation of pathogens

that cause specified exotic diseases of livestock. (15%)

15 Completion of testing and validation of Newcastle disease virus (NDV) pathotyping system at the NDV World Reference Centre, Central Veterinary Laboratory, UK.

16 Infectivity of rabbit haemorrhagic disease virus in farmed livestock, companion animals and native fauna and wildlife established.

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

17 Antibody response of sheep to antigens delivered by recombinant viruses investigated and the effect of co-expressed cytokines determined, and the ability of recombinant ovine adenoviruses to act as vaccine vectors assessed. (MF5)

18 A new method to express proteins in cells established using vaccinia virus and T7 polymerase. (MF5)

1993-94 Resources Summary

Direct Appropriation	$8,400,000
External funds	$7,754,000
Total Expenditure	**$16,154,000**
Percent from external sources	48%
Percent from external sources 1992-93	50%
Target for external earnings	37%
Year planned to reach target	1995-96

21. Division of Animal Production (IAPP)

Objective

To improve product quality and diversity; ensure sustainability of agriculture systems and increase the efficiency of animal production. To deliver the outcomes to 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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Fibre Utilisation - MDP3 (Managed by Division of Tropical Animal Production)

Land and Water Care - MDP22 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

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

1 In collaboration with Rumentek Industries, a prototype plant for the manufacture of protected protein and protected lipid feed supplements, commissioned at Moree.

2 Evaluation of the productive efficiency for meat and wool of transgenic sheep containing a novel pathway for cysteine biosynthesis.

3 The ability of an idiotype vaccine to provoke anti-idiotype antibodies that bind to the beta adrenergic receptor evaluated in rodents. Assessment of the anti-idiotypes for anabolic potential. (AP5)

4 Transgenic technologies for poultry, characterisation of the chicken embryo cell growth factor (with Dr J Heath, Oxford) and methodology to produce chimeric chickens.

Develop optimum procedures for improving wool quality and sheep production efficiency through superior breeding technologies. (14%)

5 Commencement of on-farm tests of breeding strategies for incorporating parasite resistance into Merino breeding programs. (AP3)

6 Commercialisation of the new Booroola Leicester prime lamb terminal sire breed completed.

7 The relative performance of fine wool Merino genotypes compared in a range of environments to help identify the genetic or/and environmental constraints on reducing the fineness of the national clip. (AP1)

Develop novel approaches to enhancing product quality, production versatility and environmental sustainability of the Merino wool enterprise. (25%)

8 Transfer of the glyoxylate cycle to sheep by genetic engineering to develop improved meat and wool production efficiency.

9 Determination of the potential of genetic engineering to produce sheep genetically resistant to insect parasites, in order to reduce environmental contamination and contain costs.

10 Commencement of commercialisation of a system for the harvesting and within-shed preparation of wool based on the use of epidermal growth factor.

11 Commercialisation of a method for the non-surgical mulesing of sheep.

Sustain the long term viability of animal production from pastures. (33%)

12 Means to manipulate nutrition and control stress in order to prevent the development of tender wool in susceptible sheep.

13 Completion of an assay system that provides an indicator for the biological fertility of soils and hence the sustainability of pasture systems.

14 Improved technology for controlled release devices developed in conjunction with a commercial partner.

15 A package of technologies, using calorimetry and chemistry, that will allow the identification of plant species and their components selected by grazing animals, and the rate and number of mastication and rumination chews, for use in plant breeding and grazing management.

1993-94 Resources Summary

Direct Appropriation	$12,043,000
External funds	$5,667,000
Total Expenditure	**$17,710,000**
Percent from external sources	32%
Percent from external sources 1992-93	34%
Target for external earnings	28%
Year planned to reach target	1992-93

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.
- Improve the safety and wholesomeness of Australian food.
- Transfer up-to-date technology and information to the food industry and consumers.
- Reorganise program structure to improve Divisional efficiency, and improve the alignment of the program with industry needs and CSIRO priorities, and to increase industry funding.
- Seek improved cooperation with other research providers and other CSIRO Divisions to improve research efficiency and increase outcomes.
- Improve workforce planning to allow changes in scope of R & D programs.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Active Packaging - MDP12 (Managed by Division of Materials Science and Technology)

Process and Maintenance Optimisation in Manufacturing - MDP15 (Managed by Division of Mathematics and Statistics)

Specific Objectives & Planned Outcomes

Develop new and improved processes and technologies for the processing, packaging and transport of foods for the Australian industry. (15%)

1 Identification of "indicator" substances for the detection of orange peel extract in orange juice.

2 A fractionation procedure for preparing protein-rich fractions from grain legumes for use in aquaculture foods.

3 Facilities for extrusion and ultra high pressure processing technologies.

4 Packaging materials to extend the high quality shelf life of fruits, vegetables and flowers based on the use of the patented ethylene scavenging technology. (RM2)

5 Packaging materials to release sulphur dioxide to prevent spread of fungi in grapes. (RM2)

6 Dosage rates of dry ice to hold containers of frozen foods under various environmental conditions determined.

By 1997, determine factors responsible for sensory quality foods on domestic and selected export markets and to develop sensors to monitor food processing and to assist in the control of food quality. (15%)

7 Identification of flavours due to Maillard reaction products related to cooking.

8 Continuation of the sensory evaluation service in Japan for the Australian food industry and its extension to other Asian countries. (RM1)

9 Improved membrane based biosensors using ion-channel conductors.

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. (14%)

10 Definition of the behaviour of foodborne pathogens in modified atmosphere packaging systems.

11 Procedures for control of *Listeria* on meat products established and the incidence of *Escherichia coli* 0157:H7 in Australian ruminants and on meat determined.

12 Quantification of the effects of high CO_2 and low O_2 atmospheres on fungal growth.

Develop new microbial cultures and enzyme systems for use in milk processing, to establish the efficacy of using probiotic organisms in foods, and obtain better control of dairy product quality by 1996. (4%)

13 Improved strains of bacteriophage-resistant cheese starter bacteria obtained by genetic manipulation and tested commercially.

14 Optimised laboratory process for production of a prototype functional food from cheese whey.

15 Selection of probiotic organisms active against a major human gut pathogen.

Develop and commercialise technologies for the manufacture and utilisation of novel milk protein products for the benefit of Australian dairy manufacturers, by June 1995. (7%)

16 Commercial pilot-scale operation of thermal whey protein fractionation process.

17 Optimised fat replacer for manufactured meat products based on Gelled Food Products technology.

18 Prospectus of commercial benefits from manufacture and utilisation of micellar casein.

Devise new or improved products or processes for incremental improvement in manufacturing profit margin for Australian cheese and milk powder manufacture. (7%)

19 Cow nutrition strategy for reducing variation in functionality of milk for cheesemaking, and carry out feasibility study of alternative in-factory strategy.

20 Role of milk fat globule membrane on flavour development in low-fat Cheddar cheese.

21 Finalised patent specification for new, polyfunctional milk powders and evaluation of applications.

Improve the ability of Australian meats to consistently attain quality specifications in the domestic and key export markets by 1995. (11%)

22 Meat quality from selected beef cattle assessed to identify genetic markers of quality attributes. (AP2)

23 Optimal procedure for monitoring pigmeat quality available for industry trials to determine the effects of key processing procedures on quality.

24 Recommendations to the industry for hot-boning systems for beef.

25 Report of microbiological status of Australian beef.

26 Evaluation of processing and handling factors in Japan and Korea on the quality of Australian meat.

Devise processes to add value to meat and to improve the utilisation of meat and its key components by Australian industry. (8%)

27 Production of Isolated Muscle Protein (IMP) from mutton and prototype foods therefrom.

28 Prototype packaging system for export by sea of retail-ready portions of beef, lamb and pork.

29 Key structure/function relationships established for collagen of beef muscle and hide corium.

Improve the efficiency of beef processing in the Australian meat industry - by 20% over existing Fututech technology by 1997. (12%)

30 Machines for automation of oesophagus sealing, diaphragm removal, and rectum separation and sealing at proof of concept stage; fully-automated hide opening and removal system 30% complete; clamping and tensioning devices, floor conveyor, rear leg opening device at prototype stage.

31 Commercialisation agreement for developmental prototype rib-deboning machine.

Transfer information and technology to the food industry and consumers. (7%)

32 Continuation of national technology transfer and information service for the meat industry.

33 Provision of information, technical publications, videos and specialist training courses for the dairy, meat and food processing industries and to consumers through leaflets and the media.

1993-94 Resources Summary

Direct Appropriation	$13,048,000
External funds	$10,252,000
Total Expenditure	**$23,300,000**

Percent from external sources	44%
Percent from external sources 1992-93	42%
Target for external earnings	34%
Year planned to reach target	1989-90

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. (20%)

1 Dietary fatty acid and vitamin mix to minimise oxidant induced heart disease. (RM5, HE1)

2 New cholesterol-lowering margarines 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 Antioxidant preparations to prevent UV-induced skin damage. (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 Supermarket Point-of-Sale strategies to achieve national dietary guidelines. (RM5)

6 Strategies to overcome consumer barriers to meat consumption. (RM5)

To develop therapeutic strategies based on nutrients, foods, food ingredients and drugs, to optimize health outcomes. (21%)

7 Cardiovascular health benefits of pure polyunsaturated fatty acids specified. (HE1)

8 Documentation of international trends and opportunities in functional foods. (Eval)

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.

1993-94 Resources Summary

Direct Appropriation	$5,755,000
External funds	$2,518,000
Total Expenditure	**$8,273,000**

Percent from external sources	30%
Percent from external sources 1992-93	33%
Target for external earnings	30%
Year planned to reach target	1991-92

Objective

To increase the profitability of the livestock industries in tropical and subtropical areas of Australia in accordance with the principles of sustainable agriculture.

Strategy

The livestock industries of northern Australia have capacity to supply the expanding markets of Asia. To capture a long term share of these markets, 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.

- Undertake research to:- provide livestock producers with technologies for rapid genetic improvement of livestock to meet the needs of producers, processors, and consumers; develop better control measures for important diseases and parasites; provide technologies which allow the animal to make the best use of the production environment throughout the year; improve the quality and marketability of animal products for Australian and overseas markets.
- Ensure that the appropriate technologies derived from the Division's research are developed into marketable products, all technologies are incorporated into sustainable management systems, and in collaboration with the extension agencies, promoted to the livestock industries.
- Obtain a portfolio of funds necessary to sustain effective and appropriate research and utilise good planning practices to provide a basis for the allocation of resources which optimises the national benefit of the Division's research within the framework provided by CSIRO and the Institute.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Fibre Utilisation - MDP3 (10% of total Division Resources) in collaboration with Division of Tropical Crops and Pastures & Division of Animal Production

The Division participates in the following Multi-Divisional Program:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Specific Objectives & Planned Outcomes

Quantify the distribution and competence of possible vectors of viruses of importance in the cattle and sheep industries. (3%)

1 Collection of *Culicoides* species at the sites identified in Victoria and South Australia in 1992/93, for testing of their vector competence for bluetongue virus.

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. (31%)

2 Characterisation and partial sequencing of tick larval antigen SLCD and adult antigen Bm92 to enable gene isolation. (AP4)

3 Evaluation of Baculovirus expressed 12D3 *B. bovis* antigen for protection in cattle by December 1993. (AP4)

4 Evaluation of the triple antigen *Babesia* vaccine under tick challenge conditions in 120 adult cattle at the Amberley Field Station by April 1994. (AP4)

5 Utilisation of recently developed T-cell assay to flag *A. marginale* antigens showing cell-mediated immunity for the purpose of screening vaccine candidates. (AP4)

6 Fractionation of those antigen extracts from buffalo fly now showing significant anti-fly effects. (AP4)

7 Expression of the genes coding for two *Lucilia cuprina* antigens as recombinant proteins in bacteria. (AP4)

8 One recombinant *Lucilia cuprina* antigen refolded and its anti-blowfly efficacy assessed in a sheep vaccination trial. (AP4)

9 Examination of emerging chemical-resistant cattle tick strains and evaluation of potential alternative acaricides for the chemical and cattle industries.

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. (10%)

10 Experimental evaluation of consequences of selection for growth on carcass and meat quality of export market steers.

11 Estimation of genetic parameters for growth, adaptive, reproductive and carcass traits to permit further refinement of selection technology.

12 Production of an additional 70 purebred Boran and Tuli by embryo transfer and natural mating. Initial comparison of growth of Boran and Tuli crossbreds with that of existing breeds and the production of an additional 300 Boran and Tuli crossbreds for evaluation purposes at Belmont. Commencement at comparative assessment of product quality and reproduction.

24. Division of Tropical Animal Production (IAPP)

Develop molecular genetic techniques for improved livestock breeding. (14%)

13 A bovine genetic linkage map with 90% genome coverage and complete genomic libraries for 5 bovine chromosomes constructed and characterised. (AP2, AP3)

14 An updated database on the international bovine reference panel distributed quarterly. (AP2, AP3)

15 Preliminary results on genetic markers for tenderness, yield and carcass fat traits. (AP2, AP3)

Develop technologies to increase calving rate of female cattle, to suppress fertility of male and female cattle, and to regulate the onset of puberty in male and female cattle. (4%)

16 Continuation of studies aimed at establishing the potential of GnRH analogues for achieving a controlled, reversible suppression of fertility in female cattle; further investigation of the use of GnRH agonists for increasing testis size and fertility in male cattle. (AP5)

Develop artificial breeding and related technologies of cattle to increase the rate of livestock improvement. (3%)

17 Laboratory capacity for culture and manipulation of embryos established.

18 Studies on site specific recombination of DNA in mammalian systems initiated.

19 Feasibility and usefulness of limited clonal propagation of cattle established.

Improve the quality and composition of carcase and efficiency of production through an understanding of physiological processes during growth. (14%)

20 Evaluation of the ability of a β_2-agonist to improve gain or reduce weight loss of steers fed a low quality diet. (AP5)

21 Assessment of the response of cattle to vaccination with a protein-noradrenaline conjugate. (AP5)

22 Assessment of the feasibility of the use of specific peptides base on the β-adrenergic receptor as vaccines for modifying growth in cattle. (AP5)

Understand the effects of environmental inputs (including quality of water) on growth and contribute to their sustainable use. (3%)

23 Determination of the effect of increasing concentrations of coal mine pitwater on the growth rate, health and vital organ function of cattle.

24 Preparation of DNA libraries from bacterial species which degrade blue green algae toxins in contaminated water.

Improve nutrition of northern cattle and sheep by increasing energy and protein digestion through dietary and microbial manipulations. (11%)

25 Cloning and sequencing of two types of esterases involved in ligno-cellulose degradation, and their expression in *E.coli* to assess benefits to ruminal digestion of fibre before incorporation in a rumen bacterium. (AP2)

26 Development of DNA techniques to describe rumen microbial populations and experimentally induced changes in those populations. (AP2)

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. (6%)

27 Development of an epitope map of a protective antigen of *Babesia*. (AP4)

28 Construction of a delivery vehicle for vaccines and therapeutic substances based on rabies virus-like particle technology. (MF5)

29 Demonstration of expression of foreign T-cell epitopes by the VLP delivery vehicle. (MF5)

1993-94 Resources Summary

Direct Appropriation	$7,974,000
External funds	$3,928,000
Total Expenditure	**$11,902,000**

Percent from external sources	33%
Percent from external sources 1992-93	33%
Target for external earnings	30%
Year planned to reach target	1988-89

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 Wool Research and Development Corporation. It is expected that external resources available to the Division's Leather Research Program will remain approximately constant.

- With the WRDC, 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 Novel process developed for providing wool upholstery and apparel fabrics with a high level of stain resistance.

2 Wool bulking technology commercialised.

3 Specification of raw material and processing parameters to ensure next-to-skin comfort of woven and knitted wool apparel.

4 Prototype continuous rapid conditioning machine for wool fabric commissioned.

5 Crease Pressing Performance Tester adopted internationally.

6 Instruments developed for the measurement of fabric and yarn hairiness properties.

Improve the efficiency of conversion of raw wool to end products. (33%)

7 National guidelines for the disposal of scour effluent, developed in collaboration with other appropriate authorities. (ED3)

8 Anti-setting dyeing technology transferred to the international wool textile processing industry.

9 Sirolan LTD low-temperature dyeing method licensed for transfer to the international textile processing industry.

10 Technology transfer package relating combing wool measurements to spinning performance and yarn properties.

11 Comprehensive survey of airborne dust levels in Australian wool processing mills, completed.

Develop new or improved processes for the handling, marketing preservation and conversion of hides and skins into leather products. (9%)

12 A new system for reducing the levels of sulphide discharge in effluent.

13 Technology for deliming unsplit cattle hides developed.

14 New non-chrome tannage process adopted in industry.

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%)

15 Objective measurement of greasy wool style trialled in industry.

16 Major industry seminar on raw wool specification held.

1993-94 Resources Summary

Direct Appropriation	$11,000,000
External funds	$16,440,000
Total Expenditure	**$27,440,000**

Percent from external sources	60%
Percent from external sources 1992-93	59%
Target for external earnings	50%
Year planned to reach target	1995-96

26. Biometrics Unit (IAPP)

Objective

To assist with maintaining and improving the work of scientists in those CSIRO Divisions in IAPP, INRE and IPPP who are located in Armidale, Clayton, Geelong, Hobart, Parkville 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.

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. (AP1, AP4, AP6, RM1, RM2, RM4)

2 Publications and/or consulting reports. (AP1, AP4, AP6, RM1, RM2, RM4)

Improve knowledge of CSIRO scientific staff in the areas of basic statistical methods and the use of statistical computer packages. (10%)

3 Short courses including "basic statistics" and "introduction to Minitab" prepared and given.

4 Selected statistical packages supported.

Maintain the Unit's skills base and research output. (20%)

5 Within Unit training given including attendance at conferences and visits to and from other biometricians.

6 New relevant statistical methods developed and published in statistical journals. (RM1)

1993-94 Resources Summary

Direct Appropriation	$540,000
External funds	$20,000
Total Expenditure	**$560,000**
Percent from external sources	4%
Percent from external sources 1992-93	5%
Target for external earnings	5%
Year planned to reach target	1994-95

27. Institute of Plant Production and Processing

Objective

To enhance sustainability, competitiveness and growth of Australia's field crop, horticultural, foresty and pasture-based industries, and to improve the extent of knowledge of Australia's indigenous plants, insects and soils leading to the development of technology for the better management of its natural resources.

Strategy

The plant based industries face moderate growth prospects despite current cost pressure and low commodity prices. They contribute 12% to Australia's export earnings (1991-92). 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 and sheep meat industries.

- Concentrate efforts on areas judged to give Australian plant-based industries a competitive economic advantage while conserving the country's biodiversity and maintaining or improving its resource base.
- Develop new technologies and products, where appropriate 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 improve understanding of user needs.
- Develop strategic alliances where it will further improve the effectiveness and efficiency of Australia's research and technology transfer activities.
- Secure and manage resources to achieve research and technology transfer objectives.
- Provide an environment in which staff can maintain the highest standards in science and technology and can develop their creativity and a sense of shared purpose for the benefit of Australia.

Planned Outcomes

1 Performance evaluation of Division of Entomology. (Eval)

2 Revised Institute business plan, including evaluation of commercial potential of research projects. (Eval)

3 Revised 5 year plan to take account of CSIRO triennium priorities and priorities across the rural sector.

4 Completion and reporting of 1989 May Statement programs: Land and Water Care, Reducing Dependence on Pesticides, and Gene Shears. (Eval)

5 Management development workshops for Divisional program and project leaders, including project planning and market research.

6 Facilitate the development of Divisional strategic human resources plans encompassing current and following triennium (1994-1997).

7 Implementation of procedures for full program and project costing developed by Institute working party.

8 Shared administrative and research support services at Glen Osmond, SA; Black Mountain, ACT; and North Ryde, NSW.

9 Implementation of decisions based on evaluation of soil biology potential. (Eval)

10 Implementation of decisions based on evaluation of CSIRO role in dryland farming systems. (Eval)

11 Established cohesive CSIRO program, where appropriate across Divisions, at the Laboratory for Rural Research in Western Australia.

12 A broader role for the new Montpellier laboratory as a European research base and as a focus for collaborative research with France to the benefit of Australia.

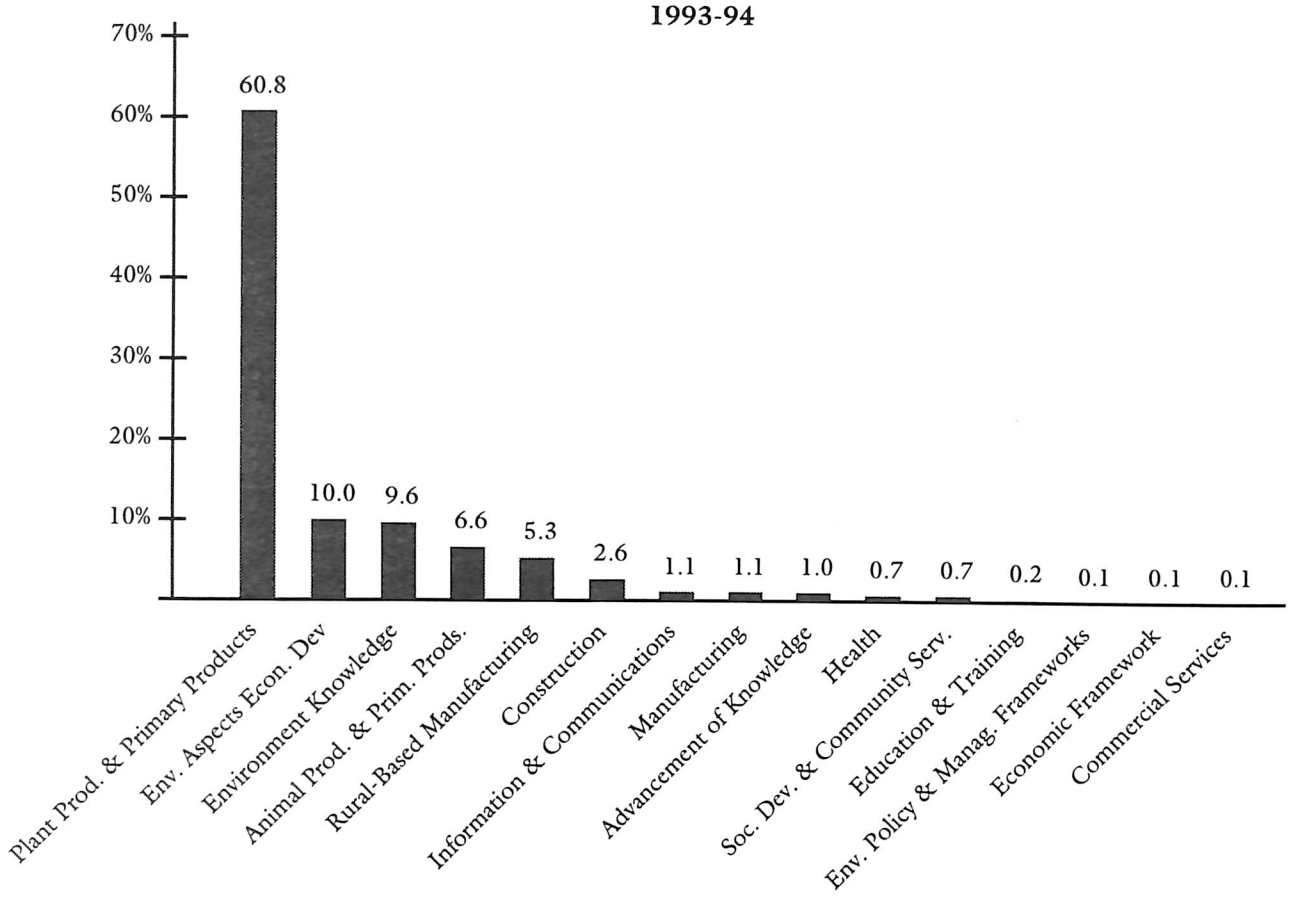
27. Institute of Plant Production and Processing

SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Entomology	212	84	10	306	15,417	9,740	25,157
Forest Products	80	21	8	109	7,592	2,123	9,715
Forestry	116	50	8	174	8,842	3,222	12,064
Horticulture	69	20	3	92	6,600	2,384	8,984
Plant Industry	331	124	12	467	24,263	11,989	36,252
Soils	116	55	6	177	12,030	6,120	18,150
Tropical Crops and Pastures	155	43	11	209	13,952	4,950	18,902
Institute Headquarters	1	5	3	9	850	20	870
Biometrics Unit	3	2	1	6	519	44	563
Institute Other	0	0	0	0	2,014		2,014
Supporting Sites	0	34	0	34	436		436
TOTAL	1083	438	62	1583	92,515	40,592	133,107

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



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 integrated combinations of these systems. In each case it uses its broad experience and expertise to provide soundly based and economically and 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.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Lessening Our Dependence on Chemical Pesticides - MDP2 (13% of total Division Resources) in collaboration with Division of Plant Industry, Division of Horticulture & Division of Biomolecular Engineering

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Conserving Biodiversity for Australia's Future - MDP18 (Managed by Division of Plant Industry)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

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. (14%)

1 Identification of the best strategy for delaying development of resistance in field populations exposed to Bt sprays or genetically engineered cotton plants expressing Bt toxins, determined from an investigation of genetics of Bt resistance in *Helicoverpa armigera.* (PP3)

2 Identification of the best characters to include in selective breeding or genetic engineering programs, determined from continuing studies on strains of cotton showing resistance to the current suite of insect pests. (PP3)

3 Evaluation of suitability of the tachinid fly, *Trichopoda giacomellii*, for introduction into Australia as a biological control agent for green vegetable bug. (PP3)

4 Identification of components of sex pheromones of babana scab moth and *Epiphyas pulla.* (PP3)

5 Purchase and commission of a new mass spectrometer for studies of biologically active molecules.

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. (17%)

6 Results of studies of the effects of earthworms on soil fertility and plant production in pastures in south eastern Australia.

7 The selection and evaluation of eucalypts for increased resistance to insect attack for use in farm plantings and rehabilitation of saline soils.

8 Development of a generic population model capable of incorporating a broad range of life history traits of arthropod pests.

9 Completion of negotiations with potential partners to enter into commercial agreement on a mycoinsecticide for control of 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%)

10 Assessment of transposition efficiency of *hobo* elements in housefly, sheep blowfly and Queensland fruit fly. (PP3)

11 Cloning and modification of a bacterial toxin gene for testing in a recombinant insect virus. (PP3)

12 Completion of transfer to commercial partner of technology for a monoclonal antibody kit to distinguish species of heliothis cotton pests. (PP3)

13 Extension of storage life of the nematode *Heterorhabditis bacteriophora* from 3 to 6 months at 21°C. (PP3)

Develop well-based, efficient pest and commodity management strategies for stored grain and similar products. (18%)

14 Resource and enhance research development of aeration of grain as a residue-free, grain preservation process, with particular emphasis on procedural and design improvements to give insect control levels meeting modern culture requirements. (PP3)

15 Development and commercialisation of Siroflo technology and, in particular, further investigation of surface treatments such as Dryacide to improve its use in horizontal stores and seek overseas licensees for the technique on a country-by-country or regional basis. (PP3)

16 Reassessment of the feasibility of non-chemical control of stored product pests in storage and processing premises (eg. mills) using biological control agents and provision of external collaboration and funding for this assessment. (PP3, Eval)

17 As part of a three year program to extend insect control techniques developed for large storages to on-farm storage, develop a mathematical understanding of aeration that can be used to optimise application to small stores, and continue investigation of application of alternative fumigants. (PP3)

18 Commercialisation and assessment of the potential of a newly patented fumigant developed by the Division. (PP3, Eval)

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. (12%)

19 Establishment of a new research unit in soil organism biodiversity under the National Research Priority program.

20 Development of a DELTA/INTKEY database of the beetle families of the world to be published on CD-ROM.

21 Completion of a presentation book on *Australia's Insects: a world of diversity* to be published on CD-ROM.

22 Completion and publication of the first of three volumes on genera of Australian Mallee Moths (Oecopherinae). First volume on the *Wingia* group will treat 92 genera.

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%)

23 Subject to approval, release and establishment the crown weevil, *Trichosirocalus horridus* and the stem-boring weevil, *Lixus cardui*, for the control of their respective hosts, *Carduus nutans* and *Onopordum* spp. thistles which are major weeds of agricultural importance.

24 Subject to approval, release and establishment the pathogen, *Phloeospora mimosa-pigrae*, and the leaf/flower feeding weevil, *Apion pigrae*, for the control of *Mimosa pigra*, a weed important in conservation areas of northern Australia.

25 Pursuit of collaborative projects in West Africa and South-East Asia to establish programs for the biological control of water hyacinth.

1993-94 Resources Summary

Direct Appropriation	$15,417,000
External funds	$9,740,000
Total Expenditure	**$25,157,000**

Percent from external sources	39%
Percent from external sources 1992-93	36%
Target for external earnings	39%
Year planned to reach target	1993-94

29. Division of Forest Products (IPPP)

Objective

To benefit Australia by improving the performance of the forest products industry.

Strategy

The Forest Products industry has a turnover in excess of $9 billion per annum. There is a large trade deficit in forest products ($1.4 billion per annum) and the Division has a key role in removing the impediments to converting this deficit to a surplus. Key features of our operational environment and our strategies in response are:

- The National Forest Policy, produced in 1992, is generally encouraging to industrial development operating within strict but achievable guidelines about sustainability.
- Large volumes of plantation-grown radiata pine will become available in the next two decades, there is increasing effort in establishing eucalypt plantations, and regrowth eucalypts are replacing old growth native forest.
- The environmental effects of some forest products and processes are under question (eg pulp bleached with chlorine, organo-chlorine termiticides, chromium based wood preservatives).
- The National Forest Policy announced the establishment of a Research and Development Corporation which is expected to begin operation in calendar year 1994.
- Some existing large funding contracts expire in 1993/94 and we have confidence that this will be offset by new collaborative arrangements.
- The Division has established an integrated research program with a national perspective.
- We work closely with forest-based industries, forest growers, and the Division of Forestry.
- Research is focussed on developing
  - increased profitability through efficient use of the changing forest resource,
  - technologies for new products and processes, and
  - more environmentally acceptable products, processes and practices.

Specific Objectives & Planned Outcomes

To improve the choice of plantation stock by linking the selection of genotype and silviculture to paper pulp quality. (10%)

1 A rapid, small sample method for assessing wood cell quality in radiata pine, and an instrument for analysing eucalypt fibres. (PP6)

2 Vibrational spectroscopic technique for assessing pulpwood quality.

To reduce the environmental impact of bleached kraft pulping. (9%)

3 Effluent analysis, extended delignification, and bleaching studies commissioned by the Federal Government's National Pulp Mill Research Program. (ED4)

To improve efficiencies in the production of high-yield mechanical pulp. (10%)

4 Define energy consumption of thermo-mechanical pulp rejoining of *P.radiata* early wood and late wood.

To improve the performance of wood in service, particularly to protect wood from insects, decay, and the weather. (27%)

5 Preservatives that impart durability and appearance qualities to local plantation timber so that it can compete with imported timber. (RM6)

6 Expert assessments of potential biocides to assist the industry in developing environmentally acceptable wood preservatives.

7 Ground-line maintenance preservative for controlling decay and termites in poles in service.

To develop new composites and chemical products mainly from wood based materials. (27%)

8 Waste utilisation for new products for the building, horticultural and animal health industries.

9 New environmentally acceptable resins suitable for gluing reconstituted wood products over a wide range of conditions.

To assist the development of the solid wood industry in Australia. (17%)

10 Assessments of eucalypt plantation wood from Tasmania, eastern Victoria and the Murray Darling region, and radiata pine clearwood from Tasmania. (ED6)

11 Drying control electronics for more efficient softwood seasoning.

12 A software based dryer control system for veneers.

1993-94 Resources Summary	
Direct Appropriation	$7,592,000
External funds	$2,123,000
Total Expenditure	**$9,715,000**
Percent from external sources	22%
Percent from external sources 1992-93	17%
Target for external earnings	30%
Year planned to reach target	1997-98

30. Division of Forestry (IPPP)

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 and for the amelioration of land degradation.
- 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.
- Implement outcomes of the Strategic Planning workshop and Human Resources Planning study to improve Divisional performance.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Conserving Biodiversity for Australia's Future - MDP18 (Managed by Division of Plant Industry)

Land and Water Care - MDP22 (Managed by Division of Soils)

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 An assessment of the potential of *Eucalyptus pellita* as a plantation species for warm, moist tropical environments.

2 Final draft of a book "Design and Analysis of Field Trials in Forestry". (Perf)

3 Extension publication summarising tree species/provenance selection for salinity control in SE Australia. (ED6)

4 Generic tree growth model, including nutrient cycling validated for both a pine and a eucalypt trial site.

Determine options for the management of native forests on an ecologically sustainable basis for wood production. (17%)

5 Report to State stakeholder, and 5 journal publications on outcomes of collaborative research program in East Gippsland native forests. (Perf)

6 "National Bushfire Model" as a completed PC-based on line fire suppression decision support system and training package promoted and made available to Country Fire Authorities and other users. (EN3)

7 Silvicultural recommendations to State and private forest owners in Tasmania for successful and profitable management of uneven-aged stands of alpine ash.

8 Prototype, computer-based system for improved harvesting planning, developed in collaboration with a State forest management agency. (Perf)

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. (27%)

9 Complete high density linkage maps of *Pinus radiata* and *Eucalyptus nitens.*

10 A publication, in collaboration with Southern Tree Breeding Association, Mount Gambier and University of Florida, USA, describing advanced breeding strategy options for pines.

11 Validation of the application of hybrid models for estimating site potentials using a range of data from NSW and ACT.

12 A description of improved methods for the management of residues and fertilisers to increase log size in thinned stands.

13 Assessments of the long-term genetic variations in growth response to nutrition between radiata pine families and the effects of genetics and nutrition on wood quality. (PP6, Perf)

14 A preliminary "User's manual" outlining the "best practices" for establishing and managing effluent irrigated plantations of commercial species. (ED3, Perf)

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%)

15 A genetic linkage map for *Eucalyptus nitens* incorporating RFLP and RAPD markers sufficiently complete for detection of quantitatively linked loci.

16 Initial empirical model simulating the mineralisation of organically bound soil nitrogen.

17 Guidelines for the successful siting and management of *E.nitens* seed orchards for optimum flowering and seed production. (Perf)

18 Specific RAPD/PCR methods for studying the population genetics and biodiversity of selected ectomycorrhizal fungi in native forests.

1993-94 Resources Summary

Direct Appropriation	$8,842,000
External funds	$3,222,000
Total Expenditure	**$12,064,000**
Percent from external sources	27%
Percent from external sources 1992-93	28%
Target for external earnings	30%
Year planned to reach target	1994-95

31. Division of Horticulture (IPPP)

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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Lessening Our Dependence on Chemical Pesticides - MDP2 (Managed by Division of Entomology)

Active Packaging - MDP12 (Managed by Division of Materials Science and Technology)

Land and Water Care - MDP22 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

Develop superior new varieties of horticultural crops to enhance productivity and quality. (54%)

1 PVR application for muscat flavoured seedless drying grape.

2 Prime licensee for the domestic distribution of Sunset mandarin.

3 Breeding strategy for development of open-pollinated melon varieties.

4 High yielding cashew trees from 1988 hybrid population selected for replicated progeny testing.

5 Lines of transgenic plants selected for testing for resistance to tomato leaf curl virus.

6 Agreement(s) for use of DNA typing technology.

7 Genes for controlling polyphenol oxidase (browning) activity in potato tubers.

8 Maize alcohol dehydrogenase promoters assessed for use in ripening tomatoes.

9 A molecular probe for the "melting flesh" character in peaches.

Develop better crop management systems to enhance productivity and quality. (28%)

10 Procedure for CO_2 fumigation of bulk bin stacks of unprocessed dried fruit.

11 Carbohydrate levels and their distribution in grapevines related to yield and grapejuice quality.

12 DNA probe to identify gene flow patterns in macadamia plantings.

13 Some root-derived signals evaluated that may control grapevine vigour.

Develop improved postharvest storage strategies based on an identification of factors controlling ripening, senescence, disease and disorders. (18%)

14 Commercial production of a fruit carton incorporating condensation control technology. (RM2)

15 Inbred parental lines of broccoli selected for short or long postharvest life and assessed with molecular markers.

16 Heat disinfestation schedules established for two apple cultivars and table grapes on basis of heat transfer evaluation and post-treatment storage assessments.

17 Stem end rot in mangoes shown to result from endophyte infection.

1993-94 Resources Summary

Direct Appropriation	$6,600,000
External funds	$2,384,000
Total Expenditure	**$8,984,000**

Percent from external sources	27%
Percent from external sources 1992-93	22%
Target for external earnings	25%
Year planned to reach target	1993-94

Objective

To carry out modern biological research for the benefit of Australian agriculture, native vegetation management, and food processing industries.

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. There is increasing emphasis on the interdependence of rural and natural ecosystem functions in total landscape management.

- Conduct research in a broad range of basic and applied plant sciences.
- Use postdoctoral fellowship and visiting scientist programs to enhance the skills base.
- Develop the next generation of plant scientists, especially those skilled in modern biological research incorporating molecular biology techniques.
- Partner Universities and Industry in Cooperative Research Centres.
- Establish joint ventures and collaborations to transfer results for industry and community benefit.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Programs:

Gene Shears - MDP1 (2.5% of total Division Resources) in collaboration with Division of Biomolecular Engineering, Division of Tropical Crops and Pastures, Division of Entomology, Division of Food Science and Technology, Division of Tropical Animal Production, Division of Horticulture, Division of Animal Health & Division of Animal Production

Conserving Biodiversity for Australia's Future - MDP18 (1.2% of total Division Resources) in collaboration with Division of Wildlife and Ecology, Division of Entomology, Division of Soils, Division of Forestry & Other Participants

The Division participates in the following Multi-Divisional Programs:

Lessening Our Dependence on Chemical Pesticides - MDP2 (Managed by Division of Entomology)

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Land and Water Care - MDP22 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

To diversify the range of crops and to improve the performance of rainfed crops and pastures in southern Australia. (17%)

1 Quantification of drainage losses during the cropping season at East Beverley. (ED6)

2 Quantification of the contribution of plant species to pastures based on subterranean clover and medic.

3 Determination of the rates of gross mineralisation of nitrogen in relation to soil type and cropping history. (ED6)

4 New genes for fast early growth and low carbon isotype discrimination backcrossed into commercial wheat cultivars.

5 Isolation of flax oleic and linoleic desaturase genes and production of flax, mustard and cotton plants transformed with desaturase genes and ribozyme/antisense constructs targeted against them.

To provide Australian rural industries with new pasture plants and guidelines for integrated crop and pasture management systems that will enhance soil fertility, thereby ensuring profitable and sustainable agriculture. (21%)

6 Establishment of the Coffin Rock Field research facility, Junee, as a joint project between the Division of Plant Industry, Charles Sturt University and Departments of Agriculture NSW and Victoria. (ED6)

7 Commercial release for research use of intra-ruminal alkane release devices for herbage intake and selection studies.

8 Wide dissemination of information on the practical aspects of using a urease inhibitor system for increased efficiency of use of urea fertiliser for flooded rice. Increased grain yields of up to 20% can be expected.

9 Release for commercial testing of a decision support system (DSS), GrassGro, for assessing long-term benefits and risks associated with adopting alternative grazing management strategies.

10 AUSFARM demonstration established at Ginninderra Experiment Station. (Eval)

To develop economically viable and ecologically sustainable systems of cotton production for Australia. (9%)

11 Improved access to pest management decision making by improving the entomoLOGIC package with incorporation of mite sampling and thresholds and development of chemical recommendation procedures. (PP3)

12 Field trials of transgenic cottons transformed with the Cry IA endotoxin genes from *Bacillus thuringiensis*, to evaluate agronomic performance and pest resistance characteristics, and to develop sustainable management strategies for their deployment by the cotton industry. (PP3)

13 Definition of the interaction of IPM with management of mite populations by investigating the mechanisms by which thiodicarb causes mite outbreaks. (PP3)

14 A robust cotton crop model for evaluating sustainable cotton production practices by completing the tuning of the carbon, nitrogen and water stress functions in the latest version of OZCOT. (ED6)

To provide a basis for biological conservation, management and use of the Australian flora and vegetation. (10%)

15 Completion of Condobolin field trial and analysis of comparative production of cineole and biomass in *Eucalyptus kochii* and *E.polybractea.*

16 Completion of specificity testing and field release of two isolates of the rust fungus *Puccinia carduipycnocephali* for the biological control of slender thistles, a prominent weed of southern Australian pastures. (ED6)

17 Submission of taxonomic revision of Australian grass genus *Eragrostis* (70 species) for publication; completion of *Flora of Australia* treatment of *Eragrostis* in DELTA format.

18 Analysis of genetic diversity in *Eucalyptus albens* (white box) in relation to range-wide variation and effects of population fragmentation - data analysis and preparation for publication. (EN4)

To create novel germplasm for increasing the market value of grain products. (8%)

19 Establish the success of wheat transformation experiments that employed DNA vectors conferring drug resistance.

20 Characterisation of the DNA marker tightly linked to CCN^R gene from *Triticum tauschii.*

21 Construction of bacterial isoamylase gene vectors suitable for transformation into wheat.

22 Introduction of glutenin protein synthesised in bacteria into dough mixing experiments.

23 Completed the construction and testing of dough extension tester.

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 Preparation and testing of amylase promoter constructs for use in barley transformation.

25 The male sterile 1 gene of *Arabidopsis* cloned and characterised for use in the production of male sterility.

26 Examination of the effect on DNA methylation of expressing the antisense of a methyl transferase gene in *Arabidopsis.*

27 Demonstration of the cleavage activity of ribozymes in plants.

28 Clone a gene responsible for a late flowering phenotype in *Arabidopsis.*

To investigate the molecular basis of resistance to fungal and viral pathogens, to investigate the biochemical basis of photosynthesis and its response to environmental factors, and to use these and other findings to identify genes for potentially useful traits (improved plant protection and nutritive value) and introduce them into crop and pasture plants using gene transfer technology. (21%)

29 Identification of protective strategies of sun and shade plants and chlorophyll b-deficient mutants with respect to damage to photosystem II under high light.

30 Determination of the extent to which loss of Co_2 from bundle sheath cells of C_4 leaves changes with varying light and temperature and in different sub-groups of C_4 species.

31 Synthetic resistance genes tested against subterranean clover stunt virus.

32 A genetic linkage map of flax rust using molecular markers and virulence genes.

33 Assessment of the effectiveness of an α-amylase inhibitor gene against stored grain pests of pea in transgenic plants.

1993-94 Resources Summary

Direct Appropriation	$24,263,000
External funds	$11,989,000
Total Expenditure	**$36,252,000**

Percent from external sources	33%
Percent from external sources 1992-93	30%
Target for external earnings	30%
Year planned to reach target	1991-92

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 increased demand for soil information and management strategies for both environmental and rural production purposes, the Division will:

- Contribute to the development of profitable and sustainable systems of soil and land management for specific industries, which also meet environmental concerns.
- Expand the information base of soils and soil based materials in the rural, mining, environmental and manufacturing sectors.
- Expand and promote soil science knowledge and capability through research, education, training and application to client needs.
- Identify soil issues of national and global importance and contribute to informed discussions and policy development.
- Engage in collaborative research with other research agencies.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Programs:

Land and Water Care - MDP22 (1.6% of total Division Resources) in collaboration with Division of Wildlife and Ecology, Division of Water Resources, Division of Tropical Crops and Pastures, Division of Plant Industry, Centre for Environmental Mechanics, Division of Horticulture, Division of Animal Production, Division of Forestry & Division of Exploration and Mining

Minesite Rehabilitation - MDP24 (5.4% of total Division Resources) in collaboration with Division of Exploration and Mining, Division of Water Resources, Division of Wildlife and Ecology, Division of Coal and Energy Technology, Division of Tropical Crops and Pastures & Division of Entomology

The Division participates in the following Multi-Divisional Programs:

Iron Ore Processing - MDP8 (Managed by Division of Mineral and Process Engineering)

Conserving Biodiversity for Australia's Future - MDP18 (Managed by Division of Plant Industry)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

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. (34%)

1 Assessment of the effectiveness of selected organisms in the control of Rhizoctonia and Pythium "damping-off" of nursery plants. (ED6)

2 Establishment of the effects of earthworms on soil properties and wheat yield. (ED6)

3 Publication and promotion of a model for predicting losses due to take-all in wheat grown in southern Australia. (ED6)

4 Investigation of the effects of land-use practices on the biodiversity of soil organisms and identification of microbial and/or biochemical indicators of soil degradation in semi-arid tropical woodland under grazing. (ED6)

5 Development of tillage methods for legume/lowland rice rotations in Indonesia and the Philippines.

6 Enhancement of methods to ameliorate the major soil physical constraints to cereal production by licensing of computer software and instrumentation technology. (ED6)

7 Promotion of guidelines for organic matter and nitrogen management in dryland crops and pastures.

8 Publication of a model to predict grain yield and protein levels of wheat and barley in South Australia.

9 Establishment of a joint venture to identify the causes of yield decline of sugarcane.

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. (35%)

10 Development of geomorphic and biological methods for improved environmental management and rehabilitation of minesites. (ED7)

11 Publication of a manual for the design and management of woodlots irrigated with sewage effluent. (ED6)

12 Prediction of risks of nutrient leaching for major land use/soil types in the Herbert River catchment in North Queensland. (ED6)

13 Publication of techniques for predicting cadmium concentrations in wheat grain and identification of the effects of soil management strategies on cadmium uptake by potatoes. (ED6)

33. Division of Soils (IPPP)

14 Recommendations for better soil management to improve water quality in the Warren reservoir, S.A. (ED6)

15 Determination of the relationship between lead in soil and grapes to identify sources of lead contamination in wine.

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. (31%)

16 Maps of salinity risk at 1:2.5m and land degradation at 1:250,000 in the Dalrymple Shire, Qld. (ED6)

17 Publication of the 3rd approximation of a New Australian Soil Classification. (ED6)

18 Development of methods which integrate topographic relief and remotely sensed data to improve prediction of spatial distribution of soil properties. (ED6)

19 Evaluation of the use of vegetated filter strips for reducing entry of soil sediment and nutrients to rivers. (ED6)

20 Publication of standards of analysis using x-ray fluorescence for ilmenite and zircon.

21 Development of improved Nuclear Magnetic Resonance techniques to identify the levels and quality of soil organic matter in a range of soils. (ED6)

To provide strategic planning, resource management and communication for the Division and its clients.

22 Implementation of a revised management structure which includes an Office of the Chief to support the management and planning of the Division.

23 A revised Strategic Plan which reflects both Divisional and client research priorities.

24 Integration of Business and Communication plans as components of research projects.

25 Establishment of a CSIRO Administrative Support Unit for the Urrbrae site.

26 Investigation of methods of costing and charging research projects for analytical and support services.

1993-94 Resources Summary

Direct Appropriation	$12,030,000
External funds	$6,120,000
Total Expenditure	**$18,150,000**
Percent from external sources	34%
Percent from external sources 1992-93	29%
Target for external earnings	30%
Year planned to reach target	1993-94

34. Division of Tropical Crops and Pastures (IPPP)

Objective

To benefit the nation through research for the livestock and crop industries of northern Australia.

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 and contribute significantly to international trade. Downstream effects of current production systems on the natural resources and upon long-term sustainable production are growing concerns of the community and industry. There is a large and growing measure of collaboration between the Division and other organisations, where complementary skills can be combined. The Division's strategies are to:

- Develop strong linkages with influential members of the grain, beef and sugar industries to facilitate problem definition, technology transfer and funding.
- Assemble multi-disciplinary project teams to address industry and strategic research problems, including alliances with other CSIRO Divisions, State and Territory Departments and Universities.
- Establish an appropriate mix of skills and portfolio of funds and commercial enterprises to support effective and appropriate research.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Gene Shears - MDP1 (Managed by Division of Plant Industry)

Fibre Utilisation - MDP3 (Managed by Division of Tropical Animal Production)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

Land and Water Care - MDP22 (Managed by Division of Soils)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

Produce improved pasture plants. (29%)

1 Biochemical methods (electrophoretic karyotyping, DNA markers) for studying the population dynamics of the anthracnose fungal pathogen, *Colletotrichum gloeosporioides.*

2 Determination of the biological nitrogen fixation capacity of the shrub legume *Calliandra calothyrsus* using N^{15} enrichment and natural abundance procedures.

3 Evaluation of the climatic adaptation and agronomic characteristics of *Bothriochloa pertusa* in the semi-arid tropics.

4 A new buffel grass with improved spring productivity and a commercial agreement for its promotion and distribution.

Provide profitable, sustainable pasture management systems for beef producers. (20%)

5 Determination of the impact of grazing behaviour of cattle on sustainable use of natural and improved speargrass pastures in a subtropical landscape system.

6 Assessment of the production impact of *Bothriochloa pertusa* invasion into native tropical pastures.

7 A software package developed in conjunction with graziers, Government agents and scientists, to provide information for managers of complex pasture systems in the tropics.

Enhance beef production by improving the efficiency of use of ingested forages. (6%)

8 Propagation of *Butyrvibrio fibrisolvens* in laboratory media and examination of its growth and survival after inoculation into a simulated rumen environment.

Produce improved crop plants. (21%)

9 Incorporation of the long-juvenile trait into lodging resistant, semi-dwarf soybean genotypes preparatory to field evaluation in the subtropics.

10 Identification of a target gene from sugarcane for one of the key enzymes of the sucrose synthesis pathway. (PP1)

11 Commercial seed of cowpea cv. Big Buff produced and made available to farmers.

12 Isolation of a gene for a phosphate and sulphate transporter from plant roots.

Develop profitable and sustainable sub-tropical crop management systems. (17%)

13 Validation of soil nitrogen simulation on black soils, using QDPI experimental data, as part of the development of a model to consider the impact of legumes in cereal rotations.

14 The CENTURY model configured for sugar cane and used to explore the impact of crop residue and nitrogen fertiliser management on long term changes in soil organic matter and nitrogen supply to crops.

34. Division of Tropical Crops and Pastures (IPPP)

Minimise the impact of agricultural land use practices on the biodiversity and stability of (eco)systems. (7%)

15 The effect of land condition upon the relationship between stocking rate and animal production determined for tropical woodland pastures. (ED6)

16 An assessment of the needs of potential clients for coastal zone management technology.

Promote the development and adoption of useful products from the Division's research.

17 An analytical tool to support investment decisions in peanut production developed to assist the Peanut Marketing Board (with the QDPI and QUT).

18 Determination of the conditions for scaling-up production of the xylanase clone in commercial fermenters.

Manage staff to meet the Division's needs and to enhance performance of individuals in achieving the Division's goals.

19 A DTCP Human Resources Management Plan which addresses the issues of workforce planning, training and development, organisational development, workforce environment, administration and managing performance.

Develop and maintain a corporate structure and ethos to facilitate effective research, and to establish a clear DTCP role in the overall Australian research effort.

20 Institute formal annual project assessment and operational planning procedures, concentrating in 1993/94 on communication and technology transfer activities.

1993-94 Resources Summary

Direct Appropriation	$13,952,000
External funds	$4,950,000
Total Expenditure	**$18,902,000**
Percent from external sources	26%
Percent from external sources 1992-93	22%
Target for external earnings	27%
Year planned to reach target	1994-95

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.

Specific Objectives & Planned Outcomes

Develop a collaborative research contribution to at least 6 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 6 publications in the biological literature, in which the Biometrician acts as senior author, demonstrating the impact of collaborative research.

2 At least 4 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.

1993-94 Resources Summary

Direct Appropriation	$519,000
External funds	$44,000
Total Expenditure	**$563,000**
Percent from external sources	8%
Percent from external sources 1992-93	5%
Target for external earnings	20%
Year planned to reach target	1995-96

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 including the INRE and CSIRO Agricultural and Divisional Advisory Committees to target the research and to help ensure its uptake.
- Apply the CSIRO methodology to assist in setting research priorities.
- Assess and evaluate rigorously the benefits of current and proposed research.
- Continue to shift the balance in research effort on rural production to an enhanced effort on the ecologically sustainable aspects for rural production.
- Increase our research effort in urban environmental issues particularly in relation to urban air quality and urban water and wastewater infrastructure.
- Consolidate research in relation to tourism, consulting with industry.
- Continue to develop and effectively manage major multi-Divisional programs intended to provide holistic solutions to large complex issues - climate change, coastal zone management, waste emissions, conservation of biodiversity, algal blooms, mariculture.
- 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 its results and in communicating its significance.
- Market its skills and promote its worth to national and international governments and organisations.
- Ensure the effective operation of the Institute and Divisional Advisory Committees.

Planned Outcomes

1 Institute Strategic Plan 1993-96 completed and promulgated.

2 Cost-benefit analyses selected and developed.

3 Funding ensured for key research areas including climate change, water quality, biodiversity, aquaculture.

4 Communication components integrated into research planning and budgeting processes.

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 Collaboration with State agencies and local government strengthened.

7 Major outcomes of National Pulp Mills Research Program announced and a review of the Commonwealth Guidelines for new bleached eucalypt kraft mills under way.

8 Strategic plan for INRE Project Office completed and implementation under way, with increased emphasis on international activities.

9 Efficient electronic communication links established throughout the Institute.

10 Effective communication/marketing plans in place for multi-Divisional programs in which INRE is the lead Institute.

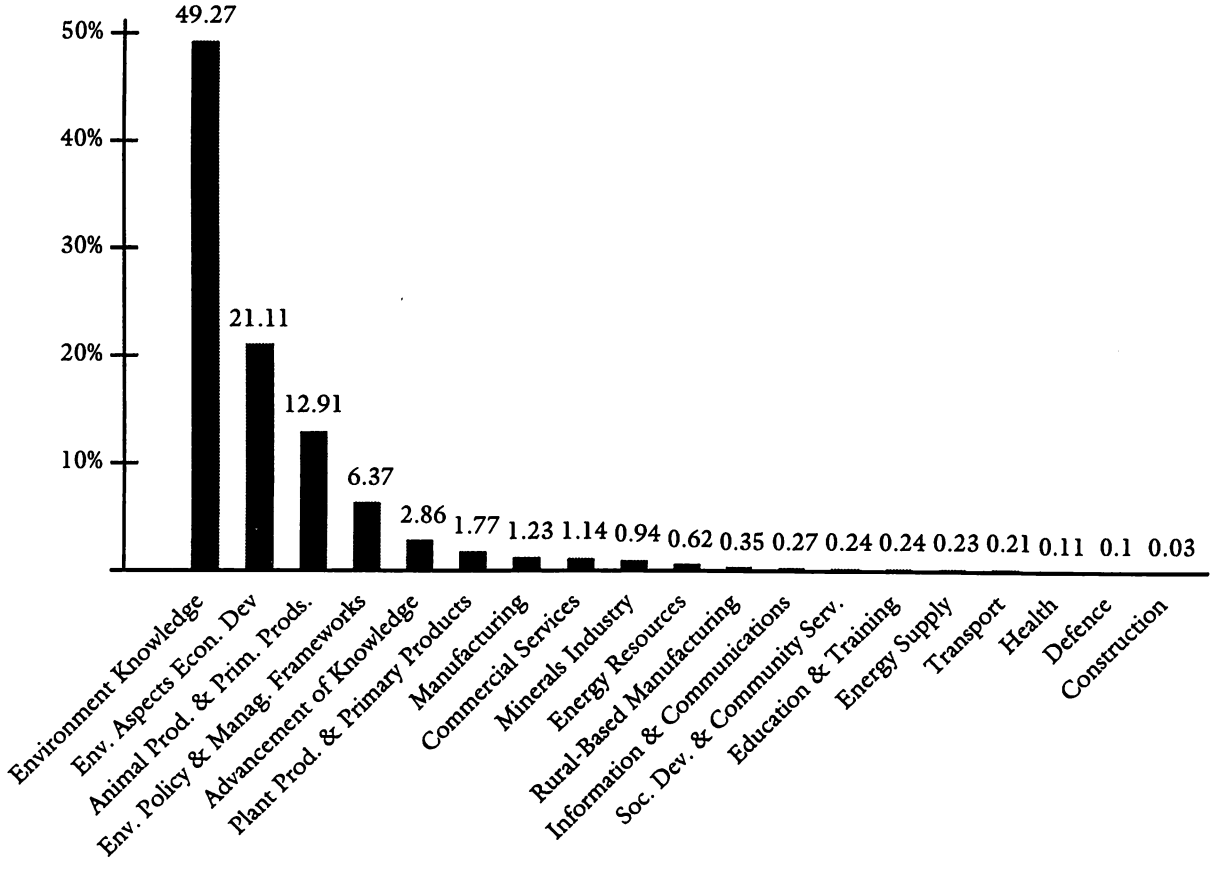
11 High public profile maintained for CSIRO environment research, through involvement in such events as World Environment Week, major travelling exhibitions, increased penetration of mass and specialist media.

SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Division	Staff by Functional Classification (EFT units)				Expenditure Estimates ($'000)		
	Research Staff	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Atmospheric Research	106	34	5	145	8,381	3,391	11,772
Fisheries	117	59	7	183	12,500	8,700	21,200
Oceanography	53	40	6	99	7,074	2,300	9,374
RV *Franklin* (A National Facility)	5	4	0	9	4,348	10	4,358
Water Resources	181	89	10	280	15,406	5,817	21,223
Wildlife and Ecology	189	56	3	248	15,033	8,244	23,277
Environmental Mechanics	22	16	1	39	2,549	688	3,237
CSIRO Office of Space Science and Applications	5	5	1	11	2,950	1,100	4,050
INRE Projects Office	0	6	3	9	95	536	631
Biometrics Unit	8	0	0	8	487	50	537
Institute specific funds	0	22	0	22	3,534		3,534
INRE Institute Headquarters	0	6	3	9	660	70	730
TOTAL	686	337	39	1062	73,017	30,906	103,923

PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1993-94



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.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Climate Change - MDP17 (40% of total Division Resources) in collaboration with Division of Oceanography, Division of Fisheries, RV ***Franklin*** (A National Facility), Centre for Environmental Mechanics, Division of Plant Industry, Division of Water Resources, Division of Wildlife and Ecology & Other Participants

The Division participates in the following Multi-Divisional Program:

Data Acquisition and Utilisation - MDP19 (Managed by CSIRO Office of Space Science and Applications)

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 Development of the theory of atmospheric dispersion and plume concentration statistics.

2 Parameterisation of plume rise and dispersion statistics from laboratory studies of buoyant chimney plumes in a connective boundary layer.

3 Models developed for reliably predicting the local and regional impact of specified pollutant emissions. (EN1)

4 Specific air quality consultancies, including the Sydney Metropolitan Air Quality Study carried out.

5 Participation in a study contributing improved understanding of the meteorology and precursors of photochemical smog in Perth.

6 Field studies of rain-water acidity in NSW and Malaysia.

7 A range of numerical/meteorological models developed, including a three-dimensional mesoscale photochemical model.

8 Project to survey concentrations of toxic synthetic chemicals in urban air commenced.

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 Creation of a Geophysical Data Processing Facility, using directly received data and major global datasets, both satellite based and model derived, for atmospheric and climate studies.

12 Field and satellite studies of land surface temperatures and radiation fluxes in Hay, New South Wales.

13 Completion of first 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.

15 ATSR data subset delivered to the Division for use in research applications.

16 Lidar field data from the ECLIPS and TOGA-COARE experiments analysed and scientific papers prepared.

Incorporate into climate models improved descriptions of dynamical systems and of the interaction of radiation with clouds and the earth's surface. (5%)

17 Completion of study identifying factors influencing short wave fluxes and net radiation in climate models.

18 Cloud climatology study extended to comparison with climate model simulations.

19 Improved surface specification, particularly surface albedo.

Apply recent developments in remote sensing instruments to research and commercialisation. (5%)

20 Completion of a two-year feasibility study of the prototype satellite-borne atmospheric pressure sensor.

21 New three-wavelength lidar used during the Southern Ocean Cloud Experiment and the Perth Airshed Study.

22 Airborne Hazards Detection System tested further and decisions made regarding its commercialisation.

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%)

23 Development of the 9-level general circulation models, development of a limited area nested model and development of a coupled ocean atmosphere model.

24 Coupled ocean-atmosphere model, involving transient growth carbon dioxide and including sea-ice and advanced land-surface schemes used in a major greenhouse modelling experiment.

25 Drought research expanded to include sea surface temperature anomalies in other oceans. (EN2)

26 "Proof of concept" experiments with a drought forecasting scheme applied in forward looking mode. New projections for 1993-94 carried out. (EN2)

Assess regional extent and impact of future climate change caused by changing atmospheric composition. (13%)

27 Development and application of new methodologies for analysis of climate change data.

28 Annual reports to WA, NT, NSW and Victoria on relevant regional climatic impacts.

29 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%)

30 Analyses of a range of radiatively active and ozone-depleting gases and their isotopes.

31 Analysis of the historical changes of the concentrations of gases in air extracted from Antarctic ice cores and from the Division's archived air.

32 Numeric models of atmospheric transport and exchange for interpretation of observations and predictions of future trends of radiatively active and ozone-depleting gases.

33 Global and national budgets of greenhouse and ozone-depleting gases will continue to be examined.

34 Commencement of field studies to examine the exchange of trace gases over legume pastures and eucalypt forests managed by prescribed burning.

35 Studies of the ocean-phytoplankton dimethyl sulfide-aerosol cloud albedo mechanism of climate regulation over the Southern Ocean.

36 Ongoing scientific support provided for the Australian Baseline Air Pollution Station.

1993-94 Resources Summary

Direct Appropriation	$8,381,000
External funds	$3,391,000
Total Expenditure	**$11,772,000**

Percent from external sources	29%
Percent from external sources 1992-93	38%
Target for external earnings	30%
Year planned to reach target	1998-99

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.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Program:

Management of Marine Living Resources - MDP23 (1.4% of total Division Resources) in collaboration with Division of Oceanography

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Algal Research Program - MDP20 (Managed by Division of Water Resources)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

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. (21%)

1 Stock assessment advice provided to resource managers for the Northern Prawn Fishery, Tropical Rock Lobster Fishery and the Northern Demersal Trawl Fishery.

2 Feasibility assessment of acoustic techniques for detailed mapping of continental shelf bottom communities.

3 Development of the Torres Strait fisheries environmental geographical information system completed.

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%)

4 Detailed survey of a heavily-fished section of the southeast Australian continental shelf to provide preliminary information on fished species assemblages, their relationship to variations in habitat, and preliminary indications of the effects of trawling on ecosystem and fishery sustainability.

5 Comparative studies of alternative methods of analysing the population structure of temperate finfish completed, and appropriate techniques applied to exploited fish stocks.

6 Techniques for assessing the importance of coastal habitats as nursery areas for southern shark species, and for the development for recruitment indices evaluated.

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. (24%)

7 A scientific assessment of the present state of the southern bluefin tuna population provided and effectively presented at international scientific and management meetings. (AP6)

8 Southern bluefin tuna tracked ultrasonically to determine their surface schooling behaviour and its effect on estimates of abundance based on aerial surveys. (AP6)

9 An archival (data storage) tag designed and developed and field trials of the tag conducted on southern bluefin tuna. (AP6)

10 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. (6%)

11 Multi-Divisional Program on Management of Marine Living Resources established and three new staff recruited.

12 Approaches to risk assessment in fisheries management assessed and the results communicated to Commonwealth fisheries managers.

To develop the scientific and technological basis necessary to expand and improve the performance of the mariculture industry. (7%)

13 Long shelf-life storage products (pastes and powders) of selected microalgal species developed and tested for use in hatchery and nursery systems.

14 An assessment of the biological and physical factors that influence the growth rate of juvenile oysters in nursery facilities completed.

15 A pilot program to develop biological tags for penaeid prawns, based on natural chemical tracers and/or inserted reporter genes completed.

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. (21%)

16 Mesocosm tanks designed, developed, their functioning documented, and the testing of environmental impacts begun by June 1994. (ED4)

17 Final cruise of the western Equitorial JGOFS series completed and analysis and publication of the results from earlier cruises completed. (EN1)

18 Techniques for using multispectral scanning for detecting individual species and mapping vegetated habitats in shallow coastal waters developed by July 1994.

1993-94 Resources Summary

Direct Appropriation	$12,500,000
External funds	$8,700,000
Total Expenditure	**$21,200,000**
Percent from external sources	41%
Percent from external sources 1992-93	35%
Target for external earnings	35%
Year planned to reach target	1992-93

39. Division of Oceanography (INRE)

Objective

To provide a scientific basis for the efficient conduct of national activity relating to the Australian regional oceans, including resources, environmental management, technolgy and the prediction of climate.

Strategy

There is growing awareness on the part of the federal and state governments and their environment departments, as well as industry, of the need for more effective monitoring and control of discharges into estuarine and ocean environments, and the Division's modelling and chemical analytical capabilities for appropriate investigations in this area are being recognised. There has also been recognition in recent years of the significant role played by the oceans in the global climate system, and the consequent need for intensive research to improve knowledge of ocean processes for incorporation into numerical climate prediction models. The Division is continuing to participate in major national and international programs to address these issues.

- Select and conduct theoretical, modelling and field oceanographic studies of the physics and chemistry of subjects of specific relevance to the use of marine resources, management of the marine environment and the influence of regional oceans on Australian and global climate variability and change; transfer research outcomes through a range of communication mechanisms.
- Enhance the efficiency and impact of divisional research through the use of special purpose grants and collaborative links with Cooperative Research Centres, national agencies, universities, and with internationally coordinated research programs.
- Provide direct marine research service and scientific advice to federal, state and industrial bodies on issues of environmental management and industrial development; develop marine products in collaboration with industry.
- Operate the *RV Franklin* and maintain its capability as a state-of-the-art National Facility for the benefit of divisional research and Australian marine science.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

Management of Marine Living Resources - MDP23 (Managed by Division of Fisheries)

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 Accurate heat and freshwater budget closures from the TOGA-COARE experiment. (EN2)

2 A trial acoustic monitoring system for detecting and charaterising ocean temperature variability deployed in the Pacific Ocean.

3 A prototype Indian Ocean numerical model, embedded within a coarser global ocean model, designed to accurately simulate sea surface temperature.

4 Evaluation of the ability of a global model to simulate turbulent-mean flow interactions in the Southern Ocean.

5 Current meters deployed to estimate the flow of water from the Pacific to the Indian Ocean through the Indonesian Archipelago.

6 A climatology of the upper Indian Ocean circulation and thermal structure and an assessment of the role of currents in large scale air/sea interaction.

7 Evaluation of the relative roles of warming and freshening, over the last two decades, using observed changes of the structure of the upper 1000m of the southern Indian Ocean.

8 A southern hemisphere verification for the Topex/Poseidon satellite altimeter mission.

9 Estimation of the mean circulation in the Tasman and Coral Seas from an analysis of historical hydrographic data.

Describe the physics of estuaries and coastal seas, by modelling and measurement, for application in pollution dispersal, fisheries management and offshore engineering. (25%)

10 A validated three-dimensional hydrodynamic model of Bass Strait applicable to the prediction of near-shore transport and dispersion of pulp mill effluents. (ED4)

11 A three dimensional hydrodynamic and water quality model of the Derwent River Estuary (Coastal Zone Program).

12 Description of the physical processes likely to be important in the development of management strategies for marine living resources.

13 Estimates, based on modelling and measuements, of the depth and concentration of jarosite dumped in the ocean by Pasminco-EZ.

Undertake directed research on the chemistry of the oceanic, coastal and estuarine environment and provide impartial advice to Government and Industry. (20%)

14 An evaluation of the factors controlling the carbon cycle in the western Equatorial Pacific (JGOFS).

15 Determination of the seasonal variability in the chemical forms of carbon dioxide in the Southern Ocean (JGOFS-WOCE-ACRC).

16 A compilation of chemical data from the Derwent Estuary (Coastal Zone Program).

17 Calibration of coprostanol concentrations against faecal coliforms as a measure of sewage contamination of the coastal environment.

18 Measurements of contaminant organic compounds in Sydney's stormwater drains and beaches and an assessment of the contribution from sewage.

19 An evaluation of the biogeochemistry of Antarctic saline lakes, with a view to studying them as proxy systems for Southern Ocean processes (ACRC).

20 Analytical techniques for the measurement of environmentally important chemical species.

Promote the development of marine products, resources and instrumentation in collaboration with Australian marine industries. (20%)

21 A process to purify squalene from shark liver oil and collaboration with industry to exploit this resource.

22 An improved procedure for extracting lipids from lyophilised marine samples.

23 Feasibility assessment of a new technique to measure the salinity of seawater over a range of defined environmental conditions.

24 A survey of the concentrations of essential polyunsaturated fatty acids in diatoms used as live feeds in aquaculture.

25 Tasmanian Earth Resources Satellite Station commissioned following development with the University of Tasmania and other partners.

26 Assessment of the ability of satellite-borne synthetic aperture radar to map major ocean currents and other ocean variables.

1993-94 Resources Summary

Direct Appropriation	$7,074,000
External funds	$2,300,000
Total Expenditure	**$9,374,000**
Percent from external sources	25%
Percent from external sources 1992-93	27%
Target for external earnings	25%
Year planned to reach target	1992-93

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.

Inter-Divisional Collaboration

The Facility participates in the following Multi-Divisional Program:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Specific Objectives & Planned Outcomes

To fully utilise CSIRO's share of available shiptime (110 days or 63% of the total) in 1993-94. (100%)

1 An Australian contribution to the international WOCE experiment - A deep meridional section through the Tasman and Coral Seas.

2 Australian contributions to the international WOCE experiment - Ocean Transport in the Tasman Sea.

3 Australian contribution to the international JGOFS experiment quantifying the biogeo-chemical cycle of carbon in Equatorial waters.

4 Interdisciplinary study of the Sydney sewage outfall.

5 Field tests and calibrations of new chemical and microstructure sensors and developments of the Seasoar and Bunyip towed bodies.

1993-94 Resources Summary

Direct Appropriation	$4,348,000
External funds	$10,000
Total Expenditure	**$4,358,000**

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. Local action groups and farmers are becoming increasingly concerned about improving productivity and reducing degradation. i.e. the maintenance of sustainable production systems.

- Develop, and operate within, a productive research environment shaped to nurture innovation, anticipate future research opportunities, and respond to community and industry needs.

Inter-Divisional Collaboration

The Division is responsible for the management of the following Multi-Divisional Programs:

Urban Water Systems - MDP16 (4% of total Division Resources) in collaboration with Division of Building, Construction and Engineering, Division of Chemicals and Polymers, Division of Information Technology, Division of Mathematics and Statistics & Other Participants

Algal Research Program - MDP20 (4% of total Division Resources) in collaboration with Division of Fisheries & Centre for Environmental Mechanics

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

Land and Water Care - MDP22 (Managed by Division of Soils)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

To develop a sound technical basis for better managing our groundwater resources, and for remediation of contaminated soil and groundwater. (24%)

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 A viable project on surface water/groundwater interaction developed.

4 New initiative developed focussing on groundwater flows in large sedimentary basins to provide a better predictive capability on flows/solute transport.

5 Integration of GIS into groundwater resources and groundwater management projects fostered.

6 Strategies for widening Adelaide Centre for Groundwater Studies to include Perth investigated.

By ecological research, promote environmentally safe management of surface waters. (18%)

7 Novel cyanobacterial toxins characterised and factors identified which control their biosynthesis and breakdown (with CSIRO Fisheries). (ED2)

8 Environmental characteristics identified, which promote the growth of cyanobacteria in regulated rivers and water bodies in south Eastern Australia (with CSIRO Centre for Environmental Mechanics and the Murray-Darling Freshwater Research Centre). (ED2)

9 The effect of introduced fish investigated, notably European carp, in disrupting aquatic ecosystems and degrading water quality (with Murray-Darling Basin Commission, NSW Department of Fisheries). (ED2)

10 Health of trees on the floodplain related to flooding and groundwater salinity. (ED6)

11 Protocols optimised for the use of sensitive aquatic organisms (*Moina, Daphnia*) to assess water quality.

12 Rapid field-based immunoassay methods developed for detecting pesticides in water (molinate, chlorphyrifos, diuron) (with CSIRO Plant Industry).

13 Instrumentation developed and trialled for the automatic measurement and satellite communication of water quality parameters, especially phosphorus, algal biomass and microbial indicators. (ED2)

Develop land and water use strategies in irrigated areas to reduce salinisation, increase productivity and maintain river water quality in the Murray Basin. (15%)

41. Division of Water Resources (INRE)

14 Selected irrigated crop water use and yield models developed and tested to include effects of shallow watertables, waterlogging and salinity. (ED6)

15 SWAGMAN Destiny (a predictive salt and water balance model) released for use in assessing the effect of various land and water management options. (ED6)

16 Suitability of soil puddling techniques to reduce deep percolation water losses below ponded rice assessed on-farm. (ED6)

17 SWAGMAN Options program further developed and applied to evaluate the economic and environmental consequences of rice and alternate crop production in irrigated areas. (ED6)

18 Research project established on alternate uses of sewage effluent for irrigation in collaboration with inland local councils. (ED3)

19 First stage assessment completed of shallow sub-surface drainage under agronomic crops and establish a collaborative project on above and below groundwater management of vines and citrus established.

To analyse the processes in the land phase of the hydrological cycle in order to predict the consequences for water resources management of land use decisions. (12%)

20 Assessment of the application of advanced airborne sensor technology in the identification of the extent and type of algal blooms in inland waters completed. (ED2)

21 Assessment completed of existing three-dimensional simulation models in applications to the first season's data obtained on water balance in a mixed cropping and pasture regime near Wagga. (ED6)

22 Material produced to allow landholder access to results achieved in the Land and Water Care Program (in collaboration with CALM NSW).

Identify sources and the fate of nutrients, salts and sediment reaching water supplies, and predict the impact of climate variability and change on water resources. (19%)

23 Impact of climate variability and change on specific water resources assessed. (EN1)

24 Methods for determining regional water balance for operational use tested.

25 Use of stable and unstable isotope techniques and mineral magnetics to trace water and sediment movement in the landscape developed. (ED7)

26 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)

27 Respective roles of nutrient and anthropogenic phosphorus in eutrophication determined.

28 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.

Develop, evaluate and apply decision support systems and other techniques of institutional, social, economic and environmental analysis to water resources problems. (12%)

29 Catchment Management Support System (CMSS) distributed to TCM groups. Major applications proceeding or planned in the Murrumbidgee, Hawkesbury-Nepean, Namoi, Hunter and Macquarie Basins.

30 Queensberry intelligent data base extended to incorporate rule-based and mathematical models representing the current state of knowledge about blue-green algal blooms. (ED2)

31 Continued development of software for intensive rural industry waste management.

32 Social research strategy of the Australian Research Centre for Water in Society implemented, with special emphasis on risk management and water allocation issues.

33 Implement the CSIRO multi-Divisional Urban Water Systems Research Program.

1993-94 Resources Summary

Direct Appropriation	$15,406,000
External funds	$5,817,000
Total Expenditure	**$21,223,000**

Percent from external sources	27%
Percent from external sources 1992-93	26%
Target for external earnings	30%
Year planned to reach target	1994-95

42. Division of Wildlife and Ecology (INRE)

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.

Inter-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Conserving Biodiversity for Australia's Future - MDP18 (Managed by Division of Plant Industry)

Data Acquisition and Utilisation - MDP19 (Managed by CSIRO Office of Space Science and Applications)

Coastal Zone Program - MDP21 (Managed by Centre for Environmental Mechanics)

Land and Water Care - MDP22 (Managed by Division of Soils)

Minesite Rehabilitation - MDP24 (Managed by Division of Soils)

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 new five year research plan, developed after joint reassessment of national priorities for rangeland research with other CSIRO Divisions and with state agencies. (ED6)

2 Release of FORSITE, a computer-based management package to assess degradation, prevent degradation, and plan for restoration. (ED6)

3 A research model to simulate the ecology and economics of semi-arid woodlands (SEESAW). (ED6)

4 A geographic information system for tourism and conservation planning for the MacDonald Ranges area, NT. (EN4)

5 A new set of sustainability indicators for wooded rangelands. (ED6)

6 Release and dissemination of a review of land rehabilitation procedures in the arid rangelands. (ED6)

7 Publication of a national framework defining the strategies for managing climatic variability in different regions of pastoral Australia. (ED6)

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%)

8 Publications on cassowary habitat selection and conservation requirements for management agencies, conservation groups and local Councils. (EN4)

9 Publications on survival and dynamics of small mammals and specialised rainforest trees in relict forest fragments. (EN4)

10 A new project on habitat selection by fauna of the wet sclerophyll/rainforest fringes.

11 Re-definition of the characteristics of Quaternary refugia in Australian tropical rainforest for conservation planning. (EN4)

12 Characterisation of the pathways and mechanisms of rainforest re-establishment after clearing on high and low fertility soils.

13 Evaluation of leaf area index as an indicator of disturbance and recovery in different complex rainforest types.

14 Establishment of sites along a 1000km transect in NT to study impacts of global change and human-based development.

15 Completion of a major review of magpie geese breeding success.

16 Evaluation of trace gas emissions from fires and their potential as atmospheric pollutants.

42. Division of Wildlife and Ecology (INRE)

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%)

17 Identification of possible agents for biological control of foxes and rabbits using an integrated ecological, virological, reproductive and molecular biological approach. (ED1)

18 A systems analysis of the rabbit-fox-mycoma-endangered species complex. (ED1)

19 A field release on the Darling Downs, Queensland of *Capillaria hepatica* for preventing plagues of house mice.

20 A management information system for use in preventing mouse plagues.

21 Identification, in Venezuela and Brazil, of possible biological control agents for the cane toad.

22 A management information system for response to an outbreak of an exotic disease of domestic animals, and incorporation into AUSVETPLAN.

23 Hormonal and biochemical studies on marsupial lactation to exploit the special properties of the marsupial mammary gland and to develop benign methods of control of kangaroo populations.

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%)

24 A new project on experimental evaluation of the concept of population viability. (EN4)

25 A new project on integrating nature conservation and agricultural production. (EN4)

26 Assessment of the status of breeding populations of seals at Heard Island and Macquarie Island. (EN4)

27 Re-introductions of endangered marsupials to the Shark Bay area, WA. (EN4)

28 Effects of forest fragmentation on scorpion populations determined from the Wog Wog experiment.

29 Analysis of distribution and abundance of birds in the WA wheatbelt.

30 A new project on the impacts of global climate change on Australia's terrestrial ecosystems.

31 Publication of "Aves, Volumes 2 & 3" and an atlas of regional populations of Australian birds.

32 A database of mammal specimens in the Australian National Wildlife Collection. (EN4)

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%)

33 Analysis of distribution of plant and animal species along NSW forest environment.

34 Development of a plant community classification of south eastern forests.

35 Preliminary conclusions about the effects of forest management practices on the distribution of key species.

36 Commissioning of prototypes of a Coastal and Marine Resources Information System for the Australian coastal zone.

37 A new project on determinants of sustainable development in the Australian ecumene.

38 Commissioning of a prototype GIS-based natural resource accounting system for NSW.

39 A spatial decision support system incorporating the minimal set algorithm for reserve selection. (EN4)

1993-94 Resources Summary

Direct Appropriation	$15,033,000
External funds	$8,244,000
Total Expenditure	**$23,277,000**
Percent from external sources	35%
Percent from external sources 1992-93	23%
Target for external earnings	20%
Year planned to reach target	1992-93

43. Centre for Environmental Mechanics (INRE)

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.

Inter-Divisional Collaboration

The Centre is responsible for the management of the following Multi-Divisional Program:

Coastal Zone Program - MDP21 (11% of total Centre Resources) in collaboration with Division of Coal and Energy Technology, Division of Fisheries, Division of Oceanography, Division of Soils, Division of Water Resources, Division of Tropical Crops and Pastures, Division of Wildlife and Ecology & Other Participants

The Centre participates in the following Multi-Divisional Programs:

Climate Change - MDP17 (Managed by Division of Atmospheric Research)

Algal Research Program - MDP20 (Managed by Division of Water Resources)

Land and Water Care - MDP22 (Managed by Division of Soils)

Specific Objectives & Planned Outcomes

Develop a better understanding of the effects of physical processes in soil, water, plants and the atmosphere on the growth and productivity of plants, concentrating on the terrestrial nitrogen cycle, fertilizer use, trace gas exchange between biosphere and atmosphere, evaporation in plant and forest canopies, and the solar radiation climate of plant communities. (20%)

1 New techniques for measuring trace gas fluxes on local and regional scales. (ED6, EN1)

2 Models for soil, water and salt balances developed and tested to evaluate salinisation risk in the Murray Darling Basin. (ED6)

3 Commencement of research on the effect of wind breaks on plant water use. (ED6)

To develop adequately verified theoretical descriptions of energy, mass and wind flows in the lower atmosphere, particularly over hills, in plant canopies and over water surfaces; and thence to improve predictions of climate, wind erosion, wind energy resources and pollutant dispersion. (30%)

4 Analysis of data on air-sea interactions from two major cruises of RV Franklin in TOGA-COARE Project. (EN2)

5 Completion, testing and communication of wind erosion hazard assessments in NSW. (ED6)

6 Soil-Canopy-Atmosphere Model for land-atmosphere interactions over heterogeneous terrain implemented. (EN1)

7 Commencement of studies of wind flow, heat and mass transfer around windbreaks. (ED6)

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. (25%)

8 Contributions of real and imaginary parts of the dielectric constant to the TDR determination of the water content of electrically conducting soils determined. (ED6)

9 Changes in soil physical properties and soil respiration due to sustainable crop management described. (ED6)

10 Data from remote hydrologic station measuring acid drainage from estuarine lands analysed. (ED6)

11 Applications to salinity disposal 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. (10%)

12 Advances in understanding of major physical processes exchanging materials between estuarine sediments and overlying water published.

43. Centre for Environmental Mechanics (INRE)

13 Advice on mesocosm design for assessing impacts of pollutants on sediments delivered to partners in the Coastal Zone Program.

14 Characterization of the interplay between biological and physical processes influencing phytoplankton and blue green algae blooms. (ED2)

15 Strategies for minimising the impact of algal blooms in the rivers of the Murray Darling Basin. (ED2)

Communicate results of Division's research to users in the community, industry and government agencies. (15%)

16 Appropriate methods of reaching the Centre's key stakeholders identified and developed, to inform them of the Centre's work and to understand their expectations of the Centre. (Eval)

17 A carefully targetted audience reached with the Centre's publications.

1993-94 Resources Summary

Direct Appropriation	$2,549,000
External funds	$688,000
Total Expenditure	**$3,237,000**
Percent from external sources	21%
Percent from external sources 1992-93	20%
Target for external earnings	25%
Year planned to reach target	1995-96

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

Involvement in global science is essential if Australia is to continue to access remotely sensed data for high priority programs such as climate change and environmental monitoring. Information gained from remotely sensed data is a cost-effective contribution to the techniques being developed for the sustainable management of the country's natural resources.

- Liaise with national and international bodies to strengthen scientific links, represent CSIRO's research priorities in remote sensing and other space science and ensure the availability to CSIRO of space-and-related data.
- Provide scientific, information, technical and engineering advice and support services to CSIRO Divisions.
- Ensure the effective transfer of research results to the end users of the applications of remotely sensed data.
- Enhance national competitiveness through the transfer of competitive technology to the Australian remote sensing and space science industries.
- Manage CSIRO access to research aircraft facilities.
- Communicate CSIRO and Australian achievements in space science.

Inter-Divisional Collaboration

The Office is responsible for the management of the following Multi-Divisional Program:

Data Acquisition and Utilisation - MDP19 (11.5% of total Office Resources) in collaboration with Division of Wildlife and Ecology, Division of Atmospheric Research, Information Services Branch & Other Participants

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. (55%)

1 Implementation of the Strategic Plan for Space Science and Applications in CSIRO. (IC3, IC4, CS1, ED2, ED3, ED6, ED7, EN1, EN2)

2 Effective CSIRO participation achieved in the Australian Space Council's formulation of a national Space Science and Industry strategy.

3 Optimisation of the design and operating parameters of an Australian environmental monitoring and resource management Imaging Spectrometer. (CS1, ED2, ED3, ED6, ED7)

4 Production of hard-copy products for end-users from the data gathered from the 1992-93 Compact Airborne Imaging Spectrometer (casi) campaign. (CS1, AP6, ED2, ED7)

5 Formulation and commencement of marketing strategies to develop a commercial Imaging Spectrometry business in Australia. Continuation of negotiations with potential commercial partners.

6 Further transfer to private enterprise of expertise in and technology for the support of airborne research.

Strengthen the participation by CSIRO and its scientific, technological and industrial collaborators in international space projects and global space programs. (20%)

7 Co-ordination of the Australian component of the NASA DC8 Synthetic Aperture/SIR-C Calibration Program, to assist Divisions in the Institutes of Natural Resources and Environment, Plant Production and Processing, Information Science and Engineering, and Minerals, Energy and Construction to meet their and their client's research and applications' objectives.

8 Effective maintenance and support of Australian scientific participation in European, Japanese and other international space missions, including ERS-1, ERS-2 and TOPEX-POSEIDON. (EN1, EN2)

9 Representation of CSIRO's interests at international fora such as the Committee on Earth Observation Satellites (CEOS) plenary session in November 1993.

10 Development of commercial export opportunities for remote sensing technologies with Australia's near-north neighbours.

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%)

11 Continued publication and promotion of the high quality CSIRO Space Industry News (SpIN) magazine to ensure the effective representation of CSIRO and other Australian achievements in space science.

12 Analysis of the SpIN circulation list to ensure that potential investors and users are aware of the technology transfer opportunities provided by CSIRO achievements in space science.

13 Maintenance of an up-to-date electronic catalogue of COSSA Resource Centre material, to ensure that the Centre meets the information needs of COSSA staff and other users.

14 Establishment of an electronic bulletin board to promote efficient remote sensing information exchange within CSIRO.

1993-94 Resources Summary

Direct Appropriation	$2,950,000
External funds	$1,100,000
Total Expenditure	**$4,050,000**
Percent from external sources	27%
Percent from external sources 1992-93	19%
Target for external earnings	19%
Year planned to reach target	1992-93

Objective

To provide statistical expertise for CSIRO's agricultural, biological and environmental Divisions in the ACT region, SA and NT.

Strategy

CSIRO's agricultural, biological and environmental Divisions require advanced biometrical 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 by maintaining a high level of collaboration and communication both inside and outside CSIRO.

- Collaborate in Divisional research programs.
- Carry out biometrical research relevant to Divisional Programs.
- Provide a high quality statistical consulting service.
- Train Divisional staff in basic statistical methods and in the use of statistical computer packages.
- Undertake external consultancies consistent with the objectives of IAPP, INRE and IPPP.

Specific Objectives & Planned Outcomes

Collaborate in Divisional research projects and provide a high quality statistical consulting service. (70%)

1 Staff located part-time in each Division as required for consulting and collaboration.

2 Full statistical analysis and reporting of selected projects.

Train Divisional staff in basic statistical methods and in the use of statistical computer packages. (10%)

3 Short courses presented at various CSIRO sites: "Regression Modelling", "Design and Analysis of Experiments", "Introductory Statistics", "Introduction to Genstat 5".

Carry out biometrical research and undertake external consultancies relevant to Divisional Programs. (20%)

4 Up to three consultancies in risk assessment. (ED4)

5 Research paper submitted on generalized linear models and estimating equations.

1993-94 Resources Summary

Direct Appropriation	$487,000
External funds	$50,000
Total Expenditure	**$537,000**
Percent from external sources	9%
Percent from external sources 1992-93	13%
Target for external earnings	20%
Year planned to reach target	1995-96

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 Department provides a management framework within which corporate support to the Organisation's line management is delivered. That support is made up of the development of policies, the provision of advice and the co-ordination and delivery of support services best handled centrally to meet the needs of the Organsiation. 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* (1993-94 edition).

- CSIRO's core business requirements must drive all activities of the Department.
- Corporately, CSIRO only undertakes activities that affect the Organisation's core business, accountability or effectiveness.
- The Department's 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.
- The Department will advise the Chief Executive on organisational performance and compliance in key policy and statutory areas.
- The Department will advise and support the Chief Executive, the Institute Directors and the Chiefs of Divisions on issues of organisational significance.
- The Department 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 will not generally be provided by the Department.
- All services provided by the Department will by 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.
- The Department 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 long term financial planning for CSIRO, by the development and implementation of a periodic budgeting system for both Revenue and Expenditure by June 1994.

2 Preparation of the Organisation's budgetary documentation to meet Government timetables in the prescribed format for Commonwealth Budget Papers.

3 Monitoring of CSIRO's financial position and production of regular financial performance reports to the Executive Committee (monthly) and Board (quarterly), and CSIRO statutory financial reports.

4 Strategic development and formulation of new "accrual" based CSIRO accounting policies, procedures and systems ensuring accounting standards are upheld and are communicated effectively within CSIRO.

5 Development of corporate policy and procedures for the purchasing of goods and services which are cost effective, provide value for money and reflect best purchasing practice.

6 Completion of the implementation of accrual accounting based management and reporting practices in all divisions using commercial accounting systems.

7 Provision of effective and efficient accounting services to senior and line managers in the Organisation.

Specify and implement financial systems to meet the Organisation's needs. (3%)

8 Provision of support for UNIBIS and financial systems in general which meets the needs of users at all levels.

9 Provision of programming/analysis to resolve problems and improve financial systems and reports in response to users' requests.

10 Provision of acceptance testing, documentation and support services for new releases of UNIBIS; module due for completion by October 1993.

11 Provision of access to integrated summary and detailed financial data.

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%)

12 Awareness of issues being considered by Government and provision of regular summaries to alert senior staff to opportunities for input on relevant items.

13 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.

14 Preparation or coordination of corporate submissions and other input to external inquiries which arise during 1993-94.

15 Provision of timely and high quality correspondence and briefings to the Minister.

16 Provision of briefings for the Chief Executive, particularly for participation on high level councils and committees and for meetings with portfolio Ministers.

17 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%)

18 Provision of a consultancy service to Divisions and other units on interactive strategic planning, team building, organisational change and human resources management.

19 Achievement of more flexible pay structures and contract conditions for senior staff to permit remuneration levels to respond more closely to performance and market factors. Removal of external impediments to this change.

20 Development and implementation of an enterprise bargaining agreement specific to CSIRO needs.

21 Development and piloting of a program for the development of senior administrative staff.

22 Two Research Management courses for a total of 60 senior research managers; the first to commence in August 1993, the second in February 1994.

23 Development and trial of a development program for research project leaders by November 1993.

24 In consultation with Institute Directors, preparation and implementation of a variety of developmental activities for Divisional Chiefs including introductory briefings for newly appointed Chiefs and seminars on issues of specific interest.

25 Completion of the Leadership Development program for 1992/93 participants and provision of a program for the 1993/94 intake including developing personal development plans and arranging relevant secondments.

26 Development of a process for review of term promotion for levels 7,8 and 9 and provide advice and support services to the EC reward review process.

27 Completion and update of recruitment policy and procedural documentation.

28 Completion of review of the competency model and implementation of changes to policy and procedures.

29 Further refinement of PPE in light of recommendations from the PPE Review Report.

30 Update and presentation of all CSIRO OHS policies in a new format in the Personnel Management Manual and development of specific OHS information booklets and brochures. Provision of OHS training to all line managers.

31 Meetings of the Consultative Council and the Health and Safety Committee and related working parties and subcommittees.

32 Investigation of options for providing a range of flexible and supportive work practices for workers with family responsibilities.

33 Implementation of Aboriginal and Torres Strait Islander Recruitment and Development Strategy to increase number of ATSI employees in CSIRO.

34 Provision of pay, superannuation and specialist administrative services for the whole of CSIRO.

35 Provision of local support services to Divisions/Units relating to the production of cheques, bank reconciliations, processing of accounts and claims and travel.

Specify and implement human resource systems to meet the Organisation's needs. (3%)

36 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.

46. Corporate Services Department

37 Specification and implementation of changes to improve the interface and quality of existing mainframe and microbased HR systems eg. Leave system and PERDIV.

38 Completion of the first round of applications and systems training in the CSIRO Human Resources Information Systems.

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%)

39 Publication of the twelve Australian Journals of Scientific Research, *Australian Journal of Experimental Agriculture* and *Australian Journal of Astrophysics.*

40 Publication of at least twenty-five CSIRO monographs.

41 Development of new products and services using emerging technologies such as multimedia, electronic transfer of files, networks and CD-ROMs.

42 Quarterly issues of the science magazines *Ecos* and *Rural Research* and bi-monthly issues of the business magazine *CSIRO Business.*

43 Production of science and research in progress databases on behalf of external customers and CSIRO.

44 Communication of CSIRO's research through multimedia displays, corporate videos and printed publications.

45 Active marketing of CSIRO's science publishing through a Bookshop service.

46 Dissemination of science information through online networks, inquiry services, consultancies and advice.

47 Provision of cost savings in centralised acquisition of library journals and management of the CSIRO library network catalogue.

48 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%)

49 Testing of the networking of the Adonis CD-ROM journals service.

50 Investigation of the viability of providing integrated access to CSIRO's information resources using the universal access infrastructure.

51 Implementation of a replacement for the GEAC library system by July 1994.

Provide a professional, cost effective and efficient information technology service to CSIRO. (31%)

52 Planning for and management of corporately required information technology services and contracts for CSIRO.

53 Provision of mainframe services under a five year commercial agreement with Fujitsu Australia Ltd.

54 Provision of and maintenance of the Corporate network infrastructure for the transmission of voice, data and image Australia wide. Continue the capital replacement program of PABXs.

55 Commencement of the integration of voice and data networks where practicable and cost justified.

56 Management of the relationship with AARNet and continued installation of links for research managers to mail and the administrative systems.

57 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.

58 Network infrastructure changed from X25 to TCP/IP by June 1994.

Provide a corporate property management service to ensure adequate and cost effective research accommodation and facilities. (5%)

59 Annual review of the Property Management Strategy and recommendations on amendments as necessary including on-going property consolidation and rationalisation.

60 Management of the Approved Capital Investment plan of $105 million over the Triennium, including externally funded items of approximately $20-30 million per annum.

61 Management of the successful implementation of an internal leasing scheme for CSIRO's accommodation.

62 Implementation of Stage 1 of the North Ryde redevelopment project.

63 Completion of the four storey laboratory building at the Parkville (Royal Parade) redevelopment project; commencement of the refurbishment of the existing main building.

64 PPWC approval for the relocation of the McMaster Laboratories to Prospect as part of Stage 1.

65 Feasibility study for the relocation of the Limestone Avenue site.

66 Implementation of a self funding strategy for the relocation of Animal Health facilities from Werribee/Maribyrnong to State Agriculture land.

SUMMARY OF RESOURCES, 1993-94

(estimates as at 17th May 1993)

Branch/Unit	Staff by Functional Classification (EFT units)			Expenditure Estimates ($'000)		
	Research Support	Management	Total Staff	Direct Approp	External Funds	Total Funds
Corporate Finance Branch	18	2	20	1,571	1	1,572
Government Business and Policy	3	2	5	515	1	516
Human Resources Branch	58	5	63	5,243	78	5,321
Information Services Branch[1]	101	2	103	3,543	3,910	7,553
Information Technology Services Branch	64	3	67	8,007	2	8,009
Corporate Property Branch	9	1	10	1,201	1	1,202
Corporate Library	4		4	247	24	271
Corporate Centre Site Administration	25		25	1,950	120	2,070
Director CSD	2	2	4	400	1	401
Internal Lease Scheme				1,150		1,150
Central Funds				109	350	459
TOTAL	284	17	301	24,036	4,488	28,524

[1](a) System Owner budget transfers are not reflected in this table. (b) Excludes new initiatives in relation to mainframe computing operations, communications, library systems and ITSC costs.

47. Office of the Chief Executive

Objective

To support the Chief Executive in managing the Organisation, and developing its external liaisons.

Strategy

- Assist the Chief Executive in the efficient conduct of the responsibilities of office.
- Provide an effective and efficient system of liaison between the Chief Executive and the Board, Institutes and Divisions by maintaining strong links to the Corporate Executive Office, Canberra, Corporate Services Department, Institute Offices and Divisions.
- Maintain effective liaison with these groups in issue analysis, development and input.
- Maintain awareness of relevant scientific, technological, social and political developments.
- Establish and operate an effective Head Office building.

Specific Objectives & Planned Outcomes

To develop and/or co-ordinate briefings or action advice on all correspondence to the Chief Executive and events and meetings involving the Chief Executive. (70%)

1 Full, timely and coordinated briefings in relation to all issues arising from the Chief Executive's correspondence.

2 New procedures for developing and coordinating briefs with Corporate Business Director (Institutes/Divisions) and/or Corporate Services Department following the establishment of new Head Office.

To facilitate the interactions of the Chief Executive, and CSIRO generally, with Australian Industry, Governments and outside bodies and at the international level. (15%)

3 Assistance and briefing for the Chief Executive's visits, meetings and programs and participation in high level committees.

4 Through close liaison with relevant sections of CSIRO, further development of effective interactions with industry, the Minister responsible for CSIRO and CSIRO's priority international connections.

To facilitate the Chief Executive's interactions with the Chairman and Board Members. (10%)

5 Effective and timely interactions with Corporate Executive Office Canberra and, as necessary, offices of the Chairman and Board Members.

Develop and operate an effective Head Office building. (5%)

6 High standard accommodation and office support for the Chief Executive and senior staff located at Head Office.

7 High standard meeting facilities for Boards and Committees and temporary office support and facilities for senior visiting staff at Head Office.

1993-94 Resources Summary

Direct Appropriation	$1,320,000
Total Expenditure	**$1,320,000**

48. Corporate Legal Services

Objective

To provide a professional corporate legal service to CSIRO.

Strategy

- Improve management of legal issues in CSIRO, particularly those involving the private sector.
- Improve understanding throughought CSIRO of basic legal principles to facilitate delivery of legal services.
- Provide better tools to help Divisions negotiate their own commercial arrangements with the Corporate Legal Service.
- Provide expert legal advisory services to the Chief Executive, The Board, Institutes and Divisions.
- Manage the contracting out of non-core legal work to lawyers in private and government practice.
- Develop a close legal working relationship with CSIRO.

Specific Objectives & Planned Outcomes

To provide professional legal services to CSIRO. (100%)

1 The Chief Executive, the Board, Directors, Chiefs and General Managers advised on all legal aspects of their management responsibilites including complience with legislation, administrative and general law, safeguarding the legal interest of CSIRO and avoiding unnecessary exposure to legal risks.

2 Litigation and administrative law proceedings managed on behalf of CSIRO.

3 Drafting and advisory services provided to support Cooperarative Research Centres and substantial contract negotiations.

4 Drafting and instruction services provided in relation to the Science and Industry Research Act and other legislation.

5 Reports produced as required under administrative law (Freedom of Information, Administrative Decisions (Judicial Review), Ombudsman, Privacy).

6 CSIRO's responsibilities under the Income Tax Assessment Act for Approved Research Institutes successfully undertaken.

7 Legal educational services provided to CSIRO staff (seminars and fact sheets).

8 Completion of an Intellectual Property review.

9 Revised standard form agreements issued for use in CSIRO.

1993-94 Resources Summary

Direct Appropriation	$610,000
Total Expenditure	**$610,000**

49. Corporate Public Affairs

Objective

To gain widespread recognition of CSIRO as an organisation of scientific excellence that gives an excellent return on public funds, good value to industry collaborators, and can be an "honest broker" on environmental and other sensitive issues. To help create a scientifically literate community and to increase the interest and awareness of students about careers in science and science in careers.

Strategy

- Work closely with Institutes and Divisions to create opportunities for CSIRO staff to interact with stakeholders and the general public and back these with a strong presence in the mass media.

Specific Objectives & Planned Outcomes

Promote CSIRO to stakeholders and the General Public (60%)

1 Opportunities for interaction of CSIRO staff with parliamentarians, industry and government officials.

2 Positive Media coverage of CSIRO.

3 Public exhibitions of CSIRO's work.

4 An efficient and responsive enquiry service providing information about CSIRO and general scientific/technical matters.

Promote an interest in science among school children. (30%)

5 Growing membership of Double Helix Science Club and publication of The Helix increased from quarterly to every two months.

6 Network of Science Education Centres in capital cities.

7 Curricula materials and student project enquiries efficiently handled.

Publish Annual Report, Co-Research and other corporate documents. (10%)

8 CSIRO Annual Report published to Parliamentary requirements.

9 Monthly staff magazine, Co-Research.

1993-94 Resources Summary

Direct Appropriation	$2,270,000
External funds	$1,220,000
Total Expenditure	**$3,490,000**
Percent from external sources	35%
Percent from external sources 1992-93	34%
Target for external earnings	35%
Year planned to reach target	1993-94

Objective

To provide the focus for international relations in CSIRO.

Strategy

With establishment of the new CSIRO Head Office, greater emphasis will be placed on providing support to Institutes and Divisions in association with Australian companies and other organisations.

- Foster cooperation in scientific and industrial research with like institutes overseas by developing and maintaining networks with government departments, foreign legations and overseas agencies.
- Develop mechanism for, and provide expert advice and services to, CSIRO Institutes and Divisions to increase their collaboration with industrial partners and other external stakeholders on international activities.

Specific Objectives & Planned Outcomes

Support CSIRO's Corporate and statutory responsibilities in relation to international matters. (50%)

1 Provision of advice to the Chief Executive and Directors and support for the development of corporate policy on international matters.

2 Fostering of CSIRO's contributions to international scientific collaboration and technical cooperation.

3 Representation of CSIRO and Australia at international meetings, conferences and government missions.

Provide services to Institutes and Divisions. (50%)

4 Establishment and coordination of an international awareness group of representatives of Institutes and Divisions to collate information and experience about interaction with companies on international ventures.

5 Implementation of a mechanism for exchange of information within CSIRO on staff travelling overseas.

6 Development of close relationships with Austrade, DITARD and various industry councils and associations with the objective of making more effective use of their services.

7 Provision of specialist skills and knowledge to Institutes and Divisions to assist them in developing international collaboration.

8 Arrangement and management of training and study tours for UN and other aid agencies and promotion of training opportunities to those agencies.

1993-94 Resources Summary

Direct Appropriation	$640,000
External funds	$500,000
Total Expenditure	**$1,140,000**
Percent from external sources	44%
Percent from external sources 1992-93	45%
Target for external earnings	44%
Year planned to reach target	1993-94

51. Corporate Executive Office - Canberra

Objective

To manage effectively the business of the Board and Executive Committee, and provide high quality policy and administrative support to the Chief Executive, Chairman, Board Members and Directors in their roles of defining and working towards corporate outcomes.

Strategy

Establishment of the Head Office in Melbourne heightens the need to ensure smooth interaction of the administrative and policy activities of the Board and Executive Committee. To meet this challenge, this Office will contribute to decision making, particularly by enhancing coordination and maintaining high value information flows. Specifically it will:

- Assist the Chief Executive, Chairman and Board Members in the efficient conduct of their responsibilities.
- Provide an effective and efficient Secretariat for the Board and Executive Committee, and help achieve/co-ordinate effective administrative and policy outcomes.
- Liaise closely with Head Office particularly in enhancing interaction and high level communication with external bodies and stakeholders.
- Maintain awareness of, and provide policy advice on, relevant scientific, technological, social, political and management developments in Australia and overseas.
- Manage the Chief Executive's Canberra Office and coordinate his Canberra-based activities.

Specific Objectives & Planned Outcomes

To maintain and improve the effectiveness of the Board and Executive Committee and ensure co-ordination of their activities. (35%)

1 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.

2 Guidance and assistance provided, where appropriate, in the preparation of papers and follow-up actions.

To develop and/or co-ordinate briefings or action advice on all correspondence to the Chairman. (30%)

3 Full, timely and co-ordinated briefings on all issues arising from the Chairman's correspondence and interactions.

4 Streamlined procedures to develop and co-ordinate briefs in consultation with Head Office, Institutes, Divisions and the Corporate Services Department as appropriate.

To facilitate and enhance the interaction of the Chairman and Chief Executive with outside bodies and stakeholders. (20%)

5 Assistance and briefing for the Chairman's visit and meeting programs and participation in high level committees.

6 In close liaison with Head Office, development of a strategy by Board and Executive Committee to enhance their interaction with major outside bodies and stakeholders (including identifying potential new users and beneficiaries for CSIRO's research).

Manage the Chief Executive's Canberra Office. (15%)

7 Effective interactions with stakeholders through procedures developed to coordinate the Chief Executive's Canberra-based activities, in ways which fully complement the Melbourne Head Office role.

1993-94 Resources Summary

Direct Appropriation	$740,000
Total Expenditure	**$740,000**

52. Corporate Audit Group

Objective

To assist CSIRO management to protect Organisational assets and to conduct the business of the Organisation in a fair and honest manner. To improve the performance of CSIRO by assisting managers at all levels in the efficient and effective discharge of their duties and by promoting cost-effective internal control.

Strategy

The objective of the Corporate Audit Group is achieved by:

- providing appraisals of the adequacy and effectiveness of Organisational systems;
- providing suggestions for improved performance;
- performing monitoring on centralised computer systems; and
- participation in the systems design process.

Specific Objectives & Planned Outcomes

To conduct a comprehensive audit review program encompassing reviews of compliance, efficiency and effectiveness across a range of CSIRO units and activities. (80%)

1 Review of nine Organisational units/divisions. (Eval)

2 Review of five CSIRO systems/functions. (Eval)

3 Provision of computer-based tools and facilities in support of the audit process. (Eval, Perf)

4 Conduct of a transaction sampling program to support the assurance function within the comprehension audit program. (Eval)

Participate in the design of all significant computerised information systems. (10%)

5 Participation in ITS Steering Committee.

6 Promotion of user groups for significant systems.

Enhance systems of internal control within the organisation. (10%)

7 Administration Guide development.

8 Review of corporate procedures for internal control.

1993-94 Resources Summary

Direct Appropriation	$870,000
Total Expenditure	**$870,000**

53. Corporate Planning Office

Objective

To provide corporate planning services required by the Chief Executive, Executive Committee and CSIRO Board in relation to the preparation of essential planning documents, the determination and implementation of CSIRO's research priorities and the diffusion of "best pratice" planning in CSIRO.

Strategy

CPO strategy focuses on understanding and responding to key factors in both the internal (CSIRO) and the external environment which are crucial determinants of CSIRO's success in achieving its corporate goals. Particular strategies are to:

- Provide high quality planning services in a timely and professional manner.
- Collect and disseminate quality data, and undertake analysis to support CSIRO planning and priority setting.
- Keep abreast of "best practice" techniques in the planning profession and to assess, adapt and apply them for the benefit of CSIRO.
- Build cooperative relationships (networks) to facilitate the transfer of planning information and the evolution of improved planning practices throughout CSIRO.
- Enhance the productivity and performance of the CPO by fostering a strong team spirit and providing opportunities for professional development.
- Initiate and respond to opportunities to contribute to workshops and consultations on planning matters in Institutes, Divisions and, selectively, for external clients.

Specific Objectives & Planned Outcomes

Preparation of essential CSIRO planning documents. (28%)

1 CSIRO Operational Plan 1994-95 completed by June 1994.

2 CSIRO Strategic Plan 1994-95 to 1998-99 completed by June 1994.

3 CSIRO Program Performance Statement completed by July 1993. (Eval)

4 CSIRO Evaluation Plan 1993-94 completed by October 1993. (Eval)

5 CSIRO input to the Science and Technology Budget Statement completed by July 1993.

Development and application of scenario planning at a corporate level. (19%)

6 Assessment of the applicability of alternative scenario planning methods to CSIRO completed by December 1993. (Eval)

7 Strategy for the development of CSIRO corporate scenarios for strategic planning agreed by March 1994. (Eval)

Support the CSIRO research priorities process. (13%)

8 Advice and support to the Chief Executive on specific aspects of the priorities implementation process for his interactions with Institute Directors and the CSIRO Board.

9 Efficient and effective implementation of the Board's decisions on research priorities, including completed SEO Role Statements and the allocation of priorities funds to priority research projects.

Data collection, analysis and dissemination. (20%)

10 Revisions and additions to the CSIRO Research Priorities Data Compendium; contributions to the Executive Information System and CSIRO Data Book; and coordination of CSIRO's Input to the ABS Survey of R&D. (Perf)

11 Analysis of topical issues and data pertinent to CSIRO presented as appropriate for use by the Chief Executive in interactions with the Board, Executive Committee and line managers.

Diffusion of "best practice" planning. (20%)

12 Wider appreciation and application by Institute and Divisional staff of best practice planning processes and techniques, particularly the research priorities process.

13 Recognition of and demand for CSIRO's corporate planning processes and products amongst other scientific research institutions, the planning profession and CSIRO stakeholders.

1993-94 Resources Summary

Direct Appropriation	$540,000
External funds	$30,000
Total Expenditure	**$570,000**
Percent from external sources	5%
Percent from external sources 1992-93	0%

The **CSIRO Information Network** provides a free access point to CSIRO for scientific and technical enquiries.

CSIRO Information Network

NSW Region Bradfield Road, Lindfield PO Box 218 Lindfield NSW 2070	Tel: (02) 413 7528 Fax: (02) 413 7635
Vic Region CSIRO Head Office 407 Royal Parade, Parkville PO Box 53 Parkville VIC 3052	Tel: (03) 662 7116 Fax: (03) 662 7140
Qld Region Cunningham Laboratory 306 Carmody Road St Lucia QLD 4067	Tel: (07) 377 0390 Fax: (07) 377 0387
WA Region Floreat Park Laboratories Underwood Avenue, Floreat Park Private Bag, PO Wembley WA 6014	Tel: (09) 387 0710 Fax: (09) 383 7894
SA Region CSIRO Resource Centre 32 Audley Street, Woodville North PO Box 4 Woodville SA 5011	Tel: (08) 268 0116 Fax: (08) 347 1703
NT Region CSIRO Tropical Ecosystems Research Centre McMillans Road, Berrimah Private Bag No 44 Winnellie NT 0821	Tel: (089) 22 1720 Fax: (089) 22 1714
ACT Region CSIRO Corporate Library & Information Service Limestone Avenue, Campbell PO Box 225 Dickson ACT 2602	Tel: (06) 276 6226 Fax: (06) 276 6374

Coming up . . .

- **ultra-clean coal** — a low-ash, low-polluting coal may replace oil in industry and power generation
- **cleaner pulp mills** — our advice is the key to the Government's pulp mill effluent standards
- **gene shears** — a major breakthrough in biotechnology: harmful or unwanted genes can be prevented from doing their work
- **vaccines** — targets include the cattle tick, the sheep blowfly, worm parasites and diseases such as footrot and salmonellosis
- **climate modelling** — predicting drought and long- and short-term changes in the Australian climate
- **wireless communications** — high capacity systems for transmission of video, images, data and voice, with the flexibility associated with mobility
- **plasma waste technology** — very high temperature plasma destruction of toxic chemical wastes

And beyond with Australia's Youth . . .

- **CSIRO's Double Helix Science Club** — bringing the excitement of today's science to tomorrow's leaders
- **CSIRO Science Education Centres** — hands-on science experiences outside the classroom
- **CSIRO Women in Science Project** — encouraging girls to go on with maths and science in their schooling and beyond
- **CSIRO Student Research Scheme** — final-year secondary students try on the shoes of the scientists with real-life research projects
- **BHP Science Awards** — fostering excellence with real rewards to tomorrow's researchers and today's best teachers
- **Scholarships** — supporting talented students at all levels of tertiary study

The Task

CSIRO, Australia's principal scientific research organisation, will be a leader in developing the scientific and technological capability Australia must have to meet the challenges of this decade and the next century.
Our work will be essential to improving Australia's economic performance and, at the same time, its care of the environment. The future quality of life of all Australians will depend on the nation's success in this task.

Role

CSIRO's main role will be the conduct of strategic research to:
- develop technologies for all sectors of Australian industry;
- improve the management of its natural resources;
- protect Australia's unique environment; and
- promote the well-being of the Australian people.

CSIRO is recognised nationally and internationally for its contributions to science and Australia's development. We will build on this reputation through close collaboration with industry, government and other research institutions to ensure the nation derives the greatest benefit from our research.

Community

CSIRO will honour the trust Australians have placed in the Organisation. We will provide authoritative and independent advice and information on matters of national importance that are within our expertise. We will take an active part in public debate on the actions and changes that are necessary if Australia is to seize its opportunities and overcome its difficulties.

People

CSIRO's ability to carry out its role rests on the creativity of its staff and the quality of its management. We will attract and retain the best people by providing strong leadership, clear direction, and the resources, facilities and conditions required to encourage and enable all staff to fulfil their potential.

Mission

CSIRO's ethos will affirm, above all, the qualities of service and excellence – service to all the Australian people through scientific excellence.
Our goal will be to give Australians a better future.

CSIRO
AUSTRALIA