# CSIRO Operational Plan

## 1995–1996

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CSIRO
AUSTRALIA

# CSIRO Operational Plan

# 1995–1996

Coordinated and compiled by CSIRO Strategic Planning and Evaluation.
Produced by CSIRO Corporate Business in conjunction with
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# Foreword

The program of work outlined in the CSIRO Operational Plan 1995-96 demonstrates the breadth, complexity and importance of CSIRO's commitment to world class scientific research and technical development for the benefit of all Australians.

CSIRO's strategic directions for the current triennium are documented in the booklet "Research Priorities and Strategies 1994-95 to 1996-97", and this Operational Plan shows how those research priorities and strategies are being implemented throughout the Organisation.

The Operational Plan necessarily reflects the current operational structure of the Organisation. However, pending the appointment of a new Chief Executive, changes in the Organisation's management and structure are expected to take place during the course of the year.

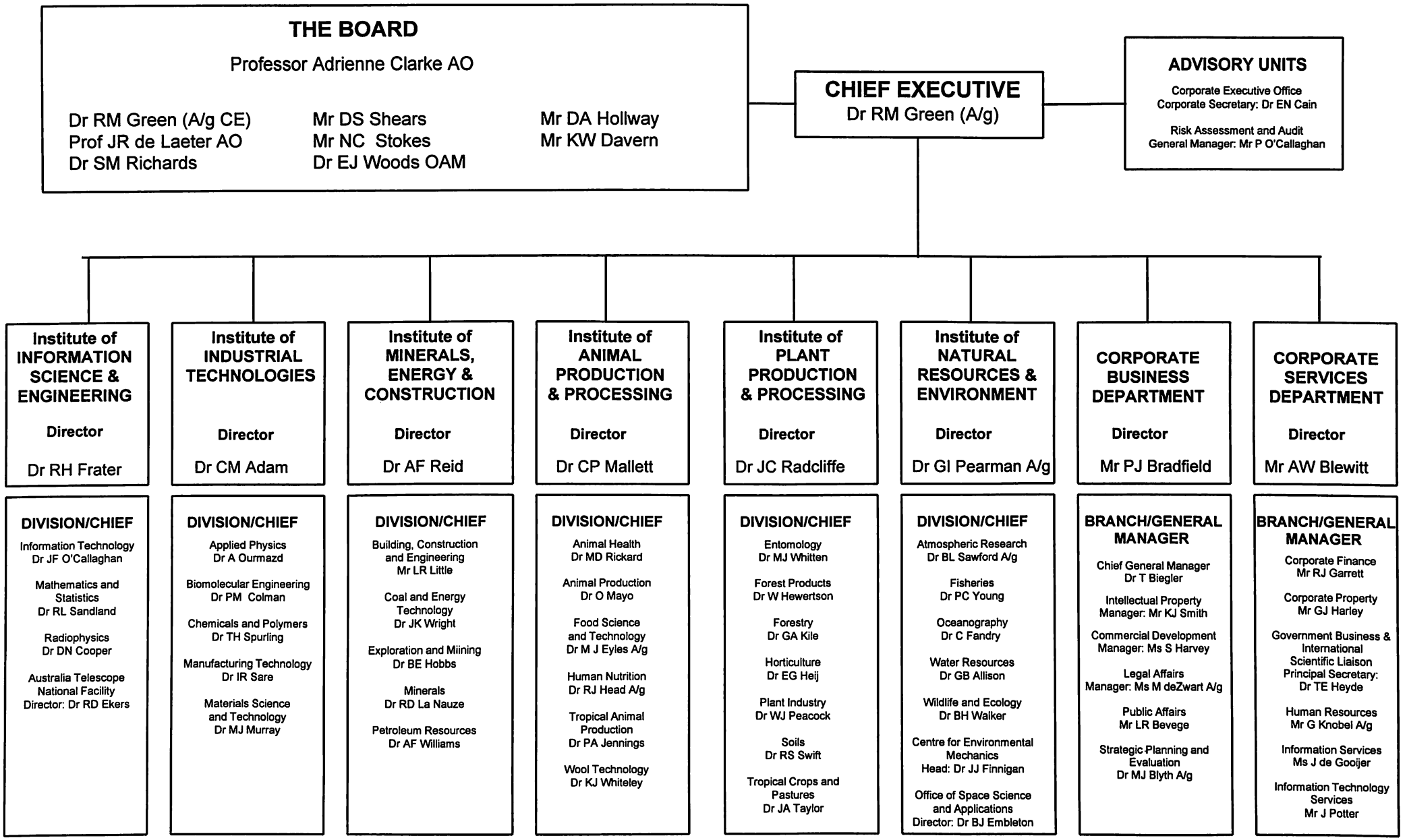
Two external events of particular significance to CSIRO during 1995-96 will be the foreshadowed "Innovation Statement" by the Minister for Science and Technology and the government's response to the Industry Commission's "Inquiry into Research and Development in Australia". Also, CSIRO's ability to raise non-appropriation funds for research will, as always, be influenced by changes in economic conditions and by the business community's attitude to investment in research and development.

CSIRO responds to such changes in its external environment in a pro-active way. We will use our positive relationships with the users of our research in government and industry to help advance Australia's national interest.

Dr R M Green
Acting Chief Executive
June 1995

# Figure 1: CSIRO ORGANISATIONAL STRUCTURE

(as at 1 July 1995)



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# Contents

## INTRODUCTION

CSIRO aims to be the world's most effective multi-disciplinary research organisation, serving Australia through excellence in research and technological development which delivers economic, environmental and social benefits.

This Operational Plan presents the planned distribution of resources to designated research purposes and provides detailed information on the objectives, strategies, planned outcomes and planned expenditure for each of the Organisation's management units in 1995-96. It also highlights the growing importance CSIRO places on cooperative multi-disciplinary research, not least through some 32 Multi Divisional Programs and participation in 53 Cooperative Research Centres.

Underpinning the Operational Plan, and CSIRO's Strategic Plan, are complementary planning and evaluation processes undertaken and reported at Institute, Division, program and project level. A formal staff Performance Planning and Evaluation (PPE) program provides a basis for encouraging optimum staff performance and achievement of Organisation goals by linking the personal objectives and professional development of individual staff members with the objectives and planned outcomes of CSIRO programs.

### RESEARCH PRIORITIES FOR 1995-96

Prior to the commencement of each triennium, CSIRO's research priorities are determined after careful assessment of the attractiveness and feasibility of research for different purposes or socio-economic objectives. In addition to its application in determining corporate research priorities, CSIRO's attractiveness-feasibility method has been applied at various levels throughout the Organisation.

At the corporate level, priorities are assessed on a triennial basis for a set of research purposes which reflect the economic, environmental and social objectives of the Australian community. These are based on the Socio-Economic Objective (SEO) classifications of the Australian Standard Research Classification. Research purposes correspond to SEO Sub-divisions. Extensive input to the process is obtained from external stakeholders, as well as from staff via workshops.

The year 1995-96 is the second in CSIRO's current triennium budget. In accordance with decisions taken by the Board in June and December 1993, an annual priorities fund of $5.5 million is reserved from CSIRO's appropriation budget for redistribution to agreed research programs in the priority research areas shown in Table 1. With matching funds from Institutes an amount in excess of $10 million will be redirected to these high priority areas in 1995-96 as a direct result of the priorities process. Institutes and Divisions also independently reallocate resources to priority research areas.

An overview of the priority assessment method and the key outcomes of the second triennial review of research priorities are presented in the document *'Research Priorities and Strategies 1994-95 to 1996-97'*. This document records the priority assessments, key priority decisions, strategies and potential outcomes determined for each of CSIRO's socio-economic objective research purposes. It also presents the program-level allocations for the triennium from the priorities research fund.

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

| Research Purpose (SEO Sub-Division) | $'000 |
|---|---|
| Mineral Resources | 1500 |
| Manufacturing | 1500 |
| Information and Communications | 1500 |
| Environmental Aspects of Economic Development | 500 |
| Environmental Knowledge | 500 |
| TOTAL | 5500 |

## CSIRO GOALS

The Organisation's goals for research and research support, as summarised in the CSIRO Strategic Plan 1991-92 to 1995-96, are listed below.

### Research Purpose Goals

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

### Research Support Goals

- Further strengthen mechanisms for determining and assessing research priorities and resources allocation across the Organisation.
- Provide efficient and effective R&D support services across the Organisation.
- Further strengthen CSIRO's human resource management practices to promote equity, to recognise the value of a diverse workforce, and to maximise CSIRO's capacity to attract and retain a high quality workforce in order to produce the best possible research and development for Australia.
- Increase recognition by government, industry and the general public of CSIRO's contribution to the nation.
- Improve Australia's ability to interpret and disseminate scientific and technical knowledge for the economic benefit of our industries.

## CORPORATE PLANNED OUTCOMES 1995-96

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

- Appointment of the new Chief Executive and implementation of decisions flowing from the Board's evaluation of CSIRO's Management and Structure.
- Implementation of actions following government decisions in response to the final report of the Industry Commission Inquiry into Research and Development and the forthcoming Minister's Innovation Statement.
- Implementation of year two of triennium research priority decisions including commensurate resource allocations.
- Completion of information technology communication infrastructure for the Universal Access Project and provision of basic training to all staff in CSIRO's communication processes including file transfer, electronic mail and world-wide-web.
- Implementation by each CSIRO Division of a set of generic performance indicators on trial basis for the final two years of the triennium, to be reported in the CSIRO Annual Report commencing with the 1995-96 Report.
- Development of initiatives to strengthen linkages with companies and industry groups, and with government departments and authorities.
- An evaluation of CSIRO's handling of enquiries from SMEs and implementation of processes to strengthen CSIRO's response to such enquiries.
- Continuing implementation of strong commercial management programs, including effective management of intellectual property and legal matters throughout the Organisation.

## 1995-96 RESOURCES SUMMARY

CSIRO's sources of funds include direct appropriation income, 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 38 per cent of total funds in 1995-96.

All resource figures reported in this Plan are estimates for 1995-96 as at June 1995. Table 2 reports planned expenditure for each Institute and for corporate functions by source of funds. Table 3 shows the planned expenditure by each Institute on each research purpose. Total CSIRO expenditure by research purpose is graphed in Figure 3. Table 4 provides estimates of Institute and corporate staffing levels during 1995-96.

**Table 2: ESTIMATED EXPENDITURE BY INSTITUTE 1995-96[1]**
(Provisional estimates as at June 1995)

| | Direct Appropr | External Funds | Total Funds |
|---|---|---|---|
| | ($'000) | ($'000) | ($'000) |
| Institute of Information Science and Engineering | 37,835 | 16,975 | 54,810 |
| Institute of Industrial Technologies | 66,787 | 31,544 | 98,331 |
| Institute of Minerals, Energy and Construction | 68,380 | 49,493 | 117,873 |
| Institute of Animal Production and Processing | 64,146 | 53,262 | 117,408 |
| Institute of Plant Production and Processing | 85,041 | 50,699 | 135,740 |
| Institute of Natural Resources and Environment | 64,640 | 35,036 | 99,676 |
| Corporate Services Department | 22,769 | 6,885 | 29,654 |
| Corporate Business Department | 4,815 | 1,654 | 6,469 |
| Chief Executive Advisory Units | 6,379 | | 6,379 |
| TOTAL | 420,792 | 245,548 | 666,340 |

[1]Expenditure on the CSIRO supercomputing facility has been apportioned across the user Institutes.

**Figure 2: PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96**

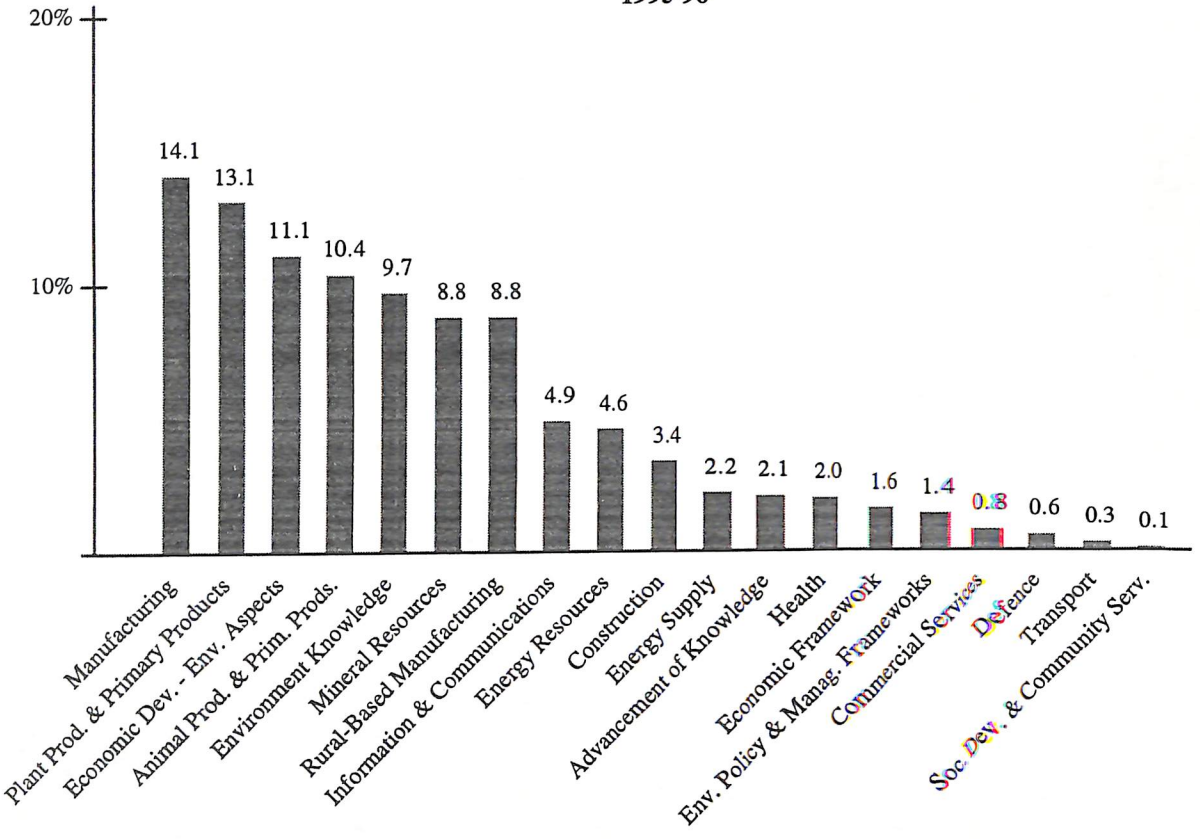


**Table 3: PLANNED DISTRIBUTION OF EXPENDITURE BY INSTITUTE [1] AND RESEARCH PURPOSE**
(Provisional estimates as at June 1995)

| Research Purpose[2] | IISE | IIT | IMEC | IAPP | IPPP | INRE | TOTAL[3] |
|---|---|---|---|---|---|---|---|
| | ($'000) | ($'000) | ($'000) | ($'000) | ($'000) | ($'000) | ($'000) |
| Plant Prod. & Primary Products | | 295 | | 470 | 79,408 | 1,495 | 87,291 |
| Animal Prod. & Prim. Prods. | | 197 | | 46,141 | 5,430 | 13,257 | 69,299 |
| Mineral Resources | 3,179 | 3,147 | 47,856 | | | 997 | 58,638 |
| Energy Resources | 1,096 | 2,360 | 24,164 | | | 997 | 30,652 |
| Energy Supply | 713 | | 11,552 | 352 | | 997 | 14,659 |
| Rural-Based Manufacturing | 110 | 1,967 | | 44,850 | 8,144 | | 58,638 |
| Manufacturing | 4,659 | 68,242 | 1,650 | 10,214 | 2,036 | 997 | 93,954 |
| Information & Communications | 23,459 | 4,917 | | | 2,036 | 199 | 32,651 |
| Environment Knowledge | 219 | | 118 | 117 | 12,217 | 48,044 | 64,635 |
| Advancement of Knowledge | 13,154 | | | | | | 13,993 |
| Env. Aspects Econ. Dev | 713 | 4,720 | 11,787 | 7,044 | 23,075 | 30,302 | 83,293 |
| Infrastructure & Services | 7,510 | 12,488 | 20,745 | 8,218 | 3,393 | 2,393 | 58,638 |
| **TOTAL** | 54,810 | 98,331 | 117,873 | 117,408 | 135,740 | 99,676 | 666,340 |

[1]See Footnote 1 to Table 2.

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

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

**Table 4: CSIRO STAFF NUMBERS, 1995-96**
(Equivalent full-time units, provisional estimates as at June 1995)

| Staff | IISE | IIT | IMEC | IAPP | IPPP | INRE | CSD | CBD | CEAUs | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| Research[1] | 310 | 613 | 733 | 865 | 1,081 | 647 | | | | 4,249 |
| Research Support[2] | 201 | 309 | 409 | 468 | 389 | 402 | 270 | 83 | 11 | 2,542 |
| Management[3] | 38 | 42 | 49 | 57 | 59 | 45 | 18 | 8 | 8 | 324 |
| **TOTAL** | 549 | 964 | 1,191 | 1,390 | 1,529 | 1,094 | 288 | 91 | 19 | 7,115 |

[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 1995-1996

**Plant Production and Primary Products**

1 Gene Shears
2 Novel Management Techniques for Plant and Plant Product Pests
25 Improving Forestry
33 Tropical Agricultural Exports
35 Rejuvenating the Murray-Darling Basin with Forest Products Industries
36 Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities

**Animal Production and Primary Products**

3 Fibre Utilisation
26 Gene Mapping
34 CSIRO Aquaculture Initiative (CAI)

**Mineral Resources**

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

**Manufacturing**

13 Biomaterials and Medical Devices
15 Process and Maintenance Optimisation in Manufacturing
27 Biosensors
28 Smart Manufacturing

**Commercial Services**

16 Urban Water Systems

**Environment Knowledge**

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

**Environmental Aspects of Economic Development**

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

## MULTI-DIVISIONAL PROGRAMS

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

Multi-Divisional Programs (MDPs) are programs of research involving two or more CSIRO Divisions and for which a formal management structure such as a steering committee or program coordinator has been established. The section below sets out the research objective and participating Divisions for each MDP, with the lead Division named first. The major outcomes and expenditure planned for 1995-96 are also shown. The MDPs have been grouped by CSIRO research purpose.

# Plant Production and Primary Products

### MDP01 *Gene Shears*

**Objective:**
To apply second generation ribozyme core technology to quality-related goals in the agri-food and agri-fibre business systems and to develop an intellectual property position based on further molecular parameters of ribozyme action in support of Australian agri-business competitiveness in Asian and global markets.

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

| Participants: | % Share |
|---|---|
| Division of Plant Industry | tbd |
| Division of Horticulture | tbd |
| Division of Tropical Crops and Pastures | tbd |
| Division of Tropical Animal Production | tbd |
| Division of Animal Production | tbd |
| Division of Biomolecular Engineering | tbd |

**Total Expenditure:** tbd

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

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

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

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

**Total Expenditure:** $1,446,000

### MDP25 *Improving Forestry*

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

**Planned Outcomes:**
1 In collaboration with industry, identify genes controlling early growth wood density and other traits in *E. nitens*.
2 Development of preparation techniques for eucalypt stem cores for image analysis in Silviscan-2.
3 Environmental variation related to radial growth patterns in *E. nitens* and *E. globulus*.

4 Production of temperate eucalypts containing introduced Bt genes. Assessment of level of Bt product and its efficiency against insect pests.

5 Introduction of gene constructs for generating sterility in eucalypts. Assessment of their efficacy.

6 Investigation, by controlled crosses, of the genetic basis of cineole levels in some of the trees with dimorphic insect resistance.

7 Investigation of phenols as a possible correlate with autumn gum moth resistance in *E. globulus*.

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

**Total Expenditure:** $2,730,000

## MDP33 *Tropical Agricultural Exports*

### Objective:

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

### Planned Outcomes:

1 Small scale field trials of fruit baits completed, and provisional patents lodged. (PP3)

2 Backcross lines of japanese soybean varieties homozygous for the long-juvenile trait produced. (RM1)

3 Root distribution studies of cashew trees of various ages completed in the NT.

4 First potential biocontrol agent for mesquite imported under quarantine. (PP3)

5 Information on rate of soil acidification in tropical stylo-based pastures compiled. (ED6)

6 Gene constructs to suppress enzymic browning in cane sugar prepared. (RM1)

| Participants: | % Share |
|---|---|
| Division of Tropical Crops and Pastures | 31 |
| Division of Horticulture | 19 |
| Division of Entomology | 14 |
| Division of Soils | 21 |
| Division of Plant Industry | 9 |
| Division of Tropical Animal Production | 7 |

**Total Expenditure:** $1,680,000

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

### Objective:

To provide the research-based information needed for the development of forestry and forest product industries in the south eastern Murray-Darling Basin and to assess the prospects of commercial success of such industries in the Shepparton-Deniliquin region.

### Planned Outcomes:

1 Characterisation of very young timber from species grown for land and water care. New sawing, drying and utilisation technologies.

2 Investigations of the value of thinnings and residues from unfamiliar eucalypt species in pulp and paper and composite products. (ED6, PP5)

3 Estimates of growth rates for selected tree species grown in a variety of environments in the Shepparton-Deniliquin region. Estimates of tree water use at the plantation scale to assist in the management of irrigated and rain fed plantations.

4 A seed orchard of key species established in the region.

5 Business plans and profitibility estimates integrated with estimates of environmental consequences of tree planting.

| Participants: | % Share |
|---|---|
| Division of Forest Products | 52 |
| Division of Forestry | 48 |

**Total Expenditure:** $356,000

## MDP36 *Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities*

### Objective:

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

### Planned Outcomes:

1 Second rotation bluegum experiments established in co-operation with industry, and nutrient base levels determined for different establishment techniques.

2 Preliminary assessment of lupin breeding lines for animal nutritive value completed and conveyed to legume breeders and industry.

3 Potential of a range of genes arising from subterranean clover genetic engineering programs tested using novel bioassay techniques for their ability to convey anthropod resistance with a view to incorporating useful genes in breeding programs.

4 Sites chosen for studies of root penetration of duplex soils by perennial plants and measurements commenced to determine the significance of this in management of soil water for production, and reduction of waterlogging and salinization.

| Participants: | % Share |
|---|---|
| Centre for Mediterranean Agricultural Research | 24 |
| Division of Animal Production | 24 |
| Division of Entomology | 6 |
| Division of Forestry | 13 |
| Division of Plant Industry | 26 |
| Division of Soils | 7 |

**Total Expenditure:** $831,000

## Animal Production and Primary Products

### MDP03 *Fibre Utilisation*

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

**Planned Outcomes:**

1 Establishment of 'proof of concept' that a mixture of recombinant bacterial strains benefit fibre digestion in mixed rumen culture. (PP2)

2 Expression of further recombinant esterase genes in rumen bacteria in stable form if esterase shown to be active against fibre. (PP2)

3 Strain-specific PCR techniques established to detect clone fungal enzymes in rumen contents. (PP2)

4 Assessment of persistence of newly produced microbes in ruminants, and effects on digestion in the rumen. (PP2)

5 Isolation of rumen organisms with the capability of degrading phenolics or phenolic/protein complexes from shrub legumes. (PP2)

6 Survey of rumen micro-organisms of exotic animals likely to be benefit to fibre digestion in domestic ruminants. (PP2)

7 Assessment of at least 2 northern Australian isolates of *B. fibrosolvens* for use as candidates for recombinant manipulation. (PP2)

8 Development of at least one functional promoter for construction of expression.secretion cassettes of fungal cellulase and xylanase in *Butyrivibrio fibrosolvens*. Assessment of the strength of the promoter. (PP2)

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

10 Quantitation of the hydrolysis of cellulose and plant fibre by CELA and CELD cloned from *N. patriciarum* relative to commercial cellulases from *T. reesei*. (PP2)

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

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

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

| Participants: | % Share |
|---|---|
| Division of Tropical Animal Production | 37 |
| Division of Tropical Crops and Pastures | 33 |
| Division of Animal Production | 30 |

**Total Expenditure:** $2,204,000

### MDP26 *Gene Mapping*

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

**Planned Outcomes:**

1 Development of a panel of sheep microsatellites suited for parentage evaluation on automatic equipment. (AP3)

2 Genetic markers for growth, conformation, tenderness, and fat colour evaluated in industry and research herds. (AP2)

3 Assessment of scope for genetic selection for hide and leather quality.

4 Assessment of possible markers for resistance to *T. colubriformis* in sheep. (AP3)

5 Completion of embryo transfer program used to generate 200 lambs in ovine resource familites. (AP1, AP3)

6 Wool related phenotypic measurements and 50 DNA markers scored in approximately 100 third generation reference flock individuals. (AP1)

7 Computer software developed for gene identification and gene tagging with markers. (AP1, AP2, AP3)

| Participants: | % Share |
|---|---|
| Division of Tropical Animal Production | 65 |
| Division of Animal Health | 17 |
| Division of Animal Production | 18 |

**Total Expenditure:** $1,192,000

### MDP34 *CSIRO Aquaculture Initiative (CAI)*

**Objective:**
To marry aquaculture industry priorities to CSIRO research capabilities identified at CSIRO Aquaculture Workshop. To combine the skills of up to ten CSIRO Divisions and apply them to aquaculture industry research needs. To focus research on the application of biotechnology.

**Planned Outcomes:**
1 A strategic plan for CAI with four projects; (i) Nutrition, (ii) Propagation and Genetics;, (iii) Microalgae, and (iv) Production and Environment.

2 A commercialisation strategy and a business plan for each project.

3 Nutrition research project developed with commercial partner; evaluation of commercially available feeds and of least cost feed formulation with domestic ingredients for *Penaeus monodon*.

4 Propagation and Genetics research project developed with commercial partner; heritability of growth in *Penaeus japonicus* estimated and isolation of micro-satellite markers for selective breeding trials commenced.

5 Microalgae research project developed with commercial partner; screening of Algal Culture Collection for species capable of heterotrophic growth and pharmaceutical leads commenced.

6 Production and Environment research project developed with Queensland Government departments; study site selected and compilation of data sets for GIS feasibility study begun.

| Participants: | % Share |
|---|---|
| Division of Fisheries | 50 |
| Division of Oceanography | 6 |
| Division of Animal Production | 7 |
| Division of Food Science and Technology | 7 |
| Division of Tropical Animal Production | 10 |
| Division of Entomology | 10 |
| Division of Plant Industry | 10 |

**Total Expenditure:** $950,000

## Mineral Resources

### MDP04 *Alumina Production*

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

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

2 Improvement in industrial clarification and thickening practice through identification of the hydrodynamic and process conditions required for optimal flocculation.

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

4 Reduction of the consumption of caustic soda through the development of methods for producing alternative 'desilication product' phases and by improving the efficiency of residue washing circuits.

| Participants: | % Share |
|---|---|
| Division of Minerals | 90 |
| Division of Building, Construction and Engineering | 10 |

**Total Expenditure:** $4,900,000

### MDP05 *Aluminium Production*

**Objective:**
To support development of aluminium technology that will increase the proportion of Australian raw materials processed locally, improve smelter

productivity and reduce the environmental impact of the aluminium industry.

### Planned Outcomes:

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

2 Scaled-up production of Al to kg scale by carbothermic reduction, including technoeconomic evaluation of the process.

3 Determination of the effects of melt chemistry on the thermodynamic and transport properties of potential low temperature electrolytes and the interaction of cryolite melts with carbon.

4 Review of metal recycling operations in Australia with the aim of improving and developing new purification and separation technologies.

5 Commercialisation of laser HP monitor.

| Participants: | % Share |
|---|---|
| Division of Minerals | 90 |
| Division of Materials Science and Technology | 10 |

**Total Expenditure:** $1,900,000

## MDP06 *Heavy Mineral Processing*

### Objective:

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

### Planned Outcomes:

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

2 Transfer of the technology for removal of radioactivity from ilmenite feedstocks and downstream products to a commercial plant.

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

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

| Participants: | % Share |
|---|---|
| Division of Minerals | 94 |
| Division of Building, Construction and Engineering | 4 |
| Division of Mathematics and Statistics | 2 |

**Total Expenditure:** $4,400,000

## MDP07 *Integrated Geological, Geophysical, Mine Design Visualisation*

### Objective:

To develop an integrated system capable of handling three dimensional geoscientific data derived from exploration and mining.

### Planned Outcomes:

1 Prototype 3D Geoscience Data Model.

2 Prototype 3D Geoeditor.

3 Software to interface between existing commercial mining packages.

4 Software for delivery of new visualisation products to industry.

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

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

**Total Expenditure:** $1,000,000

## MDP08 *Iron Ore Processing*

### Objective:

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

### Planned Outcomes:

1 Linkage of the CSIRO classification scheme to processing performance.

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

3 Demonstration of a dry frictional separator for beneficiation of Australian iron ore.

4 Revision of International Standards for sampling iron ores.

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

| Participants: | % Share |
|---|---|
| Division of Minerals | 95 |
| Division of Exploration and Mining | 5 |

**Total Expenditure:** $2,000,000

## MDP09 *Magnesium Alloys*

### Objective:

To develop metal refining, casthouse and downstream

casting technology for magnesium metal and to develop new magnesium alloys and composites and to evaluate materials properties and product performance.

### Planned Outcomes:

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

2 Development of new magnesium alloys for casting technology applications.

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

| Participants: | % Share |
|---|---|
| Division of Manufacturing Technology | 60 |
| Division of Materials Science and Technology | 25 |

**Total Expenditure:** $2,100,000

## MDP10 *Magnesium Production*

### Objective:

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

### Planned Outcomes:

1 Identification and optimisation of conditions for producing anhydrous magnesium chloride and transferring this material to electrolytic cells. (MI1)

2 Establishment of process conditions for the electrowinning of magnesium. (MI1)

3 Development of hydrodynamic models of magnesium electrowinning cells that provide the basis for improvements in cell design and power utilisation. (MI1)

4 Scaled-up production to kg scale and evaluation of flow sheets for commercialisation of Mg by carbothermic reduction. (MI1)

5 Evaluation of refactories used in magnesium electrowinning cells to identify materials that maximise operating life. (MI1)

6 Assessment of alternative technologies for electrowinning magnesium.

| Participants: | % Share |
|---|---|
| Division of Minerals | 80 |
| Division of Building, Construction and Engineering | 15 |
| Division of Manufacturing Technology | 3 |
| Division of Materials Science and Technology | 2 |

**Total Expenditure:** $2,200,000

# Manufacturing

## MDP13 *Biomaterials and Medical Devices*

### Objective:

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

### Planned Outcomes:

1 Identification of functionally important sites in key molecules involved in the biomaterial tissue interface.

2 Development of novel composite polymeric materials which incorporate active biological components.

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

4 Testing of selected materials in functional models.

5 New products for ophthalmic and cardiovascular applications.

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

**Total Expenditure:** $2,400,000

## MDP15 *Process and Maintenance Optimisation in Manufacturing*

### Objective:

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

### Planned Outcomes:

1 Three strategic research programs: Applications for Robust Manufacturing (ARM), Process Improvement for Robust Manufacturing (PIRM), Process Advisory Control Systems (PACS) - to deliver over the next 3 years, a coherent set of products and services through transfer of research outcomes to industry: 1) methods and tools for process improvement and system optimisation, 2) decision support and advisory applications, 3) collaborative and contract research projects with industry clients and industry partners for systems development and technology transfer.

2 In collaboration with international manufacturers and software product suppliers in manufacturing and food processing industries, develop systems for client enterprises: 1) plant and equipment asset management decision support systems, 2) real-time production planning and scheduling systems, 3) comprehensive condition monitoring and diagnostic systems, 4) operator guidance systems to sustain continuous improvement and optimisation of integrated manufacturing processes.

3 Collaboration with a global manufacturer in a comprehensive systems optimisation program to achieve substantial reductions in product delivery lead times. (MF4)

4 A portfolio of on-going consultancy services contracts with food processing and manufacturing industry clients for technology transfer of research outcomes.

| Participants: | % Share |
|---|---|
| Division of Mathematics and Statistics | 34 |
| Division of Manufacturing Technology | 22 |
| Division of Information Technology | 22 |
| Division of Food Science and Technology | 14 |

**Total Expenditure:** $2,000,000

## MDP27 *Biosensors*

### Objective:

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

### Planned Outcomes:

1 Completion of a business plan with a selected commercial collaborator for the development of a biosensor in the environmental (building) management sector. (MF4)

2 Establishment of links with potential industrial partners and key users in the potable water and food quality sectors. (ED2)

3 Evaluation of the gated-ion channel transducer for application in aerosol environments.

4 Construction and demonstration of an antibody and a DNA receptor for a targeted food quality/environmental application. The effective immobilization of these receptors onto transducer substrates as evidenced by their ability to respond to target DNA and antigen fragments. (MF5)

5 Demonstration of effective detection of salmonella using a piezo-electric detector.

| Participants: | % Share |
|---|---|
| Division of Chemicals and Polymers | 29 |
| Division of Applied Physics | 27 |
| Division of Animal Health | 21 |
| Division of Biomolecular Engineering | 9 |
| Division of Plant Industry | 9 |
| Division of Food Science and Technology | 5 |

**Total Expenditure:** $2,300,000

## MDP28 *Smart Manufacturing*

### Objective:

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

### Planned Outcomes:

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

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

3 Development of specialised hardware, software and optical modules for high speed machine vision and provision of machine vision solutions to specific industrial problems. (MF5)

4 Provision of generic framework and software tools for inter-enterprise management and concurrent engineering.

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

**Total Expenditure:** $2,000,000

## Commercial Services

### MDP16 *Urban Water Systems*

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

**Planned Outcomes:**

1 HYDRA, a graphical interface for integrating urban hydrological, hydraulic, and other models, extended for applications using HSPF and SALMON-Q models. HYDRA applied in assessing the potential pollution impacts of development patterns for greater Sydney.

2 The TOPAZ-SUCO model for integrating hydraulic network optimisation with urban land use - transportation planning extended to incorporate detailed sub-division design models for water cycle management. TOPAZ-SUCO applied in assessing water management issues in the context of development options for Adelaide.

3 A prototype decision-support system developed for assessing the potential for changed stormwater management practices to influence the level of drainage flows and the level and distribution of pollutants in runoff.

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

5 Production of Draft National Guidelines for injection of non-potable water into near-urban aquifers for storage and subsequent re-use.

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

7 The FILTER technique for crop irrigation evaluated in field trials using secondary-treated effluent from the Griffith NSW sewage treatment plant.

8 Establishment of experimental procedures to determine the feasibility of effective community involvement in wastewater management and stormwater pollution control. Implementation of these procedures in a number of Australian capital cities.

9 Report to the Standing Committee on Agriculture and Resource Management, and the Council of Australian Governments, on the ramifications of increased town wastewater re-use, improved stormwater management, and effects on sensitive receiving environments.

10 Provision of scientific and technological advice, and agreed demonstration projects, to MFP Adelaide in the implementation phase of the multi-function polis.

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

**Total Expenditure:** $1,800,000

## Environment Knowledge

### MDP17 *Climate Change*

**Objective:**
To predict changes in climate and the environmental impacts arising directly from them. To determine the contribution of human activities in Australia to the alteration and regulation of global atmospheric composition and climate change. To advise government and the community of the scientific understanding of climate change.

**Planned Outcomes:**

1 Anaysis of major 'greenhouse' modelling experiments using the CSIRO coupled ocean-atmosphere-sea ice global climate model, including an experiment where $CO_2$ is tripled in the model atmosphere.

2 Completion of field work for Observations at Several Interacting Scales experiment and analysis of data from phase 1 of the experiment.

3 Analysis of data from phase 2 of Southern Ocean Cloud Experiment and consolidation of data from phase 1.

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

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

6 Assess the simulations from a number of transient $CO_2$ experiments from coupled ocean-atmosphere climate models to determine their ability to simulate present-day climate over Australia and their utility for development of improved scenarios of climate change.

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

| Participants: | % Share |
|---|---|
| Division of Atmospheric Research | 40 |
| Division of Oceanography | 19 |
| RV *Franklin* (A National Facility) | 9 |
| Division of Water Resources | 7 |
| Division of Fisheries | 8 |
| Division of Plant Industry | 5 |
| Division of Wildlife and Ecology | 8 |
| Centre for Environmental Mechanics | 4 |

**Total Expenditure:** $12,000,000

## MDP18 *Conserving Biodiversity for Australia's Future*

### Objective:

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

### Planned Outcomes:

1 Characterising, estimating and sampling biodiversity; establishment of GC-FAME technology as a new tool for studying the biodiversity of soil microbial communities; establishment of experiments determining effects of silvicultural treatments on genetic diversity of eucalypt species.

2 Biodiversity and the sustainability of rural production systems; characterisation of shifts in the genetic structure of *Pythium* spp. and nitrogen-fixing bacteria in soils under different land use. (ED6)

3 Experimental elucidation of extinction processes; commencement of habitat quality and predation treatments in the extinction experiment; analysis of vegetation patterns over 10 years in the Wog Wog fragmentation experiment. (EN4)

4 Resource use and management for conserving biodiversity; linkage of DIVERSITY and LUPIS software; integration of pastural land data and values into the rangelands regional model, completion of a land allocation model for Wallatin Creek catchment in WA. (ED6)

| Participants: | % Share |
|---|---|
| Division of Wildlife and Ecology | 36 |
| Division of Plant Industry | 20 |
| Division of Entomology | 15 |
| Division of Soils | 15 |
| Division of Forestry | 14 |

**Total Expenditure:** $2,420,000

## MDP19 *Data Acquisition and Utilisation*

### Objective:

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

### Planned Outcomes:

1 Implementation of the CSIRO Executive Committee's response to the Multi-divisional Program's Review.

2 Establishment of Algorithm Development and Validation Working Groups. (ED6, EN1, EN3)

3 Continuation of the Continental Integrated Ground-truth Site Network (CIGSN). (ED6, EN1, EN3)

4 Re-orientation of emphasis, towards development of higher-level Earth Observation data products, and towards strategic Research and Development in Earth Observation methods. (ED6, ED7, EN1, EN2, EN3)

5 Finalisation of the first stage of collaborative Australia/Japanese satellite sensor calibration/validation field experiments. (EN1, EN2)

| Participants: | % Share |
|---|---|
| CSIRO Office of Space Science and Applications | 69 |
| Division of Wildlife and Ecology | 9 |
| Division of Atmospheric Research | 8 |
| Other Participants | 14 |

**Total Expenditure:** $1,160,000

## MDP29 *Climate Variability and Impacts*

### Objective:

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

### Planned Outcomes:

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

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

3 Provision of a focus for, and better integration of, CSIRO research relating to climate variability.

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

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

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

**Total Expenditure:** $9,800,000

## Environmental Aspects of Economic Development

### MDP20 *Algal Research Program*

### Objective:

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

### Planned Outcomes:

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

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

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

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

5 Integration of instream component into the catchment management support system.

6 Understanding of the cause of blooms in subtropical reservoirs.

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

**Total Expenditure:** $1,500,000

### MDP21 *Coastal Zone Program*

### Objective:

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

### Planned Outcomes:

1 Automated duplicated water flow and contaminant monitoring equipment installed and tested on rivers draining the major subcatchments of the Herbert River.

2 Mesocosm systems used to develop the methods necessary to measure and understand the transport, fate and impacts of contaminants in marine sediments. Development of the models necessary to predict these processes and integration of these models into the management of contaminants in the coastal zone.

3 Demonstrated application of sediment chemistry and physics skills to the study of field and mesocosm behaviour of metal and organic contaminants, including a thorough study of the effects of bioturbation. Extension of these activities to physical and chemical processes in sediments during resuspension and settling of disturbed sediments.

4 CAMRIS - As part of the Ecumene initiative, development of the capability to model the impacts of population on disparate coastal environments in eastern Australia.

5 Contributions to the establishment of the National Marine Information System by ERIN Unit of DEST.

6 In conjunction with external partners, development of a comprehensive spatial database of substrate properties for use in coastal and marine management.

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

**Total Expenditure:** $1,800,000

## MDP23 *Management of Marine Living Resources*

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

### Planned Outcomes:
1 Development of an operational framework for evaluating the costs and benefits of research for fishery management. The framework will be based on a decision theoretic approach which models the effects on management of a reduction in uncertainty through research. Preliminary application of the framework using a case example will be explored.

2 Construction and testing of a bioeconomic model for the Northern Prawn fishery. Identificaton of future management options for the fishery, to be evaluated at a later stage using the model. Identification of hypotheses which link environmental processes with stock dynamics.

3 Initiation of an integrated biological, economic and oceanographic evaluation of management strategies for the fishery on southern rock lobster fishery in Tasmania.

| Participants: | % Share |
|---|---|
| Division of Fisheries | 70 |
| Division of Oceanography | 30 |

**Total Expenditure:** $700,000

## MDP24 *Minesite Rehabilitation*

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

### Planned Outcomes:
1 Consolidation of management strategies for the MDP, including the operation of cost-centre 20, the effective integration of new staff, and the streamlining of time management. International business development based on research projects with mining companies and government agencies in China and Chile/Peru, building on knowledge from studies in Australian environments.

2 The design and operation of wetland systems in Tropical Australia for effective treatment of waters on minesites.

3 Strategies for studying dust generation from minesites and for minimising dust generated on tailing dams.

4 Innovative photogrammetric methods using remote photographic data to monitor small changes in landsurface topography due to erosion of settlement.

5 Effective treatment of seed for optimising plant germination and establishment for broad-acre revegetation of minesites in harsh climates.

6 Demonstration of cost-effective remote sensing techniques for monitoring water quality and vegetation attributes at minesites.

7 Designs for capping trials and monitoring systems in tailings dams.

8 Approval for sponsored projects, through participation in the Australian Centre for Minesite Rehabilitation, on co-disposal of waste rock and tailings from metalliferous mines; key indicators for ecosystem reconstruction success; and for rehabilitation of minesite to produce fauna habitats.

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

| Participants: | % Share |
|---|---|
| Division of Soils | 37 |
| Division of Exploration and Mining | 31 |
| Division of Water Resources | 7 |
| Division of Wildlife and Ecology | 6 |
| Division of Coal and Energy Technology | 16 |
| Division of Tropical Crops and Pastures | 2 |
| Division of Entomology | 1 |

**Total Expenditure:** $2,800,000

## MDP30 *Air Quality*

### Objective:
To provide improved methodologies and information systems for the assessment and management of air quality in the urban and regional environment. To

underpin this systems development with a focussed core research program. To provide a coordinated approach to air quality consulting work within CSIRO.

### Planned Outcomes:

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

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

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

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

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

**Total Expenditure:** $4,250,000

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

### Objective:

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

### Planned Outcomes:

1 For the Bago-Maragle Ecological Sustainable Management project with State Forests NSW: a subset of forest growth plots covering a range of productivity selected for more detailed investigation of soil sustainability indicators; DEMS and terrain attribute coverages produced over the ESM area; an explicit sampling strategy developed using the terrain attributes, geology and climatic coverages; and completion of initial 150 soil-site descriptions and soil sampling at these selected sites.

2 Evaluation of various geochemical indices and lithological classes as variables in environmental response models predicting forest distribution in the SE forests.

3 The simple environmental response models for the Yambulla Research Catchments forest species distribution upgraded with terrain attributes and remote sensed data.

4 NOAA AVHRR remote sensed data utilised to delineate dominant forest types in the south east of NSW and relate the signals to existing field data.

5 At the Wombat State Forest, Victoria, regression based modelling techniques used to predict forest productivity attributes (such as height, basal area and/or volume PAI) from satellite spectral and spatial variables (especially texture measures from the SPOT Panchromatic data) plus geographic variables such as altitude, temperature and topographic position.

6 Within the Bateman's Bay region of NSW, Landsat and SPOT remote sensed data used to predict forest structure and leaf area over a range of forest types and productivity classes.

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

**Total Expenditure:** $573,000

## MDP32 *Dryland Farming Systems for Catchment Care*

### Objective:

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

### Planned Outcomes:

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

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

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

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

5 Collation of available information on utility of current and proposed indicators of catchment health and publish the outcomes as a book, setting down guidelines and recommendations for application and adoption of indicators to provide assessment and monitoring of catchment condition.

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

| **Participants:** | **% Share** |
|---|---|
| Division of Soils | tbd |
| Division of Plant Industry | tbd |
| Division of Tropical Crops and Pastures | tbd |
| Division of Animal Production | tbd |
| Division of Forestry | tbd |
| Division of Water Resources | tbd |
| Division of Wildlife and Ecology | tbd |
| Centre for Environmental Mechanics | tbd |

**Total Expenditure:** $530,000

## 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.

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

CSIRO is a core participant in the 53 Centres listed below.

### Manufacturing Technology

*CRC for Materials Welding and Joining*
Division of Manufacturing Technology

*CRC for Polymer Blends*
Division of Chemicals and Polymers

*The RC Garvie CRC for Advanced Ceramics Processing*
Division of Materials Science and Technology

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

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

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

*CRC for Alloy and Solidification Technology*
Division of Manufacturing Technology

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

### Information and Communications Technology

*CRC for Intelligent Decision Systems*
Division of Information Technology

*CRC for Robust and Adaptive Systems*
Division of Radiophysics

*Australian Photonics CRC*
Division of Applied Physics

*CRC for Advanced Computational Systems*
Division of Information Technology

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

### Mining and Energy

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

*G K Williams CRC for Extractive Metallurgy*
Division of Minerals

*A J Parker CRC for Hydrometallurgy*
Division of Minerals

*Australian Petroleum CRC*
Division of Petroleum Resources

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

*Australian Geodynamics CRC*
Division of Exploration and Mining

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

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

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

### Agriculture and Rural Based Manufacturing

*CRC for Legumes in Mediterranean Agriculture*
Division of Plant Industry

Division of Entomology
Division of Animal Production

*CRC for Plant Science*
Division of Plant Industry

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

*CRC for Tropical Pest Management*
Division of Entomology

*CRC for Temperate Hardwood Forestry*
Division of Forestry

*CRC for Hardwood Fibre and Paper Science*
Division of Forest Products

*CRC for Viticulture*
Division of Horticulture

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

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

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

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

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

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

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

**Environment**

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

*CRC for Soil and Land Management*
Division of Soils

*CRC for Catchment Hydrology*
Division of Water Resources

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

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

*CRC for Freshwater Ecology*
Division of Water Resources

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

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

*CRC for Improved Water Quality*
Division of Chemicals and Polymers

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

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

**Medical Science and Technology**

*CRC for Tissue Growth and Repair*
Division of Human Nutrition

*CRC for Cellular Growth Factors*
Division of Biomolecular Engineering

*CRC for Eye Research and Technology*
Division of Chemicals and Ploymers
Division of Biomolecular Engineering

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

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

*CRC for Diagnostic Technologies*
Division of Biomolecular Engineering

All entries include an objective, strategy, planned outcomes and resource summary. Additional information is presented depending on whether the unit is an Institute, Division or Department. Each of the possible components of an entry is described briefly below:

**Objective**

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

**Strategy**

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

**Multi-Divisional Collaboration**

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

**Specific Objectives**

These are more detailed objectives, printed in bold type. They are specified for all operational units 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 1995-96 toward stated objectives is detailed in a list of selected planned outcomes. Each planned outcome is numbered and, where appropriate, a planned outcome may also be followed by one or more codes in parentheses. These codes are included to highlight the following:

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

- Planned outcomes which reflect an intent to undertake or implement the results of major program evaluations or reviews of functional areas in 1995-96 are followed by (Eval).

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

**Summary of Resources, 1995-96**

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

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

All figures in the summary of resources section are estimates for the 1995-96 year as at June 1995.

**External Earnings**

Each entry includes an estimate of the operational unit's external earnings for 1994-95 and targets for 1995-96 and 1996-97. This is shown as a percentage of total income. These are the only financial data in the Operational Plan shown on the basis of income rather than expenditure.

**Planned Distribution of Total Expenditure by Research Purpose 1995-96**

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 1995-96 will be allocated between CSIRO's Research Purposes. Figure 2 in Section One shows the distribution for CSIRO as a whole.

# 1. Institute of Information Science and Engineering

## Objective

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

## Strategy

Australia's information and communication industries constitute a significant sector of the economy - 8% of GDP. They are innovation and export oriented. Exports are growing rapidly and have doubled over the past four years to $3 billion pa. Innovation is recognised in the industry as a critical determinant of success - there is substantial investment in R & D and the use of technology for competitive advantage is an integral part of company strategy throughout the sector. Australia's information and communication industries also play a major infrastructural role in the economy: the goods and services produced are key inputs to every sector. This has resulted in strong links between companies in this sector and their key customers in other parts of the economy. One consequence is the involvement of both end-users and companies from the information and communications industries in many research projects.

- Value-added opportunity areas are the driving force for the Institute's research. The identification of such opportunities will be undertaken in conjunction with enterprises from both within the information and communication industries and in end-user industries. 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.
- The Institute will adopt a whole-system view when addressing the needs of users of its research. This will require 'end-to-end' understanding, ranging from electronic components through to integrated computer and communications systems, applications and services.
- Users of the Institute's research results will be actively involved from an early stage, through rapid prototyping and demonstration.
- The Institute will work with active research teams possessing complementary skills in academic and other research establishments. To this end joint research centres will be established in conjunction with tertiary educational institutions. This will involve, in particular, improvement of software engineering. The Institute will also become involved in education and training, both undergraduate and postgraduate.

## Planned Outcomes

1. Consolidation of the Decision Support for Process Improvement platform. (A platform is an aggregation of technical and other capabilities able to be used to deliver related products and services into a number of market segments.)
2. Identification and initiation of a second platform involving research groups from across the Institute.
3. Adoption of a continuous improvement approach.
4. Adoption of a framework for a structured approach to communicating with customers, and integrating their present and anticipated needs into the Institute's planning.
5. Trials of a common framework for project selection and evaluation.
6. Trials of 360° staff assessment. (This involves assessment of an individual's performance by their manager, peers and those who report to them.)

## SUMMARY OF RESOURCES, 1995-96

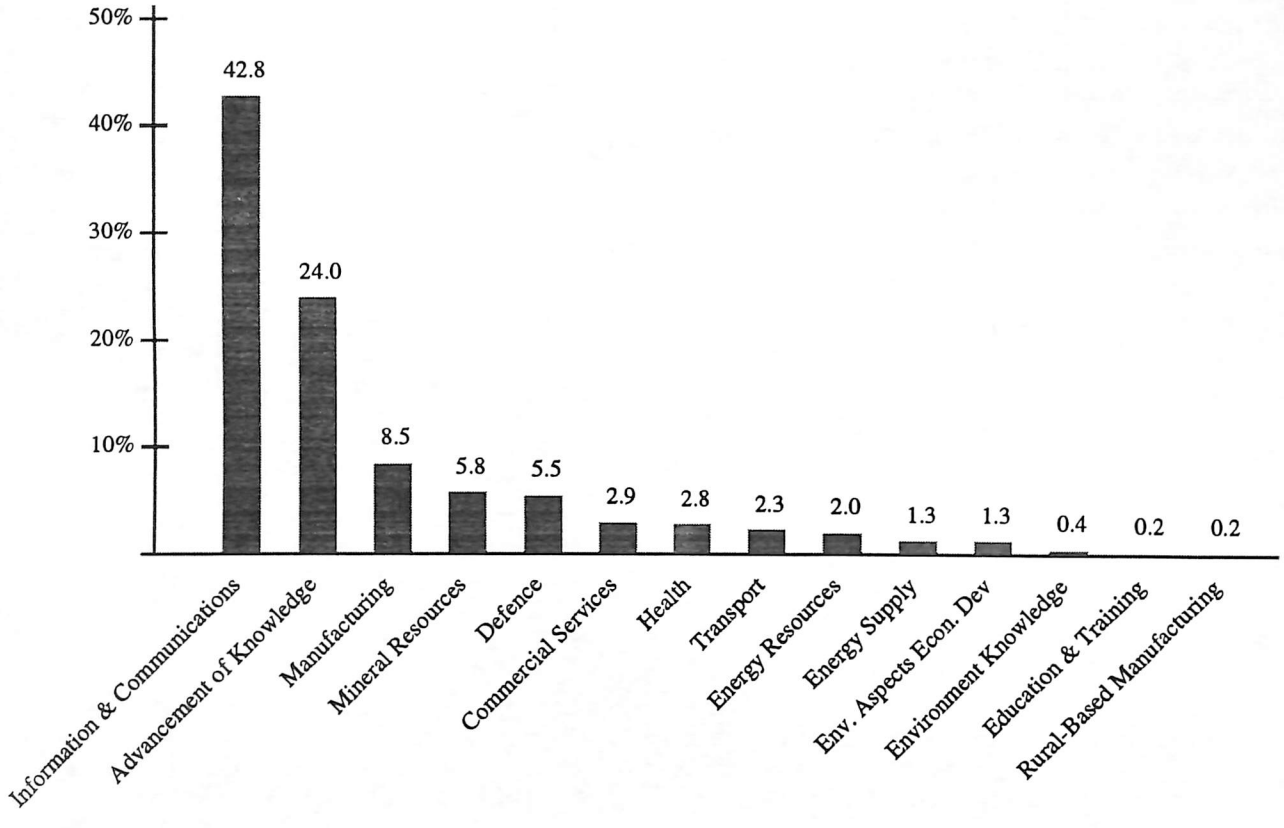
(estimates as at June 1995)

| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Information Technology | 75 | 29 | 10 | 114 | 6,734 | 3,800 | 10,534 |
| Mathematics and Statistics | 71 | 24 | 6 | 101 | 7,158 | 3,931 | 11,089 |
| Radiophysics | 115 | 56 | 12 | 183 | 11,295 | 7,342 | 18,637 |
| Australia Telescope National Facility | 45 | 81 | 7 | 133 | 10,514 | 1,902 | 12,416 |
| CSIRO Supercomputing Facility[2] | 4 | 0 | 0 | 4 | | | |
| IISE Institute Headquarters | 0 | 11 | 3 | 14 | 2,134 | | 2,134 |
| TOTAL | 310 | 201 | 38 | 549 | 37,835 | 16,975 | 54,810 |

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

[2]Supercomputing expenditure is charged to user Divisions.

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



# 2. Division of Information Technology (IISE)

## Objective

**To contribute to the international competitiveness of Australian industries by improving the effectiveness of their utilisation of advanced information technologies, systems and services.**

## Strategy

The software and related services sector is the fastest growing part of the information technology industry because of its role in underpinning the competitiveness of enterprises across the whole economy and the national information infrastructure. Improving the productivity, quality and effective use of software technologies and systems are key objectives for Australian business enterprises and other organisations. The Division will:

- Focus research on the demonstration and development of advanced software technologies and information systems particularly for the following industries: information services, manufacturing, commercial services, transportation, and mineral exploration and mining.
- Form strategic relationships with other research and industrial groups, and participate in major research centres in information technology.
- Participate in industrial consortia addressing significant commercial opportunities for advanced information technologies, systems and services.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Integrated Geological, Geophysical, Mine Design Visualisation*** - MDP7

***Process and Maintenance Optimisation in Manufacturing*** - MDP15

***Urban Water Systems*** - MDP16

***Smart Manufacturing*** - MDP28

## Specific Objectives & Planned Outcomes

**To develop system architectures, tools and techniques for processing geographic data in problem-oriented geographic information systems.** (30%)

1 An evaluation, through pilot studies primarily in the commercial services sector, of the applicability of data mining technologies.

2 Design and assessment of a networked server for very large spatial databases in the public utilities sector. (IC3)

3 Demonstration of a decision support system for applying multiple hydrological models in planning of urban water systems. (CS1)

4 Development of a high-performance traffic and road network simulation package for use in the design and operation of the next generation of traffic management systems.

**To develop knowledge based advisory and training systems for government, industry and commercial services.** (15%)

5 Demonstration of a knowledge processing environment for adaptive scheduling in aviation applications.

6 Design of a knowledge-based system for the training of air traffic controllers.

7 Design of a prototype integrated knowledge base and hypermedia system for intelligent training and documentation in manufacturing and commercial services applications.

**To develop architectures, tools and techniques for distributed information systems and processes.** (15%)

8 Design of a robust distributed electronic trader as part of the core technology required for resource discovery. (IC5)

9 Design of a communications infrastructure for a highly distributed reasoning system being commercialised by an industry collaborator.

10 Development and integration of an authoring tool with an SGML document repository.

11 A plan to trial electronic commerce on the Internet, involving Australian industry and international groups.

**To develop architectures, methodologies, tools, demonstrations for advanced applications using image-based modelling and visualisation and interactive multi-media user interfaces and systems.** (25%)

12 Demonstration of an interactive system for ore grade estimation, based on parallel realisations of geostatistical algorithms, for collaborators in the mining industry. (IC4)

13 Demonstration of a software framework that allows interactive visualisation to be easily portable across a wide range of high performance computing platforms. (IC4)

14 Demonstration of the use of fractal based representations of complex three-dimensional data for compression and sparse data interpolation, in collaboration with the Division of Exploration and Mining and with industry partners.

15 Demonstration of an on-line interactive system for film and television researchers to remotely access, and navigate through, biographical material in multiple media forms. (IC5)

**To develop and apply advanced specification, design, implementation, and verification methodologies, which improve the productivity and quality of software engineering.** (10%)

16 Establishment of an Outreach Program, as part of the CSIRO Software Engineering Initiative, to improve the productivity and quality of applications software developed in CSIRO.

17 An industry requirements study on object-oriented approaches to re-engineering legacy information systems.

18 Completion of a pilot project trialling Internet-based services to support the software engineering community in Australia.

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

19 Access to the CSIRO Supercomputing Facility that satisfies the community of scientific and engineering users.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $6,734,000 |
| External funds | $3,800,000 |
| **Total Expenditure** | **$10,534,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 31% | 32% | 31% |

*estimates as at June 1995

# 3. Division of Mathematics and Statistics (IISE)

## Objective

**To develop mathematical and statistical products and services which will be employed for the benefit of Australia and/or Australian enterprises. To continually enhance the knowledge base from which these products and services have been created to ensure we are able to meet the longer-term needs of our customers and Australia.**

## Strategy

- Engage in mathematical and statistical research, working directly with Australian enterprises on problems of immediate tactical importance to them and identifying their strategic research needs.
- Concentrate on increasing resources for longer-term projects. External funding for these is being sought through industrial partnerships, joint ventures and other channels.
- Carry out regular marketing to identify the mathematical and statistical research needed to improve the competitive position of Australian industries. Collaborative projects with other CSIRO Divisions will be actively sought.
- Enlist the collaboration of universities and other research groups.
- Communicate activities by means of technical reports, scientific publications, workshops, industry news-sheets, targeted courses, software products, media releases and ongoing interaction with stakeholders.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Heavy Mineral Processing* - MDP6

*Process and Maintenance Optimisation in Manufacturing* - MDP15

*Urban Water Systems* - MDP16

*Smart Manufacturing* - MDP28

## Specific Objectives & Planned Outcomes

**To formulate mathematical models and develop computational algorithms and functional software for industrial applications, and to deliver the benefits of this research to users.** (27%)

1 Development of mathematical models to help understand and improve specific processes and products. Applications will include metal casting, operation of coke ovens, design and fabrication of progressive spectable lenses, metal rolling and coating, operation of bio-sensors, food extrusion and continuum models for granular flow.

2 Completion of development work on Project Fastflo ('New Computational Fluid Dynamics Algorithms for Industrial Applications). Development of international licensing procedures for commercialisation of Fastflo. Application of Fastflo to collaborative research projects.

3 Development of models and software for specific applications involving fluid flow: pulsating combustion, heat transfer in coke ovens, the aeration step in the Becher process and carbothermic smelting.

4 Optimisation algorithms and software to improve specific processes including scheduling of airline crews, rostering of service workers and meat processing.

5 Application of simulation concepts and software in a wide variety of industries to understand and improve processes, including mineral processing plants, mail sorting centres and temperature variation in the distribution of fuel.

6 Continued development of particle-based computational algorithms for flow of granular materials, including collaboration with other CSIRO Divisions and marketing to identify prospective industrial customers.

**To develop and apply the capability to make efficient and effective use of data and measurement in support of management and decisions by Australian enterprises.** (28%)

7 Development of an SME point of access/referral for advice.

8 Data and information about the business requirements of SMEs which has been collected through the Division's access point for SMEs.

9 Identification of related activities in government agencies, consulting and training organisations, graduate management schools and overseas research groups.

10 Establishment of networks which include both technologies enablers (like CSIRO) and other change agencies which have complementary programs (e.g. AQC, ACM, NIES, AusIndustry).

**To improve the competitiveness of the Australian small-to-medium enterprises (SMEs) sector by developing, providing, and facilitating access to appropriate mathematical and statistical services, tools and techniques.** (9%)

11 Development of an SME point of access/referral for advice.

12 Data and information about the business requirements of SMEs which has been collected through the Division's access points for SMEs.

13 Identification of related activities in government agencies, consulting and training organisations, graduate management schools and overseas research groups.

14 Establishment of networks which include both technological enablers (like CSIRO) and other change agencies which have complementary programs (e.g. AQC, ACM, NIES, AusIndustry).

**To enhance the competitiveness of Australian enterprises, particularly the computer software and service industries, by improving their software quality and productivity.** (6%)

15 A framework for an extension service (inside CSIRO in the first instance) in software quality management, based on the key theme of process improvement.

16 Establishment of research projects on the software development process and associated measurement issues (software metrics), in collaboration with key research workers elsewhere.

**To develop and apply methods for the analysis and integration of temporal and spatial data to provide information for environmental management.** (9%)

17 Completion of studies to demonstrate the use of remotely sensed data for monitoring and mapping salinity. (ED6)

18 Methods for calibrating AVHRR data.

19 Integration of remotely sensed and terrain data to predict areas at risk from salinity. (ED6)

20 Methods for assessing, representing and combining the uncertainty in the data layers of a geographic information system.

**To meet and anticipate the needs of Australian enterprises by developing and applying algorithms for image filtering, segmentation and characterisation.** (10%)

21 Faster algorithms for filtering and segmentation of two dimensional grey scale images. (MF4)

22 Three-dimensional reconstruction algorithms suitable for stereoscopic images.

23 Camera calibration methods for 3D analysis and demonstration of their applicability to the SIROVISION project.

**To provide an IT infrastructure that facilitates innovation and wide area collaboration, and at the same time ensure stable and secure environments for the Division's activities.** (11%)

24 An agreement with Divisional management for service levels to be provided on the Divisional servers.

25 A project plan that schedules changes to hardware, operating systems, and application software according to available resources.

26 A pilot implementation of faster local area networks using 100baseT technology.

27 Documentation of a Divisional IT strategy, IT operational plan, security policy and disaster recovery plans.

28 Provision of Microsoft Officer services to UNIX users from a Windows NT server and Tektronix software for accessing NT from X-terminals.

29 Standards for integrating portable computing equipment into the Division's IT environment.

30 Development of World Wide Web services for communication within the Division and CSIRO and for publicity.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $7,158,000 |
| External funds | $3,931,000 |
| **Total Expenditure** | **$11,089,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 33% | 33% | 32% |

*estimates as at June 1995

# 4. Division of Radiophysics (IISE)

## Objective

**To extend and apply the knowledge and techniques of radio and imaging systems for the benefit of Australian industry and the Australian community.**

## Strategy

- Conduct research into generic technologies appropriate to telecommunications and image forming systems.
- Recognise emerging trends in services relevant to the Division's strengths and adapt its technology research to meet the future needs.
- Collaborate with industry, universities, Government business enterprises and organisations such as DSTO, and foster the formation of research partnerships, drawing on wider CSIRO expertise where appropriate.
- Maximise the exploitation of the Division's research through partnerships giving access to international markets.
- Provide SME's with ready access to the Division's capabilities.

## Specific Objectives & Planned Outcomes

**To develop and apply electronics and communications technologies in conjunction with telecommunications equipment manufacturers and providers of telecommunications services.** (21%)

1 Establishment of a new capability in broadband telecommunications networking, using in-house and external ATM-based networks to demonstrate collaborative multi-media services in areas such as geophysical imaging, telehealth and multimedia authoring. (IC1)

2 Investigation of the signalling and messaging required to deal with mobile and radio access to ATM networks while maintaining the required quality of service. (IC1)

3 Development of an enhanced personal intelligent communication system as a demonstrator for mobile communications systems technologies and for the development of new services for use mobile communications.

4 Improved antennas for cellular telephony base stations. (IC2)

**To develop advanced wireless and untethered communications systems for mobile and portable computing networks, telecommunications customer access and other short-haul network links, and investigate enhanced applications for wireless access computing.** (12%)

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

6 Demonstration of key radiofrequency and antenna components for high bit rate wireless applications such as WCAN at 27 GHz. (IC1)

7 Development of 38 GHz radio for cellular telephone infrastructure for commercial production. (IC1, IC2)

**To develop advanced GaAs based semiconductor devices and MMICs or application in communications and defence systems.** (24%)

8 Fabrication on 50 mm wafers of 0.15 micron quantum-well doped HEMTs and MMICs for use in low-noise and moderate power application at frequencies up to 110 GHz.

9 Initial device reliability trials completed.

10 Higher throughput achieved by developing a new sputtered airbridge process.

11 A complete bi-directional transceiver operating at 60 GHz designed and fabricated. (IC1)

12 Evaluation of cryogenic operation of HEMTs and MMICs for use in focal plane arrays at 100 GHz.

**To develop new and improved ultrasonic imaging, Doppler and tissue characterisation techniques for medical diagnosis underwater imaging, and pursue applications in medical imaging technology.** (14%)

13 Prototype equipment for acoustic mine imaging developed with industrial collaborators.

14 A report to industry on methods to quantify heart wall motion in adults.

15 Evaluation of the performance of a prototype 'expert assistant' workstation for computer aided diagnosis of lung and breast disease.

**To apply advanced signal processing technologies in the following areas: digital electronics, telecommunications, the security industry, and sensing technologies for the communications, mining and minerals industry.** (10%)

16 Application of the principles of content-based image processing to a number of areas, including real-time face recognition.

17 A low bit-rate audio/video encoder as a mobile systems application demonstrator.

18 Assistance provided to Australian industry with the development of signal processing application supported by the A4 audio processing chip.

19 Investigation of the use of digital processing solutions in the implementation of improved safety instrumentation for the mining industry.

20 Application of radio imaging technology and software to mine planning and mine operations.

**To develop robust and adaptive methods for telecommunications and control, as part of the**

**activities of the Co-operative Research Centre for Robust and Adaptive Systems.** (4%)

21 Real-time speech coding demonstrator for voice archiving applications.

22 Application of the principles of synergetic computation to the development of fast methods of pose estimation for a human head or other objects.

23 A blind-equalisation system for wireless communications implemented and tested.

**To develop techniques for the design and manufacture of antennas and passive microwave devices for communications systems.** (15%)

24 Investigation of reflector and feed array modelling methods for satellite antennas. (IC2)

25 Duel-band feed components for application to earth stations analysed, designed and manufactured. (IC2)

26 The upgrade of meteorological radar antenna for duel polarisation operation completed.

27 Feed systems for two satellite ground stations designed and manufactured. (IC2)

28 Design and manufacture of focal feed system for Nancay radiotelescope commenced.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $11,295,000 |
| External funds | $7,342,000 |
| **Total Expenditure** | **$18,637,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 32% | 40% | 40% |

*estimates as at June 1995

# 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

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.

- 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.

## Specific Objectives & Planned Outcomes

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

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

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

3 Completion of the HI mosaic observations of the Large Magellanic Cloud.

4 At least 50 scientific papers published in refereed journals.

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

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

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

7 85-115 GHz capability on a shared-risk basis achieved at Mopra.

8 Development of operational arrangements at Narrabri and Mopra for support of space VLBI missions.

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

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

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

11 The new frequency agile front end system incorporated into standard operations.

12 Development of operational arrangements for support of the Galileo mission.

13 Development of operational arrangements for support of space VLBI missions.

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

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

15 The operation of the LBA correlator facility organised and sufficient user support provided.

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

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

17 Coordination of computer systems development at all observatories.

18 Design of the new Parkes control system completed and development initiated.

19 Continued active participation in the AIPS++ development.

20 Development and implementation of procedures for electronic submission of proposals for all ATNF facilities.

**To develop the next generation of ATNF instrumentation.** (14%)

21 A joint ATNF-Radiophysics design study for a 3 mm focal plane array initiated.

22 Four sites (Parkes, Mopra, Narrabri, Hobart) equipped with new S2 data acquisition systems for VLBI and the LBA correlator system commissioned to the full 6-station capability.

23 The first of the 12-25 GHz receiver systems constructed for the AT Compact Array.

24 The 12-25 GHz receiver system commissioned at Parkes.

25 The 85-116 GHz duel-channel SIS receiver on the Mopra 22m antenna commissioned and made available for general use.

26 Feeds and receivers for the HI multibeam system at Parkes substantially completed and a new correlator designed and constructed.

27 Major National Research Facilities proposal to fund the development of mm-band systems for AT antennas and VLBI at Ceduna actively pursued.

**To satisfy external agreements for telescope use and instrumentation development.** (17%)

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

29 Upgrade of Parkes focal cabin to provide frequency agility for Galileo support.

30 Provision of 2.3 GHz Parkes receiver for the NASA Galileo mission support.

31 Upgrade of all Parkes systems to provide Galileo support as per NASA contracts.

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

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

33 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.

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

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,514,000 |
| External funds | $1,902,000 |
| **Total Expenditure** | **$12,416,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 18% | 23% | 13% |

*estimates as at June 1995

# 6. Institute of Industrial Technologies

## Objective

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

## Strategy

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

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

## Planned Outcomes

1 Provision of Secretariat for the Asia/Pacific Metrology Program (APMP) to promote regional cooperation and upgrading of national measurement systems as a means of promoting trade in the APEC area; leadership in Australian measurement science through implementation of the Kean Committee recommendations.

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

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

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

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

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

7 Design and fabrication for local and overseas markets of optically variable device masterplates for optical security and anticounterfeiting applications.

8 Development of machine vision applications in relation to highway pavement monitoring, food processing and aircraft detection and monitoring.

9 Construction and testing of ceramic fuel cell stacks of up to 1kW capacity with Ceramic Fuel Cells Ltd. Continued support for development of the technology and the company.

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

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

12 Leadership of specified activities with Australian collaborating companies within the newly established international Intelligent Manufacturing Systems (IMS) program which also involves leading companies and research agencies from Japan, US and Europe.

13 Research-related support for 15 Cooperative Research Centres, including delivery of research outcomes to collaborating companies.

14 Strengthened interaction with SMEs through the recently established network of Industrial Liaison Managers (ILMs) operating in Sydney, Melbourne, Brisbane and Adelaide.

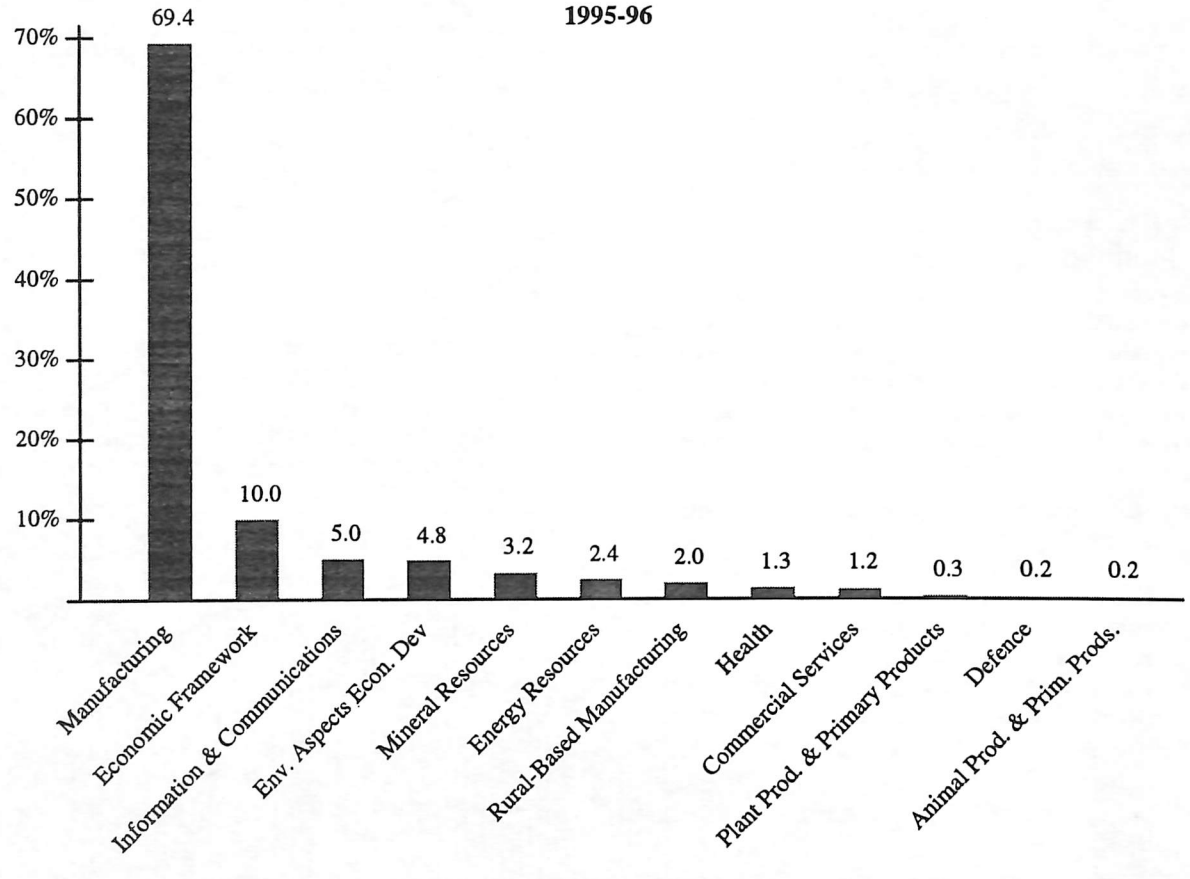
## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Applied Physics | 179 | 94 | 7 | 280 | 20,237 | 7,782 | 28,019 |
| Biomolecular Engineering | 109 | 38 | 9 | 156 | 10,076 | 4,150 | 14,226 |
| Chemicals and Polymers | 111 | 60 | 8 | 179 | 11,160 | 6,800 | 17,960 |
| Manufacturing Technology | 127 | 57 | 7 | 191 | 12,403 | 6,760 | 19,163 |
| Materials Science and Technology | 87 | 50 | 7 | 144 | 10,715 | 6,052 | 16,767 |
| IIT Institute Headquarters | 0 | 10 | 4 | 14 | 2,196 | | 2,196 |
| TOTAL | 613 | 309 | 42 | 964 | 66,787 | 31,544 | 98,331 |

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

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



# 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.
- Through the National Measurement Laboratory (NML) maintain Australia's national standards of measurement, provide a first-level calibration service, and collaborate with national and international organisations concerned with standards, measurement and testing.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Biomaterials and Medical Devices*** - MDP13

***Biosensors*** - MDP27

***Smart Manufacturing*** - MDP28

## Specific Objectives & Planned Outcomes

**Undertake R & D and participate in regional and other international activities to maintian Australia's standing in international metrology, maintain Australia's standards for physical quantities, and provide and support calibration services for the national measurement system.** (33%)

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

2 Completion of a cryogenic current comparator to upgrade NML's standard for electrical resistance.

3 Completion of a preliminary study on the design and construction of a transfer electric field probe and its calibration system with DIST to provide traceability for electromagnetic compatibility (EMC) measurements in Australia.

4 Completion of an intercomparison between two trapped-ion frequency standards to evaluate their stability; completion of a two-way time transfer experiment in collaboration with the United States Naval Observatory and National Institute of Standards and Technology (US).

5 Completion of an international comparison of spectral responsivity measurements from trap detectors referenced absolutely to a cryogenic radiometer.

6 Coordination of the 22-nation Asia/Pacific Metrology Program (APMP), and completion of Stage 2 of a collaborative program to gain international recognition of Indonesia's national standards of measurement.

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

7 With an industrial partner, continuation of improved engineering and field trial demonstrations of SQUID-based magnetometers for large-area mineral exploration.

8 In collaboration with an industrial partner and the University of Wollongong, establishment near Liverpool of the first phase of a pilot plant for high-temperature superconducting wire.

9 Following the establishment of a biosensor prototype development group at AWA Microelectronics, Homebush, achievement of scheduled milestones in the commercialisation plan for the CRC for Molecular Engineering and Technology.

10 In association with the CRC for Mining Technology and Equipment, development and field trialing of high-frequency ground-probing radar systems for bore-hole applications and machine guidance operation within the Australian coal industry.

11 Establishment and expansion of relationships with a Brisbane based SME, with a view to enhancing its competitive international position through innovative medical diagnostic instrumentation.

**Develop thermal, magnetic and electromagnetic technology of current or potential value to Australian industry, and develop ozone assessment models for environmental evaluations.** (17%)

12 Continued development of a two-dimensional stratospheric model for assessing the impact of supersonic aircraft on ozone; participation in the international model intercomparisons coordinated by NASA; in collaboration with the CRC for Southern Hemisphere Meteorology, continued development of a three-dimensional atmospheric model, taking prime responsibility for the chemistry in that model.

13 With the Division of Manufacturing Technology, development of diagnostic and modelling techniques of plasma-based processes for the destruction of ozone-depleting substances, and assistance in commercial application of the technology.

14 In collaboration with the CRC for Materials Welding and Joining, development of a state-of-the-art model for the Gas Metal Arc Welding process, including studies of the formation and detachment of liquid metal droplets and their interaction with the arc column.

15 In collaboration with Transfield Technologies and Australian Defence Industries, completion of the design, construction and testing of laboratory and pre-production prototypes of two novel electromechanical controllers.

16 Completion of the design, construction and testing of laboratory and pre-production prototypes of two novel electromechanical controllers, in collaboration with Transfield Technologies and Australian Defence Industries.

17 Completion of Stage 4 of a contract with Pacific Grid to study and test the characteristics and electrical performance of various types of insulating oils; measurement of the electrostatic charge tendency from ageing and defective equipment; and investigation of this characteristic as a diagnostic tool.

**Develop acoustical, ultrasonic, and surface mechanical technologies of current or potential value to Australian industry.** (25%)

18 Application to the needs of Australian aerospace and marine manufacturers of the results of a previous collaborative research project with Boeing on the non-destructive testing of bonded structures, using acoustic and ultrasonic techniques.

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

20 Extension of overseas marketing arrangements for the Ultra-Micro Indentation System (UMIS) to Japan, and implementation of arrangements for manufacture of the total system in Australia for the world market.

21 Development of the Filtered Arc Deposition System (FADS) precision surface coating technology for application to Australian tool, die and instrument manufacture, in particular with Surface Coating Technologies Pty Ltd and Nulite Systems International Pty Ltd.

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

**Develop optically-based technologies and instrumentation of benefit to Australian industry, and maintain a scientific base in optics through provision of optical fabrication, coating and metrological services.** (10%)

23 With a major tyre manufacturer, completion of the prototype stage of an instrument for in-process dimensional measurements on extruded rubber.

24 With support from industry sponsors, completion of a collaborative project with the Division of Exploration and Mining on the development of techniques for remote measurement of highwall and muck-pile profiles.

25 In collaboration with an industrial partner, completion of the development of instrumentation for the measurement of oil-layer thickness on rolled metal product.

26 Demonstration of improved methods for the production of etalons using area-selective deposition techniques to fine-tune the optical thickness of substrate; production of etalons for customers in Australia, the United States and Japan.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $20,237,000 |
| External funds | $7,782,000 |
| **Total Expenditure** | **$28,019,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 25% | 28% | 29% |

*estimates as at June 1995

# 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

- 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, CRC for Diagnostic Technologies and the Biomolecular Research Institute (a joint venture between CSIRO and the Strategic Research Foundation).

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Gene Shears* - MDP1

*Novel Management Techniques for Plant and Plant Product Pests* - MDP2

*Biomaterials and Medical Devices* - MDP13

*Biosensors* - MDP27

## Specific Objectives & Planned Outcomes

**To acquire knowledge of the structure of protein molecules relevant to the development of new pharmaceuticals.** (10%)

1 This program forms part of the Biomolecular Research Institute, a joint venture between CSIRO and the Strategic Industry Research Foundation (SIRF). The percent resources shown do not include the matching funds from the SRF. (MF2)

2 Human trials with anti-influenza compounds developed from CSIRO research in collaboration with BIOTA Holdings continued by Glaxo. (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 proteolytic enzymes and fatty-acyl conjugates.** (20%)

3 Establishment of the CRC for Diagnostic Technologies and initiation of research projects into library technolgy, bi-specifics and expression systems.

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

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

6 Evaluation of the delivery and efficacy of a number of fatty-acyl drug complexes with Fauldings.

**To design, develop and evaluate novel regulators for gene targeted therapies, particularly for acquired human diseases.** (21%)

7 Design and evaluation *in vivo* of minizymes with improved cleavage activity against therapeutically important targets. Development and testing of new transfection reagents for delivery of nucleic acids.

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

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

**To develop anti-viral compounds based on the structure and function of viral regulatory proteins and molecular mechanisms employed in virus replication cycles.** (13%)

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

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

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

12 Continuation of electron microscopic and protein crystalization analyses of purified insulin receptor domains and their complexes with antibodies and/or ligand in collaboration with commercial partner and GIRD funding.

13 Elucidation of molecular mechanisms involved in insulin receptor signaling pathways with particular emphasis on those controlling glucose transport.

14 Structural characterisation of a natural product with insulin-like effects.

15 Initiation of studies to express the rat obesity gene product for 3D structural studies and receptor cloning strategies.

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

16 Evaluation of *in vivo* trials of collagen-based biomaterials.

17 Expression of two enzymes involved in collagen biosynthesis in functional forms.

18 Biological components of surface chemistry optimised for persistence of cell attachment.

19 Evaluation of novel commercial candidate materials for use in artificial cornea applications.

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

21 Evaluation of synthetic inhibitors of heparanase enzymes as inhibitors of vascular smooth muscle cell activation.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,076,000 |
| External funds | $4,150,000 |
| **Total Expenditure** | **$14,226,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 32% | 29% | 32% |

*estimates as at June 1995

# 9. Division of Chemicals and Polymers (IIT)

## Objective

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

## Strategy

The chemical industry is one of the largest value-added mainstream sectors in the Australian economy. However, Australia is a net importer of chemicals, adding about $3 billion to the negative trade balance each year. The chemical industry is of vital importance to the Australian economy and will find increasing relevance in the shift from a nation of low value-added exports to a manufacturing nation exporting high value-added products.

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

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

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

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Biomaterials and Medical Devices*** - MDP13

***Urban Water Systems*** - MDP16

***Biosensors*** - MDP27

***Smart Manufacturing*** - MDP28

## Specific Objectives & Planned Outcomes

**Generate biologically active chemicals for evaluation in crop protection, and investigate pre-industrial scale production of fine chemicals to determine optimum conditions for maximising outputs.** (20%)

1 Synthesis of new biologically active compounds for evaluation as environmentally friendly insecticides, herbicides and fungicides. (MF1)

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

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

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

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

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

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

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

**Develop new polymer products utilising expertise in monomer synthesis, polymerisation processes, physical/chemical characterisation and thermal processing of plastics.** (16%)

8 Formulation of carbon fibre-epoxy resin composites and their use to construct automobile parts with Holden Special Vehicles.

9 Development of compatibilising agents for polypropylene-polyethelene blends by reactive extrusion.

10 Generation of a new class of pigment dispersants using CSIRO's macromonomer chemistry.

11 Development of prototype dental composite materials based on CSIRO's ring-opening monomer technology.

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

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

13 Materials for high performance contact lenses and artificial corneas developed and evaluated. (ED3)

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

15 Assistance provided in the development of security devices.

16 Commercialisation of membrane reactors for effective chemical synthesis.

17 Further upgrade of microwave chemical reactors.

**Apply knowledge of surface and colloid properties of materials to enable manufacturers to create new products and to meet environmental standards and to apply physicochemical knowledge to the treatment of industrial effluents.** (12%)

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

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

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

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

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

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

24 Demonstration of novel device for the recovery of valuable components from waste explosive emulsions.

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

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

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

27 Achievment of the commercial development of the RACOD (Readily Assimilable Chemical Oxygen Demand) instrument.

28 Development of a novel process for removal of ammonia from waste waters.

29 Development of processes for the treatment of storm water.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $11,160,000 |
| External funds | $6,800,000 |
| **Total Expenditure** | **$17,960,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 35% | 38% | 39% |

*estimates as at June 1995

# 10. Division of Manufacturing Technology (IIT)

## Objective

**To develop and exploit new and improved products and processes which will increase Australia's competitiveness in selected areas of manufacturing in the metals and related industries, particularly those that are export oriented.**

## Strategy

- Conduct research and development in advanced manufacturing technologies by the application of skills in electronic, materials and mechanical engineering and computer science in accordance with CSIRO, Institute and Division priorities. Collaborate with other CSIRO Divisions to supplement core skills.
- Collaborate with universities and industry across a range of basic, applied and commercial activities by active participation in Cooperative Research Centres.
- Increase the transfer of technologies from the Division's research to industry by establishing business plans for the Division as a whole and for key research programs, setting up specific commercialisation strategies and improving interaction with client companies.
- Maintain effective links with manufacturing industry by participation in specialist industry centres, such as the Australian Automotive Technology Centre, and in industry and professional associations.
- Taking a leading role in the international research programs on Intelligent Manufacturing Systems.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Magnesium Alloys*** - MDP9

***Magnesium Production*** - MDP10

***Process and Maintenance Optimisation in Manufacturing*** - MDP15

***Smart Manufacturing*** - MDP28

## Specific Objectives & Planned Outcomes

**Develop diecasting processes for non-ferrous metals and alloys, and generic elements of casting and solidification technology.** (24%)

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

2 Investigation of influence of operating parameters on the structure and properties of low pressure diecast aluminium alloys and squeeze cast aluminium-matrix composites. (MF3)

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

4 Further development of iron-chromium-boron alloys for high temperature tool and die applications.

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

**Develop high productivity processes and consumables in arc welding technology.** (15%)

6 Development of core formulations aimed at the commercialisation of rutile-flux wires with improved mechanical properties, a barium-free self-shielded wire, and improved basic-flux and metal-cored wires for use with pulse welding.

7 Development of a robotic cell integrated with a CNC work station for high current plasma arc welding.

8 Extension of the high current GTA welding process technology for out-of-position welding in the joining of aluminium plate in shipbuilding applications.

9 Development of a tandem-head laser based welding prototype.

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

11 Development of a model for distortion in welding process and of means to ameliorate distortion problems.

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

12 Development of improved arc-based hard surfacing technology.

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

14 Development of plasma transferred arc surfacing technology for aluminium alloys.

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

**Develop the technology of electrically generated plasmas.** (16%)

16 Support provided for R & D based on laboratory studies and mathematical models of the PLASCON™ process to enable development of a commercial pilot plant for the destruction of ozone depleting substances, such as Halons and CFCs. (ED5)

17 Improved performance of the PLASCON process. (ED5)

18 A new method for the manufacture of pipe.

19 Using the plasma smelting laboratory, prediction of the operating parameters and running costs of a full scale plasma smelting furnace.

20 A facility to demonstrate the feasibility of directly making seamless thin walled steel tube from the melt.

21 Improved technologies based on electrically generated plasmas for manufacturing applications.

22 Establishment of the novel plasma cutting process control and torch-on-line diagnostic technologies for commercialisation.

23 Commercialisation arrangements for the manufacture and marketing of the Electronic Spray System completed.

**Develop vision sensing and real-time system technologies for applications in manufacturing, food processing, service infrastructure and mining industries.** (22%)

24 Completion of feasibility evaluation of the application of vision and other sensing technologies for the detection and acquisition of images of aircrafts landing at civil airports.

25 Development of a prototype vision processing system to identify and classify cracks on paved roads at highway speeds.

26 Establishment of a project to develop generic vision technologies under structured lighting for application to manufactured products, such as roof tiles and the development of a proof-of-concept prototype.

27 Establishment of the feasibility of vision sensing for inspection and sorting of pineapples and the completion of design specification for a prototype construction.

28 Development of colour machine vision techniques to find defects in products for food and plastic industries.

29 Demonstration of machine vision control on ACIRL's model dragline and structuring an industry consortium to further develop and implement the technology on a production machine.

30 Development of generic machine vision and electro-hydraulic control technology for underground mine automation.

31 Completion of a scoping study on the requirements for a virtual dragline training simulator.

32 Correlation of wear types with the particle attributes calculated through computerised processing of optical microscope images of used oil filtergrams.

33 Design and manufacturing of a tungsten carbide cutter for hard rock mining machinery.

34 Development of a laboratory test rig to demonstrate the feasibility of AC hydraulics in hard rock excavation.

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

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

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

37 Research programs formulated with BHP and international partners within the framework of the IMS program.

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

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

39 Integrated software for optimising sheet metal fabrication.

40 Completion of beta tests of the RETA scheduling software.

41 Development of diagnostics and maintenance tools as part of the Process and Maintenance Optimisation in Manufacturing MDP.

**Develop and commercialise software in the field of product design and assembly.** (5%)

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

43 Development of a method and software tools to speed up product design phase. Design of concepts for parts planning software.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $12,403,000 |
| External funds | $6,760,000 |
| **Total Expenditure** | **$19,163,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 40% | 36% | 34% |

*estimates as at June 1995

# 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 as a basis for novel products in Australia's export performance is creating new opportunities for advanced materials and related technologies.

- Establish and maintain effective linkages with key companies and sectors of manufacturing industry.
- Develop improved materials (alloys, ceramics and composites) and more efficient materials processing techniques to add value to Australian raw materials and to increase the world competitiveness of Australian made products.
- Apply expertise in optical materials, X-ray and laser methods, and computational capabilities, to construct prototype equipment for materials inspection and remote sensing.
- Apply advanced electron-beam pattern generating expertise to create optically variable devices for the security industry, construct masks and other devices for the electronics industry and offer a machinery capability for parts and devices at the micro and nano size levels.
- Maintain an appropriate balance between technological development and strategic research.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Aluminium Production*** - MDP5

***Magnesium Alloys*** - MDP9

***Magnesium Production*** - MDP10

***Smart Manufacturing*** - MDP28

## Specific Objectives & Planned Outcomes

**To apply fundamental skills in materials and corrosion science, materials processing and coatings technology to the development of improved materials and methods of production for Australian industry.** (17%)

1 Completion of the assessment of dispersion hardened iron aluminides to support patent application. Development of kilogram scale clean melting facilities for reactive alloys and intermetallics.

2 Development, in conjunction with Division of Mathematics and Statistics, of the first phase of a computer simulation of the continuous strip casting process. Completion of aluminium strip production trials.

3 Assessment of trace element effects in AZ91E alloys completed. Establishment of creep resistant magnesium alloy project in conjunction with commercial partner.

4 Establishment of competitive rare earth conversion coatings technology for aluminium alloys, and zinc- or zincalume-coated steel, and delivery of the aerospace part of the technology to a commercial partner.

5 Development with commercial partners of surface coating technology for copper pipes for water reticulation.

6 Development of new lead overlay bearing alloy for high performance automotive engine applications, with technology transfer for commencement of export production.

**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.** (24%)

7 Development of a commercially viable manufacturing process, in conjunction with industrial collaborator, for production of alumina based refractory products.

8 Development of new refractory systems based on controlled microcrack toughened materials.

9 Fabrication and test evaluation of non-consumable anodes for improved smelting operations as part of MDP project on inert anodes with the Division of Minerals.

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

11 Continued support and expansion of refractory testing service for Australian mining and manufacturing companies in collaboration with other Divisions and Institutes.

**To develop solid oxide fuel cells for electricity generation.** (9%)

12 Construction and testing of cell stacks up to 1kW capacity. Continued support for the technological and manufacturing capabilities of Ceramic Fuel Cells Ltd.

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

13 Construction of dedicated laser atom cooling apparatus for prototype atom interferometer.

14 Development of suitable diode laser systems for Atomic Absorption spectrometry.

15 Completion of airborne multispectral scanner for environmental monitoring applications.

16 Geophysically Integrated Mineral Mapping Spectrometer (GIMMS) completed for flight trials.

17 Construction of a prototype phase contrast X-ray imaging system.

**To apply chemical and chemical engineering skills to the synthesis, processing and utilisation of advanced materials, particularly those of Australian origin or of importance for Australian manufacturing industry.** (14%)

18 An evaluation of the application of the CSIRO extraction process to the recovery of rare earths from monazite.

19 Process optimisation and commercial viability assessment of carbon fibre pilot plant production. Develop lithium ion rechargeable battery technology for traction application.

20 Completion of negotiations with Stage 1 partners for the second stage of development of the CSIRO process for extraction of titania from ilmenite.

**To develop techniques to optimise packaging and to develop environmentally benign packaging systems.** (6%)

21 Development of new biodegradable packaging for commercial partners.

22 Development of novel low cost membranes for packaging of food products for commercial partners. (RM2)

**To design and fabricate, using electron lithography techniques, innovative products and processes based on the physical properties of arrays of microscopic surface relief structures for industrial optical, electrical and mechanical applications.** (11%)

23 Design and fabrication of EXELGRAM Optically Variable Device (OVD) master plates for optical security and anti-counterfeiting applications in support of the requirements of CSIRO's international licensees.

24 Further development of the EXELGRAM and OVD technology base for a wider range of optical security applications and customer requirements.

25 Development of OVD simulation software for design bureau applications in Europe and elsewhere.

26 Development of a design and fabrication capability for Surface Acoustic Wave (SAW) devices for very high frequency filtering and microwave applications.

27 Development of a fabrication and prototyping capability for specialized opto-electronic devices that enhances and complements existing Australian opto-electronic technology centres.

28 In collaboration with Australian industry, development of injection moulding applications of novel microstructure patterns generated by electron beam lithography techniques.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,715,000 |
| External funds | $6,052,000 |
| **Total Expenditure** | **$16,767,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 32% | 36% | 37% |

*estimates as at June 1995

# 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

The minerals, energy and construction industries together represent over 20% of Australian GDP, 50% of total Australian merchandise exports and approximately 60% of fixed capital investment. The efficiency of these industries is central to Australia's trade position, standard of living and overall comparative advantage. They represent a significant input to all forms of economic activity in Australia. Companies operating in these sectors are in an increasingly open and competitive world marketplace. Consequently, their continued and enhanced viability, and concomitant wealth generation potential, will increasingly rely on productivity improvements and new value adding processes and products that can only be achieved through the development and application of advanced technologies. To meet the increasing commercial and environmental pressures IMEC research is directed to the strategic and tactical needs of enterprises active in this most competitive arena.

- Align research strategies and planning closely with the business and operational philosophies and needs of clients.
- Maintain research and technical skills of the highest standard necessary for the provision of an appropriate knowledge base to serve industry needs in a timely and cost effective manner.
- Ensure that research is directed to the major technological needs, both present and emerging, of industry.
- Implement a structure and an outlook that focuses on delivery to explicit market sectors within IMEC.
- Enhance marketing and technology transfer strategies to facilitate industry co-investment in IMEC research.
- Strengthen synergies between the research efforts of groups within IMEC and between IMEC and other research bodies/providers or groups both internal and external to the Organisation.
- Achieve best management practices and a high level of management capability and accountability.
- Ensure recognition and support for the Institute from all stakeholder groups.
- Maintain an adequate funding base to support existing and emerging priority areas and to provide an ongoing, major contribution to the strategic research needs of the sectors served by IMEC.
- Ensure that the location of and availability of physical infrastructure fully supports and facilitates IMEC client applications, interactions and strategic research imperatives.

## Planned Outcomes

1 Improved marketing of IMEC research services through dedicated and outward-focussed activities.

2 More productive partnerships with clients and relationships with market sectors achieved through more explicit project formulation processes and heightened awareness of client needs and expectations.

3 Strategic relationships with key companies and industry associations developed, enhanced and employed in setting research strategies.

4 Research project development linked with the business development processes of major clients.

5 Appropriation funds invested to maintain and enhance IMEC's strategic research base and capability.

6 Redevelopment of sites at North Ryde, Clayton, Pinjarra Hills, Highett and Perth advanced to provide new accommodation and infrastructure appropriate to activity and client service needs.

7 Development of a more flexible and adaptable approach to building appropriately resourced research teams that respond to changing circumstances and new challenges in a timely, coherent and complete fashion.

8 Continuous improvement in the delivery of project outcomes to clients.

9 Improved support processes and systems making research service provision more efficient and cost-effective.

10 Development of more flexible career pathways for researchers and managers.

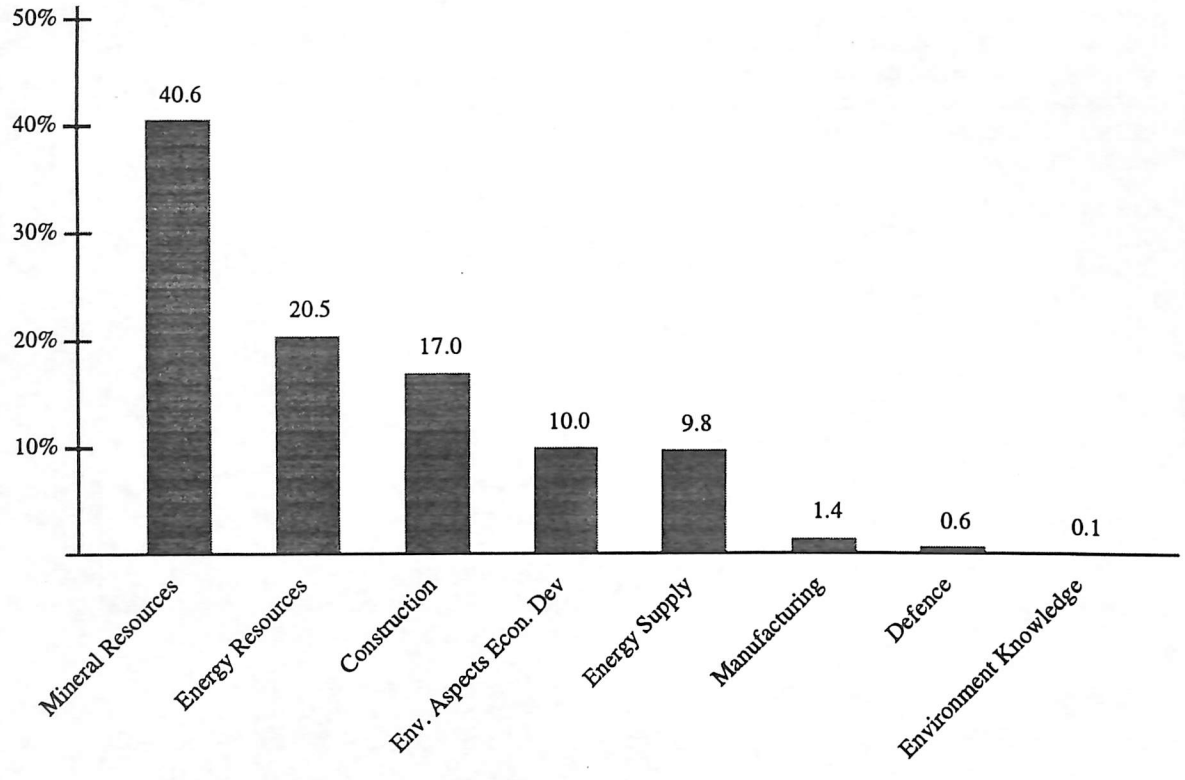
## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Building, Construction and Engineering | 183 | 115 | 7 | 305 | 17,054 | 9,543 | 26,597 |
| Coal and Energy Technology | 134 | 79 | 7 | 220 | 10,535 | 8,440 | 18,975 |
| Exploration and Mining | 148 | 72 | 10 | 230 | 14,409 | 12,864 | 27,273 |
| Minerals | 208 | 105 | 15 | 328 | 17,842 | 11,300 | 29,142 |
| Petroleum Resources | 46 | 27 | 3 | 76 | 4,861 | 4,866 | 9,727 |
| Minesite Rehabilitation | 14 | 4 | 1 | 19 | 739 | 2,480 | 3,219 |
| Delhi Road Site Services | 0 | 2 | 0 | 2 | 322 | | 322 |
| IMEC Institute Office | 0 | 6 | 6 | 12 | 2,618 | | 2,618 |
| TOTAL | 733 | 409 | 49 | 1191 | 68,380 | 49,493 | 117,873 |

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

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



# 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. Restructuring and reform of the industry has incorporated more R & D to bring it to international competitiveness.

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

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Alumina Production*** - MDP4

***Heavy Mineral Processing*** - MDP6

***Magnesium Production*** - MDP10

***Urban Water Systems*** - MDP16

***Climate Variability and Impacts*** - MDP29

***Air Quality*** - MDP30

## Specific Objectives & Planned Outcomes

**Improve the efficiency of planning and design and reduce the costs of operating facilities through the development of knowledge bases and decision support systems for planners and designers of housing, commercial and industrial structures, infrastructure and urban systems.** (32%)

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

2 Structural design enhanced in particular through improved undertanding of the behaviour and failure mechanism of building materials and structures exposed to fire, flood, wind, wind-driven rain and hail and earthquakes.

3 Development of broadband applications in construction.

4 Water and sewerage network optimisation for cities in Australia and Asia (currently Adelaide).

5 Report on design principles for community housing (Queensland).

6 Industry and demographic forecasting methodologies developed for the Housing Industry Indicative Planning Council and Telecom.

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

8 HOSPIM expert software enhanced and applied to hospital site selection.

9 Design criteria and Australian standard for structural glazing developed.

10 Further progress of strategic research related to building regulations to enable revision of the building code from a prescriptive format to a performance based format, initially in relation to fire regulations.

11 Quantitative justification provided for fire related building regulations.

**Improve construction processes and increase efficiency through off-site production, robotics and automation, decision support systems and electronic data interchange. Provide performance measures to allow reliable benchmarking relative to world's best practice standards.** (10%)

12 Radical re-engineering of key construction processes to make substantial improvements in time, cost and quality by eliminating non-value adding activities and applying more efficient management and logistics procedures.

13 A review of relations and practices in construction processes to gather and make operational the existing knowledge of 'lean production' principles and create a basis needed in re-engineering project management, design and construction processes.

14 Decision support systems for design and construction including artificial systems (expert systems, neural networks, pattern recognition, fuzzy logic systems).

15 Performance measures and benchmarks.

16 Cost effective protection systems for concrete floor slabs and rafts.

17 Measures and procedures to assist in determining the sustainability of buildings and infrastructure and their impact on the environment, including embodied energy, recycling and reuse of construction materials.

18 Standards relating to building envelopes.

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

19 Technologies for safe utilisation of municipal and industrial solid wastes in building products.

20 Composites developed with recycled rubber and surface treatments for controlled rubber-polymeric matrix adhesion.

21 Enhanced knowledge of stone properties, geological characteristics, selection criteria, durability prediction and construction techniques in the Australian building stone industry.

22 Minimisation of the total life cycle cost of metallic building products; definition of the microclimatic regimes in the envelope of buildings; development of accelerated tests to assess durability; methodology to estimate life and life prediction models.

23 Develop new techniques for assessing occupant exposure to indoor air pollutants.

24 The main factors in bonding identified, their range in Australia quantified and the principle mechanisms of bonding with common masonry materials determined.

25 The bonding ability of polymers and composites improved and controlled.

26 The deterioration of plastics pipeline materials and systems quantified and pipline installation performance, maintenance and rehabilitation improved.

27 Design tools for loaded and unloaded fire-rated steel-stud partition systems.

28 Fire test procedures for thermal insulation materials and air handling ductwork designed.

**Improve the life cycle cost of materials, components and systems, improve energy efficiency in buildings, improve the performance of engineered products and services, reduce industrial energy usage and costs in industrial processes and improve management of land, air, water and noise pollution.** (36%)

29 Prediction of internal air flows, the dispersal of pollutants in buildings, the spread of smoke and pollutants from fires.

30 Thermal analysis software provided for use by building designers, engineers, architects and regulatory authorities.

31 Techniques for non-intrusive investigation of combustion. Thermally and environmentally improved combustion equipment.

32 Further development of artificial intelligence based technology to analyse the surface of structures to detect, classify and rate severity of defects, assess structural integrity and likelihood of failure.

33 Large area, low cost, conformable, high effectivity heat exchangers.

34 Enhancements to the efficiency-in-use of large infrastructure system networks and improved solutions to large scale network problems.

35 Numerical techniques and computer software to handle the class of flows which involve injection and mixing with free-surfaces, treatment of multiple fluid phases, swirl and solid particles in turbulent flows, and flows over bluff bodies.

36 Demonstration of design for improved wear performance in equipment.

37 New methods for measuring fluid flows, in particular multiphase flows by mechanical and optical means.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $17,054,000 |
| External funds | $9,543,000 |
| **Total Expenditure** | **$26,597,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 26% | 36% | 35% |

*estimates as at June 1995

# 14. Division of Coal and Energy Technology (IMEC)

## Objective

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

## Strategy

While profit margins in the Australian coal industry remain low, the increased attention given by the coal, power generation and metallurgical industries to coal R&D will provide opportunities to increase external funding and support research to meet both long and short term needs. These industries are also showing increased interest in moving towards greater environmental acceptability and this, plus growing worldwide demand for new technologies and processes which will provide cleaner production and improved waste management, will support the development of a strong environmental focus within the Division.

- Enhance ties with the coal industry and other research organisations to pool expertise and produce coordinated and effective projects which will enable the Division to be more competitive in seeking an increased share of the limited funding available for coal research.
- Develop a balanced portfolio of research projects which attracts industry support and incorporates both strategic and applied research.
- Enhance marketing and commercialisation strategies to maintain industry funding levels and facilitate the transfer of technology.
- Promote the environmental benefits gained by improved and new processes and technologies.
- Strengthen synergies between the Division and research groups both within and outside CSIRO.
- Foster creative, productive interaction between staff to develop a stimulating work environment.
- Create a continuous improvement culture within the Division to improve the delivery of quality R&D.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Coastal Zone Program* - MDP21

*Minesite Rehabilitation* - MDP24

*Air Quality* - MDP30

## Specific Objectives & Planned Outcomes

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

1 Binderless briquetting progressed to commercial implementation. (EX4)

2 Demonstration scale projects on coal recovery from tailings, ultraclean coal and dewatering-agglomeration substantially progressed or completed. (EX4)

3 Pilot plant projects on selective breakage, size classification and coarse and fine coal centrifuges established. (EX4, MI2)

4 New projects on ash/moisture washabilities, coal and tailing filtration, rapid turn round analyses, improved sensor and instrumentation and process control of coal. (EX4)

5 Proof of concept projects completed and scale-up initiated for slurry sub-division and turboflotation. (EX4, MI2)

6 Implementation of marketing and development strategies commenced as recommended by external consultants. (EX4)

7 Initiation of project on Coal Quality Expert Systems to facilitate integration of coal preparation, utilisation and environmental control (EX4)

8 Increased CSIRO collaboration in selective breakage, sensors instrumentation and process control projects. (EX4)

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

9 Current projects on coal reactivity furnace fouling, coal ash trace element analysis and $NO_x$ and $SO_x$ advanced. (EX4)

10 Continued development of unique equipment to assess the PCI properties of Australian coals to match specific industry needs.

11 A new laser reactor developed for high temperature/pressure single particle coal combustion kinetics.

12 Development of capability for evaluating coking coals and blends.

13 A new project on high temperature/pressure gas cleaning in support of advanced power generation technology. (EX4)

14 Laboratory-scale entrained flow pressure gasifier commissioned. (EX4)

15 Further studies of the measurement and control of coal ash viscosity of Australian coals in IGCC systems. (EX4)

16 Leadership and guidance provided for the new CRC for Black Coal Utilisation.

17 Prototype capacitor of at least 3.0 whr/kg energy density constructed.

**Develop processes and equipment for the expanded use of Australian natural gas resources.** (10%)

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

19 Commercial partner found for the development of a new process for the direct reduction of iron ore by natural gas.

20 Development of an inter-divisional project on coalbed methane. (EX2)

21 Catalysts for the oxidative coupling reaction of natural gas tested.

22 Completion of project testing a new method for the separation of the catalyst particles from heavy waxes.

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

23 Commercialisation of new process for the destruction of PCBs in transformer oils.

24 Demonstration of the technical and economic feasibility of recycling hydrogen fluoride formed during combustion of spent pot liners used in the manufacture of aluminium metal.

25 Demonstration of the technical feasibility of a new process for the destruction of tetraethyl lead in similar compounds.

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

27 Industrial support obtained for a new project on the decontamination of capacitors containing PCBs.

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

28 Ok Tedi Mining Ltd provided with a comprehensive interpretation of the process controlling the partitioning and fate of mine-derived copper in local rivers. (ED7)

29 Evaluation of the toxicity of copper in waters receiving mine effluents using algal bioassays.

30 The source and distribution of mercury in waters, sediments and biota in Lake Murray, PNG identified. (ED7)

31 A suite of soil bioassays for the assessment of contaminated sites developed and applied.

32 Successful demonstration of the laboratory scale removal of selenium from power station wastewaters.

33 Successful performance of a constructed wetland designed to remove contaminants from wastewater from the Ranger mine. (ED7)

34 Commercial partner obtained for the development and production of instruments for monitoring sewage contamination.

35 Demonstration of new procedures for investigating mixed gas transport through coal. (ED7)

36 Completion of a model of selfheating in underground goafs from longwall coal mining and presentation of results to the coal industry. (ED7)

37 Software and expertise resulting from the MAQS study for Sydney transferred to the NSW EPA.

38 Evaluation of field measurements on the nearfield impact of the Kwinana industrial plume in the thermal internal boundary layer.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,535,000 |
| External funds | $8,440,000 |
| **Total Expenditure** | **$18,975,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 39% | 45% | 47% |

*estimates as at June 1995

# 15. Division of Exploration and Mining (IMEC)

## Objective

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

## Strategy

Rapidly changing commodity prices for minerals and coal over the past decade have forced producers to seek to maximise their return by focussing on larger, more profitable mines and reduced costs of production. Indications are that further productivity gains can be achieved by even more extensive use of advanced technologies. The Division aims to:

- Establish and maintain high level relationships with key companies and industry bodies, particularly those working internationally to provide for joint planning and objective-setting, ensure adequate funding of research activities, and facilitate adoption of research results.
- Realign the physical resources of the Division through restructuring of Programs, to optimise the effectiveness of the Division in matching the logical continuum of company activities (area selection, area evaluation, deposit delineation, excavation design and engineering, mining technology and equipment and mining environmental management).
- Build strong commercialisation alliances with selected mining equipment manufacturers, and speed the transfer of technology to industry through development of reliable products.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Integrated Geological, Geophysical, Mine Design Visualisation*** - MDP7

***Iron Ore Processing*** - MDP8

***Minesite Rehabilitation*** - MDP24

## Specific Objectives & Planned Outcomes

**To develop more effective concepts and technologies to optimise the exploration industry's capability to identify prospective ground and, accordingly, select tenements with the highest potential for economic mineralisation.** (11%)

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

2 Deep lithospheric mapping for diamondiferous kimberlites and lamproites.

3 Hydrothermal copper/gold deposits in Australia and the Pacific Rim - Resistate indicator minerals - Modern ore-forming environments - Hydrothermal fluid characterisation.

**To produce an integrated geodynamic synthesis of the larger scale rock deformations and geological processes that have formed the Australian continent over geological time and to improve the success rate for exploration companies looking for new world class minerals and energy deposits.** (10%)

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

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

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

7 Construction of an integrated tectonics-geophysical analysis package.

8 Development of the AUSTRALIS analytical facility.

**To develop more effective methods and technologies to efficiently locate world-class ore deposits, in particular gold, base metals, iron and diamond deposits, in terrain types of strategic importance to Australia and the Australian mineral industry world-wide.** (15%)

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

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

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

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

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

14 Advanced exploration geophysics and imaging software (AEGIS).

**To dramatically improve exploration technology for Australian conditions. Key areas are electromagnetic (EM) including airborne, and airborne gravity.** (10%)

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

16 Improved signal/noise performance of Airborne Electro-Magnetic systems to detect targets to 300m depth under conductive cover.

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

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

**To develop technologies to improve the 3D evaluation and delineation of economic mineralisation.** (21%)

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

20 Integrated and interactive capabilities for modelling and visualisation of 3D geoscience data.

**To enhance the capability of mining companies to optimise excavation design, mine layout, and extraction so as to minimise dilution through an improved understanding of rock mass characteristics and its behaviour.** (11%)

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

22 New pre- and post-excavation design techniques to optimise mine design, scheduling and mineral extraction.

23 Enhanced geomechanical sensing technologies to forewarn against excavation instability.

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

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

25 Improved methods of production scheduling.

26 Geophysical characterisation of an orebody for production purposes.

27 Improved methods of controlled rock breakage.

28 Improved equipment technologies, particularly in the area of automation.

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

29 Improved methods for a safer operating mine environment.

30 Sustainable rehabilitation methods for reconstructed mining landscapes.

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

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

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $14,409,000 |
| External funds | $12,864,000 |
| **Total Expenditure** | **$27,273,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 40% | 47% | 48% |

*estimates as at June 1995

# 16. Division of Minerals (IMEC)

## Objective

**To deliver R & D outcomes to the Australian mineral and metal production industries that will benefit their efficiency, product quality and value adding prospects.**

## Strategy

On January 1 1995, CSIRO merged the Divisions of Mineral Products and Mineral and Processing Engineering to form the Division of Minerals. The Division's strategies for change are:

- Increase the effectiveness of strategic decision-making processes within the Division.
- Transform the whole of the Division into a customer-service-driven organisation. Expand the volume of the Division's business and hence the total benefits it can deliver to Australian industry.
- Increase the flexibility and responsiveness of the Division in relation to its customers' needs for research project teams.
- Ensure that R & D product quality meets customer needs and expectations.
- Ensure that the investment strategy for appropriation funds explicitly targets the future needs of customers for new expertise, facilities and technologies.
- Improve the efficiency of support services and the associated customers' perceptions of R & D costs.
- Enhance the Division's reputation for the efficient negotiation of sound and reasonable commercial agreements.

Generate an image and awareness of the Division as a service organisation that concentrates on the needs of its customers.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Alumina Production*** - MDP4

***Aluminium Production*** - MDP5

***Heavy Mineral Processing*** - MDP6

***Iron Ore Processing*** - MDP8

***Magnesium Production*** - MDP10

## Specific Objectives & Planned Outcomes

**To deliver R & D outcomes to the Australian mineral processing industry that will benefit its efficiency, product quality and value-adding prospects.** (29%)

1 Establishment of an AMIRA project on nickel flotation and process mineralogy.

2 Development and testing of strategies for counteracting the adverse effect of fine grinding on flotation recovery.

3 Development of an advanced model and scale-up procedure for high pressure grinding rolls.

4 Transfer of QEM*SEM technology to a modern SEM platform.

5 Linkage of the CSIRO ore group classification scheme to processing performance.

6 Development of on-line analysers for measuring the Fe, $Al_2O_3$ and Mn content of iron ore.

7 Development of on-line analysers for analysis of brown coal and measurement of pulverised coal mass flow.

8 Construction of the world's largest circulating fluidised bed cold model and generation of data for coal gasification start-up. (EX4)

9 Construction of an integrated hot pilot plant for circulating fluidised bed reforming of natural gas and demonstration of final proof of concept.

**To deliver R & D outcomes to the Australian metal products industry that will benefit its efficiency, product quality and value-adding prospects.** (28%)

10 Assist development and scale-up of HIsmelt to commercial status through physical modelling and computational fluid dynamic situations.

11 Assistance to licensees in the development and commercialisation of SIROSMELT technology. (MI3)

12 Identification and optimisation of conditions for producing anhydrous magnesium chloride and transferring this material to the electrolytic cells. (MI4)

13 Assessment of alternative technologies for electrowinning magnesium. (MI1)

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

15 Scaled-up production of Al and Mg to kg-scale by carbothermic reduction and evaluation of flowsheets for commercialisation. (MI1, MI2)

16 Identification of coating materials suitable for rapid deposition onto substrates.

**To deliver R & D outcomes to the Australian mineral-based products industry that will benefit its efficiency product quality and value-adding prospects.** (42%)

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

18 Improvement in industry clarification and thickening practice through identification of the hydrodynamic and process conditions required for optimal flocculation.

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

20 Reduction of the consumption of caustic soda through the development of methods for producing alternative 'desilication product' phases and by improving the efficacy of residue washing circuits.

21 Assistance in commercial plant implementation of the technology for removal of radioactivity from ilmenite feed stocks and downstream products.

22 Through optimisation of the chemistry and hydrodynamic mixing characteristics of the aeration step in the Becher process, demonstration of savings in infrastructure, maintenance and operating costs.

23 A commercially-viable model for the prediction of ilmenite reduction behaviour in the Becher process.

24 Determination of the mechanisms by which impurities and dopants influence the bulk specific gravity and crystal size of dead-burned magnesia.

25 Determination of the most efficient route for the production of flame-retardant grade magnesium hydroxide and provision of engineering data to support construction of suitable pilot plant.

26 Optimised active material and battery charging characteristics to increase the energy density and cycle life of lead-acid batteries for electric vehicle applications.

27 A gelled electrolyte lead-acid battery for remote power applications and electric bus propulsion.

28 Quantification of the advantages of on-line sensors for measurement of cyanide concentrations in carbon-in-pulp plants.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $17,842,000 |
| External funds | $11,300,000 |
| **Total Expenditure** | **$29,142,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 35% | 39% | 38% |

*estimates as at June 1995

# 17. Division of Petroleum Resources (IMEC)

## Objective

**To add value to Australia's oil and gas industry by working with industry to develop technology, locate strategic resources, develop the required understanding of Australia's reservoirs and enable efficient recovery of the resources they hold.**

## Strategy

Maintenance of Australia's high level of self-sufficiency in oil and gas is dependent on developing and extending the life of new and existing resources. As a participant in the Australian Petroleum Cooperative Research Centre the Division will:

- Develop long term research plans to achieve research directions, funding strategies and discipline base requirements consistent with CSIRO and industry priorities.
- Build on established relationships with industry to maintain guidance for strategic research directions.
- Develop discipline-based research activities consistent with the requirements of the Division.
- Continue to make technology available to industry for assessment and use.

## Specific Objectives & Planned Outcomes

**Generation and improvement of concepts using geochemical and petrological sciences to determine source rock potential, migration pathways and reservoir charge.** (36%)

1 Establishment of a commercial isotope analytical service for the environmental, minerals and oil markets through a selected service company. (EX1)

2 Finalisation of a research contract with a Japanese oil company for joint development of a laser micropyrolysis instrument. (EX1)

3 Completion of testing and commissioning of fluorescence microprobe. (EX1, EX2)

4 Completion of a demonstation study of organic parameter relationships. (Eval)

**Development of tools for characterising and interpolating reservoir heterogeneity for use in oil and gas reservoir development and management.** (13%)

5 Completion of statistical models and marketing through a third-party industry service company. (EX1)

6 Completion of a multiphase flow model for oil/gas/water mixes in complex petroleum reservoirs and incorporation into third party simulators via a commercial agreement. (EX1)

7 Commencement of a major research initiative to yield better estimates of relative permeability and residual saturation in petroleum reservoirs. (EX1)

**Development and assessment of technology to reduce drilling costs and increase productivity for wells drilled in the oil and gas industry.** (42%)

8 Commencement of a major new initiative to reduce drilling costs by modelling the drilling process and capturing field experience. (EX1)

9 Completion of a study of physical-chemical interaction between drilling fluids and shales for incorporation in technology to reduce time-dependent instability in wellbores. (EX1)

10 Commencement of a new initiative to provide a set of guidelines to optimise the rate of penetration of drill bits used by the oil and gas industry. (EX1)

11 Completion of a series of hydraulic fracturing tests with industry support. (EX1)

12 Incorporation of stress measurement technology developed by the Division into test procedures routinely conducted by industry. (EX1, EX2)

**Development of a fundamental understanding, and verification by field and laboratory investigation, of range of stimulation technologies for use in the oil and gas and coalbed methane industries.** (9%)

13 Completion of initial studies of extraction of methane from low permeability coal. (EX2)

14 Completion of a review of technology to recover oil and gas from reservoirs affected by in situ stress. (EX1, EX2)

15 Development of a major research project funded by industry and ERDC, to fund development of a commercial process for extraction of coalbed methane from low permeability coals. (EX2)

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $4,861,000 |
| External funds | $4,866,000 |
| **Total Expenditure** | **$9,727,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 49% | 50% | 51% |

*estimates as at June 1995

# 18. Institute of Animal Production and Processing

## Objective

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

## Strategy

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

- Allocate research and information resources to projects and manage these with a very strong focus on paying customers and outcomes in each of our business areas in accordance with CSIRO and Institute priorities and with advice from the CSIRO Agricultural Sector Advisory Committee and business area industry advisory panels.
- Ensure a balanced portfolio of research programs and skills which is driven by customer needs including clear differentiation of requirements for existing knowledge from research needs, and which is aimed at maintaining our long term effectiveness in areas which will maximise benefits to Australia.
- Ensure research and advisory services are appropriately priced so that appropriation funds are effectively allocated with a bias to public good and strategic research, provided future customers are identified for all such services.
- Continue to strengthen our working relationships with business enterprises, rural research and development corporations and public bodies.
- Continue to develop business and marketing plans for each business area, covering targeting of potential customers, prospective benefit-cost evaluations and market research to estimate benefits to the nation and potential customers, selection of the most appropriate intellectual property management and commercialisation strategies, and effective interaction with customers from business enterprises, industry organisations and government departments.
- Assist in development of sector innovation plans where appropriate.
- Improve the effectiveness and efficiency of research support services across the Institute.
- Develop strategies for managing targeted promotional and public relations activities by customer type and business area (eg rural events) and/or functional area (eg issues management). Foster a skills-based approach to promoting CSIRO agri-food, fibre and public health research, using teams led by communication area experts. Encourage participation by other CSIRO operating units with similar objectives.

## Planned Outcomes

1 Development of a new strategic plan of program priorities, future resource requirements and commercialisation strategies on a business area basis in collaboration with other Institutes, particularly IPPP. (Eval)

2 Completion of business area analyses and marketing strategies for red meats, wool and processed foods and further development of strategies for animal health products and aquaculture. (Eval)

3 Development and trialing of a CSIRO capabilities information kit for agri-food and fibre research to support commercialisation activities.

4 Development and implementation of a promotional marketing plan based upon allocation of resources by customer type and priority. Regular team planning and evaluation of promotional and public relations activities and feed back of results into forward planning exercises. Support of communication staff education, training and secondments where appropriate to underpin this approach.

5 Improvement of our level of interaction with small and medium enterprises through the provision of technical services and information to firms in relevant business sectors.

6 Implementation of an improved set of performance indicators for the Institute. (Perf)

7 Improvement of procedures, in consultation with the Corporate Business Department, for complying with accountability requirements on the benefits, costs and risks involved in commercial arrangements.

8 Continued implementation of the Board's policy for rationalisation of sites to achieve enhanced research synergies and reduce support costs by integrating; - the Parkville and Geelong laboratories of the Division of Animal Health at Geelong; - the Ryde and Geelong laboratories of the Division of Wool Technology at Geelong; - the Highett laboratory of the Division of Food Science and Technology with the Australian Food Research Institute at Werribee (complete Jan 1997); - the Adelaide and Glenthorne Laboratories of the Division of Human Nutrition.

9 Maintenance of a committment to maximising redeployment opportunities for potentially redundant staff, including the completion of skills exercises in all Divisions.

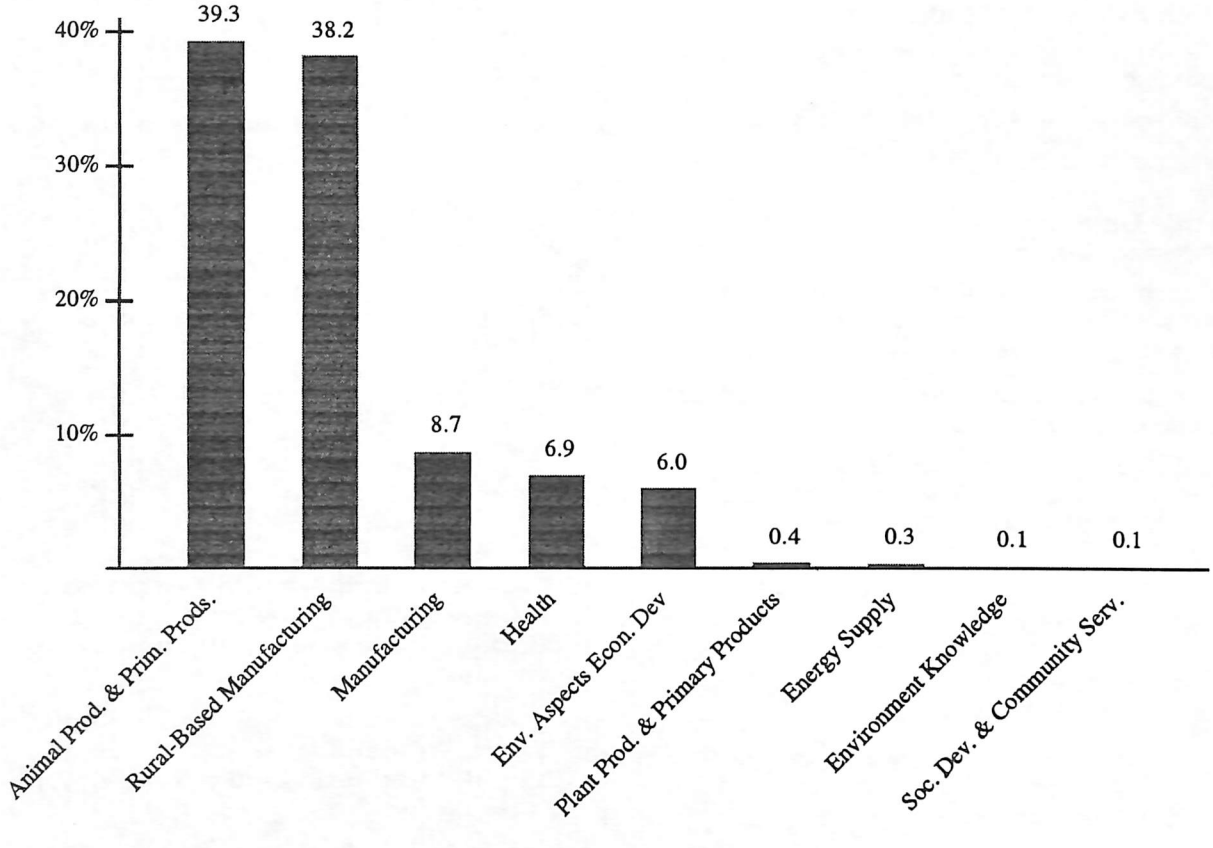
## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Animal Health | 115 | 50 | 7 | 172 | 7,738 | 5,708 | 13,446 |
| Australian Animal Health Laboratory | 66 | 110 | 4 | 180 | 5,388 | 8,238 | 13,626 |
| Animal Production | 128 | 77 | 7 | 212 | 10,175 | 6,230 | 16,405 |
| Food Science and Technology | 195 | 41 | 9 | 245 | 13,441 | 8,443 | 21,884 |
| Human Nutrition | 77 | 21 | 6 | 104 | 5,612 | 2,682 | 8,294 |
| Tropical Animal Production | 96 | 34 | 5 | 135 | 7,422 | 5,238 | 12,660 |
| Wool Technology | 179 | 124 | 13 | 316 | 10,987 | 16,519 | 27,506 |
| Biometrics Unit | 9 | 0 | 0 | 9 | 483 | 14 | 497 |
| Institute Headquarters | 0 | 11 | 6 | 17 | 2,900 | 190 | 3,090 |
| TOTAL | 865 | 468 | 57 | 1390 | 64,146 | 53,262 | 117,408 |

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

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



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

- 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 to complement the activities of State and Commonwealth disease control authorities.
- Collaborate with other bodies and institutions to facilitate research, obtain external funding for projects, and where appropriate, develop commercial opportunities to maximise the benefits to Australia of research results.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Gene Mapping* - MDP26

*Biosensors* - MDP27

## Specific Objectives & Planned Outcomes

**Develop vaccines and diagnostic test to control or eradicate the economically important bacterial diseases of livestock and poultry** (12%)

1 The chicken gamma interferon gene expressed and the therapeutic value assessed.

2 The transfer of sheep footrot diagnostic monoclonal antibody and gene probe technology to the State Regional Veterinary Laboratories completed.

3 Improved primers for the detection of enterohaemorrhagic *E.coli* developed.

**Develop sustainable control strategies for internal parasites of sheep and cattle** (18%)

4 Preliminary linkages established between genomic markers and resistance to *T. colubriformis* in sheep (AP3)

5 Formulation finalised to improve distribution of synthetic pyrethroid lousicides applied to back-line of sheep.

6 Biological control of free-living stages of sheep nematodes using nematophagous fungi demonstrated under grazing conditions.

7 Licence agreement finalised with industry partner to commercialise novel anthelmintic formulations for sheep and cattle.

**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** (7%)

8 A commercially acceptable formulation of CSIRO's lupinosis vaccine to be field tested in collaboration with the Western Australian Department of Agriculture.

9 Ability of a novel antimethanogen developed by CSIRO to reduce methane emission and increase production in sheep and cattle determined.

10 Immunological methods for detecting pyrrolizidine alkaloid and pyrrolic metabolite contaminants in animal tissues established.

**Improve the efficacy of current vaccines and the design and delivery of new vaccines for livestock** (13%)

11 Rationally attenuated vaccines for bacterial infection in pigs developed. (MF5)

12 The adjuvant potential of recombinant cytokines in vaccine formulations evaluated. (MF5)

13 The immune response to vaccine antigens delivered in bacterial vectors assessed. (MF5)

**Provide and develop diagnostic sciences relevant to the task of maintaining and improving the health of Australia's livestock, fish and shellfish, for the benefit of Australia's rural communities and international trade in agricultural products.** (27%)

14 The equine morbillivirus disease assessed in the laboratory.

15 Field studies at Wardang Island to assess the potential of rabbit calicivirus as a biological control agent for the wild rabbit.

16 The sequence of the entire genome of the v351 strain of rabbit calicivirus being used in the field trials completed.

17 A national serological survey for the presence of porcine respiratory and reproductive syndrome (PPRS) antibodies of the pig industry undertaken.

**Investigate the structure and genetic organisation and immune response to selected viruses for application in disease control and vaccine delivery.** (23%)

18 Pathogenic viruses for consideration as biological control agents for the cane toad identified.

19 Recombinant bacteriophages expressing virus peptides on their surface utilised in the development of a novel range of diagnostic test systems and their potential as vaccines explored.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $7,738,000 |
| External funds | $5,708,000 |
| **Total Expenditure** | **$13,446,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 36% | 31% | 32% |

*estimates as at June 1995

# 20. Division of Animal Production (IAPP)

## Objective

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

## Strategy

Of Australia's two major livestock industries, the beef industry appears poised for further growth and expansion, and the wool market is undergoing a substantial recovery with potential increases in sales, particularly into the Asian market. Further growth appears likely in the intensive livestock industries. Direct funding for animal research is likely to remain static for the foreseeable future. In this context the Division will:

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

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Gene Shears* - MDP1

*Fibre Utilisation* - MDP3

*Gene Mapping* - MDP26

*Climate Variability and Impacts* - MDP29

*Dryland Farming Systems for Catchment Care* MDP32

*CSIRO Aquaculture Initiative (CAI)* - MDP34

*Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities* - MDP36

## Specific Objectives & Planned Outcomes

**Improve the quality of meat for specific domestic and export markets and enhance the efficiency of its production.** (26%)

1 The optimal proportion and type of fibre required in the diets of feedlot cattle given "protected" nutrient supplements determined.

2 Feedlot trials with "protected" nutrients in North American countries initiated with commercial partner.

3 The optimal treatment conditions for the protection of anthelmintics for cattle established.

4 The feasibility of using "protected" nutrient technology for supplying amino acids, fatty acids and micronutrients to the prawn aquaculture system established.

5 Experiments providing information for incorporation into the AUSPIG decision support system on the effects of respiratory diseases on the physiological and biochemical responses of pigs completed.

6 The association between stress in pigs and the production of specific gene products that may be used as selection criteria for identifying stress tolerant and disease resistant pigs determined.

7 The AUSBEEF FRMS (Feedlot Management and Recording System) released and tested under commercial conditions.

8 Tests of the efficacy of a clenbuterol like antiidiotype vaccine on the growth and body composition of rats. (AP5)

9 Potential reasons for the poor reproductive performance of broiler breeder hens identified.

**Develop optimum procedures for improving wool quality and sheep production efficiency through superior breeding technologies.** (17%)

10 Completion of the next phase of a breeding program designed to develop breeding plans for fine and superfine wool genotypes, and to evaluate the effect of environment on these plans. (AP1)

11 Procedures for establishing sheep flocks that have improved nematode resistance extended into commercial flocks.

12 DNA fingerprinting methodology that enables identification of both male and female parents of progeny within the stud sheep industry. (AP1)

**Improve the textile quality of Australian wool, reduce the environmental impact of its processing and increase the efficiency of its production by manipulating skin function.** (21%)

13 Improved design specifications for a fleece retention system such that it is "fit-for-purpose" for the commercial release of the Biological Wool Harvesting Technology.

14 Demonstrated efficacy of recombinant plant chitinase against sheep blowfly larvae on the sheep's back.

15 Transgenic mice containing an anti-sense tyrosinase gene to eliminate ultimately pigmented fibres in sheep.

16 Tests of the efficacy in sheep of the recombinant microbial biochemical pathway for producing the essential amino acid cysteine.

17 The possibility of using sperm to deliver foreign DNA for the production of transgenic sheep investigated.

18 The role of several growth factors in the initiation, development and maintenance of the wool follicle evaluated.

**Improve the efficiency of grazing ruminants, particularly in seasonally fluctuating environments.** (36%)

19 Individual "stressors" that predispose sheep to the production of tender wool in seasonally fluctuating environments identified.

20 Management strategies and diets for the economic supplementation of sheep to prevent the occurrence of tender wool in seasonally fluctuating environments.

21 MRC research contract on methodology to quantify long-term changes in botanical composition of pastures using Geographic Information Systems completed.

22 A springless drive suitable for commercial application for ruminal controlled release devices for sheep and cattle.

23 The efficacy of a naturally occurring rumen defaunating agent on the productivity of sheep and cattle established.

24 The efficacy of immunisation against specific rumen microorganisms on the productivity of sheep and cattle established.

25 An objective specification system for Australia that is suitable for evaluating the productive capacity of hays.

26 A contract with a commercial partner to commercialise a procedure for predicting in advance of shearing the strength and length of wool produced on a regional basis.

27 The long-term viability in sheep of foreign rumen fungi with superior capacity to digest poor quality forage established.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,175,000 |
| External funds | $6,230,000 |
| **Total Expenditure** | **$16,405,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 38% | 33% | 35% |

*estimates as at June 1995

# 21. Division of Food Science and Technology (IAPP)

## Objective

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

## Strategy

The food industry has the capacity to greatly increase its exports, particularly of value-added processed foods to expanding markets in Asia. To do this it will need to improve its international competitiveness, address market specifications and provide "clean, green" foods of consistent quality.

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

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Process and Maintenance Optimisation in Manufacturing*** - MDP15

***Biosensors*** - MDP27

***Smart Manufacturing*** - MDP28

***CSIRO Aquaculture Initiative (CAI)*** - MDP34

## Specific Objectives & Planned Outcomes

**Develop commercially viable processes for manufacture of food ingredients, improve efficiency of ingredient manufacturing processes, and determine factors influencing functional properties of food ingredients as a basis for applications development, quality improvement and product marketing.** (21%)

1 Two cost-effective confectionery ingredients based on dairy products developed.

2 Method for the manufacture of recombined sweetened condensed milk improved.

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

4 Expansion of the range of polysaccharides and other products from plant cell culture by screening an extended range of plant species.

5 Methods developed for enhancing productivity of plant cell cultures for polysaccharide manufacture.

6 Development of technology for utilisation of new Australian fractionated whey protein ingredients in Japanese manufactured seafood products.

7 Reduced fat meat products developed in collaboration with licensee of gelled food products technology.

**Develop processes for efficient manufacture of cheese and cultured food products, improve their quality and flavour, and establish the efficacy of probiotic organisms in foods.** (8%)

8 Novel mechanism of bacteriophage resistance into commercial starter bacteria introduced.

9 Confirmation of suitability of laboratory mouse model for screening potential probiotic strains.

10 Identification of flavour-enhancing starter bacteria via *in vitro* laboratory technique.

11 Demonstration of the strategy for improved salt uptake in cheddar cheesemaking at commercial scale.

12 Establishment of effective DNA-based method for identification of bifidobacteria.

**Develop, modify and introduce technology and methods to provide a new processing environment conducive to technical skill, cooperation and efficiency. The aim is to achieve an initial productivity improvement of 20% by 1996.** (17%)

13 Development, construction and installation into a commercial meatworks of a production prototype semi-automatic machine for sealing bovine oesophagus prior to opening the hide.

14 Investigation and evaluation of new and existing technologies for the effective cleaning and sterilisation of the hide of a beef carcass prior to hide opening commencing in specific locations.

15 Development of procedures, design, manufacture and trialing of equipment to allow the safe and hygienic removal of beef heads and the automated delivery of heads to existing processing lines.

16 Procedures developed and mechanical equipment designed to assist head boning opeators in optimising food safety, head/cheek meat yield and value, and the OH&S risk.

17 Semi-automatic machine developed to prototype stage to remove 80% of the muscle and associated tissue from the forequarter of a side of beef in a conventional boning operation.

18 Development, construction and trialing in a commercial boning room of an operator-assisted prototype machine which places a particular size, shape and weight cut of meat into a vacuum pack and/or polythene bag.

**Improve the quality of meat and meat products, especially that exported with high added value.** (14%)

19 Development of procedures to improve the overall quality and image of Australian beef.

20 Establishment of specific co-product projects with a variety of meat and ingredient companies.

21 Development of new strategic projects to identify heat-stable crosslinked intramuscular collagen; establishment of collaborative links with INFRA and new contracts in applied research for Australian collagen processing industries.

22 Development of projects to determine collagen's contribution to meat texture; identification of the proteases active during conditioning of meat and fat quality attributes affecting meat quality.

23 Crosslinked edible films to coat meat developed for a major meat processing company.

24 Meat quality indices for first turn-off core cattle determined for Meat Quality CRC.

**Develop new and improved technologies for the packaging and distribution of foods for Australian industry.** (10%)

25 Application of oxygen scavenging technology to maintain very low oxygen levels in packaged products prone to oxidation during storage.

26 Assessment of various technologies for the production of anti-microbial films.

27 Identification of operating parameters for commercial application of a technology for the prevention of bitterness in Navel orange juice.

28 Production of a detector film for 'freshness' of foods prone to oxidation after packaging.

29 Survey of problems affecting the use of tinned and tin-free steel cans.

30 Commercialisation of the CSIRO Water Activity kit.

31 Assessment of the 1995 Code of Practice for the distribution of chilled and frozen foods.

**Enhance the ability of the Australian food processing industry to produce food reliably that is safe, has the required shelf-life, and complies with the safety and hygiene specifications of customers in domestic and export markets.** (14%)

32 Reduction of aflatoxin formation in peanuts by means of competitive non-toxigenic strains of *Aspergillus*.

33 Assessment of the incidence of fungal contamination during all stages of vine fruit drying and processing.

34 Determination of the ability of enterohaemorrhagic *Escherichia coli* to survive during production of fermented meats.

35 Determination of the impact of new processing technologies on the microbiological status of Australian beef and sheep meat.

36 Methods for identifying thermophilic bacteria and tracing their origin in milk powders developed.

**Determine factors responsible for the sensory quality of foods, and for taints and off-flavours.** (8%)

37 Determination of the influence on food acceptability of the pungency of ginger.

38 Apparatus to dispense precise mixtures of aromas (olfactometer) commissioned.

39 Prototype chemical sensory array for the detection of sweetness developed.

40 Prototype biosensor for water-borne pathogens developed.

41 Determination of the influence of diet and environment on the flavour of crustaceans.

42 Determination of the extent of migration of hazardous chemicals from selected packaging materials into high-fat foodstuffs.

**Transfer information and technology to the food industry and consumers.** (8%)

43 Information and technical publications provided to the food processing industries and consumers.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $13,441,000 |
| External funds | $8,443,000 |
| **Total Expenditure** | **$21,884,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 39% | 37% | 36% |

*estimates as at June 1995

# 22. Division of Human Nutrition (IAPP)

## Objective

**To provide appropriate research and development to improve human well-being and community health in Australia whilst at the same time enhancing the competitiveness of the Australian food industry.**

## Strategy

The continued interest and expectations by consumers and Government of the importance of nutrition orientated solutions to health problems in conjunction with the high level of interest by the food industry in producing foods that satisfy those expectations provides the framework for the Division's research and development strategy.

- To interact with the food and health care industries to examine and evaluate foods with optimal nutritional characteristics.
- To conduct the appropriate research to understand the basis of nutrition-related disorders particularly those that account for the greatest morbidity and mortality in Australia.
- To interact and collaborate with other CSIRO Divisions as well as research institutions to enhance Australia's skill base in the areas of health, food and the pharmaceutical industries.
- To utilise techniques for improving nutritional knowledge and behaviour in the community and to transmit that information to community health agencies and the food industry.

## Specific Objectives & Planned Outcomes

**Investigate the protective and cancer-causing factors in food with a view to assisting the food industry to develop foods with enhanced health benefits, and to advise health professionals and Government agencies.** (25%)

1 Novel plant substances, including antioxidants, for incorporating into food products to enhance genetic stability and protect against degenerative disease. (HE1)

2 Cereal and legume fibres and proteins, dairy 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.** (27%)

3 Development of extensive food consumption and consumer behaviour databases for use by food industry and health groups for planning and evaluating nutrition strategies in Australian and Asian communities. (HE1, RM5)

4 Identification of the nutritional needs of selected population groups and the assessment of the efficacy of food-based strategies to address these. (HE1, RM5)

**To assist the Australian food industry in identifying foods with health potential, foods that have the potential to prevent or retard the development of its degenerative diseases.** (21%)

5 Determination of nutrient contents in foods, their bioavailability and their mechanism of action. (RM5)

6 National and international trends in the health-potential of the food arena identified.

**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.** (27%)

7 Commercialisation of whey growth factor extracts through GroPep Pty. Ltd. to the Australian dairy industry.

8 Recombinant growth factors developed to target specific human health and agricultural applications.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $5,612,000 |
| External funds | $2,682,000 |
| **Total Expenditure** | **$8,294,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 35% | 36% | 34% |

*estimates as at June 1995

## Objective

**To research and develop technologies that enhance the competitiveness and sustainability of Australia's tropical animal industries.**

## Strategy

In order for the livestock industries of northern Australia to capture a long term share of the expanding markets of Asia, the industries will need to improve international competitiveness in the face of decreasing prices for primary products, address market specifications for primary as well as value-added products, provide "clean, green" products of consistent quality, and achieve this using sustainable management systems. To assist, the Division will:

- Provide the best possible environment for creative research in animal biology and management, in terms of facilities, funds, staff, training and appropriate awards.
- Ensure that our research portfolio consists of projects selected on the basis of their realistic potential to provide the most cost-effective benefit on a continuing basis.
- Provide supporting skills and structures to enable projects to meet their objectives, technology to be transferred to end users, and commercialisation to be effective.
- Increase our ability to perform these tasks by collaborating with others in CSIRO, other research providers, the funders of our research, the extension providers, and the users of our research results. Significant external collaborative commitments include participation in the Tropical Beef Centre (a joint venture between CSIRO, QDPI and VCQ) at Rockhampton, and the Molecular Animal Genetics Centre at the University of Queensland.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Gene Shears*** - MDP1

***Fibre Utilisation*** - MDP3

***Gene Mapping*** - MDP26

***Tropical Agricultural Exports*** - MDP33

***CSIRO Aquaculture Initiative (CAI)*** - MDP34

## Specific Objectives & Planned Outcomes

**Produce non-living vaccines against ticks, the tick fever organisms, Babesia spp. and Anaplasma marginale, buffalo fly, the larva of sheep blowfly and maintain chemical control of ticks and buffalo fly.** (32%)

1 Evaluation of recombinant tick antigens produced by Biotech Australia as potential components of the tick vaccine. (AP4)

2 Completion of any tick antigen characterisation required as determined jointly with Biotech Australia. (AP4)

3 Comparison of the activation of T-cell subsets and cytokine production during immune response to natural infection and vaccination with *B. bovis*. (AP4)

4 Completion of a vaccination trial of *Anaplasma marginale* antigens which induce T-cell proliferative responses *in vitro*. Testing of recombinant interferon-gamma as vaccine adjuvant and attenuating agent against *A. marginale* infection. (AP4, MF5)

5 Identification of buffalo fly fractions showing anti-fly activity in *in vivo* assays. (AP4.)

6 Evaluation and optimisation of ovine immune response to recombinant *Lucilia cuprina* peritrophic membrane antigens. (AP4)

7 Negotiation of collaborative agreement with a commercial company for further development of blowfly vaccine project. (AP4)

8 Examination of emerging chemical-resistant cattle tick strains, evaluation of potential new acaricides for control of resistant ticks and evaluation of acaricides with decreased residue problems.

9 New formulations and new insecticides tested on susceptible and resistant buffalo fly *in vitro* and *in vivo*.

**Develop advanced selection and crossbreeding technologies for beef cattle in the tropics and subtropics to improve product quality and the efficiency with which it is produced.** (14%)

10 Successful mating of 1000 Brahman females with sires of 9 breeds as part of the cross-breeding program for the Cattle and Beef Industry CRC.

11 Slaughter of representatives of first calf crop of the CRC's straight-breeding program to complete data collection on this group of animals, and production of further straight bred calves on collaborators' properties.

12 Complete analysis of three generations of data derived from Belmont selection line experiments.

13 Continuation of comparative evaluation of reproduction, growth, survival, resistance to environmental stresses and meat and carcase attributes of a range of straightbreds and 2-way and 3-way crossbreds as part of MRC project CS183.

14 Commencement of comparative evaluation of a range of genotypes for their suitability for the SE Asian live cattle trade.

15 Continuation of testing of the action of the major gene for tick resistance from the Belmont Adaptaur in five other genetic backgrounds.

# 23. Division of Tropical Animal Production (IAPP)

**Develop molecular genetic techniques for improved tropical animal breeding.** (16%)

16 Genetic markers for growth, conformation, tenderness, and fat colour evaluated in industry and research herds. (AP2)

17 Partial sequences and polymorphisms determined for genes for collagen types, calpain, and calpastatin, each having involvement in meat quality. (AP2)

18 Twenty microsatellite markers isolated from the prawn, *Penaes japonicus*.

19 Computer software developed for gene identification and gene tagging with markers. (AP1, AP2, AP3)

20 Assessment of scope for genetic selection for hide and leather quality.

**Develop reproductive technologies to: increase the reproductive potential of male and female cattle, increase the rate of livestock improvement and selectively suppress fertility of male and female cattle.** (7%)

21 New protocols that improve the efficiency of oestrus synchronisation and superovulation.

22 Demonstration of the feasibility of the use of LHRH agonists to reverse immunocastration.

23 Determination of the benefits of immunospaying in enhancing carcass quality of young cattle.

24 Completion of experiments on transgenic manipulation of sperm-specific gene expression.

**Improve the efficiency of production, the quality and the composition of carcase and by-products.** (15%)

25 Assessment of the growth response of cattle to a $\beta_2$-adrenoceptor vaccine in 3 trials, and identification of research needed to make the vaccine attractive to a commercial partner. (AP5)

26 Completion of assessment of a strategy to achieve sustained growth promotion of steers through alternate use of growth promoting agents with different mechanisms of action.

27 Assessment of the influence of animal age and growth rate on two biochemical markers for meat quality assayed by reverse transcriptase PCR.

**Improve nutrition of northern cattle and sheep by increasing energy and protein digestion through dietary and microbial manipulations.** (10%)

28 Establishment of 'proof of concept' that a mixture of recombinant bacterial strains benefit fibre digestion in mixed rumen culture. (PP2.)

29 Assessment of persistence of the modified microbes in ruminants, and effects on digestion in the rumen. (PP2)

30 Expression of further recombinant esterase genes in rumen bacteria in stable form. (PP2)

31 Evaluation of effect of solubilised lignin released from plant substrates on fibre digestion by recombinant microbes. (PP2)

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

33 Establishment of conditions under which practical chemical treatments improve digestibility of low quality lignocellulosic materials. (PP2)

**Generalise and extend existing therapeutic and vaccine technologies through the development of new systems for targeted delivery of antigens.** (6%)

34 Development of systems for efficient construction and production of new replicating rhabdovirus virus-like-particle (VLP) delivery vectors. (MF5)

35 Construction of an infectious, replicating BEFV vaccine vector. (MF5)

36 Establishment of the principle of selective cell targeting of rhabdovirus VLPs by using chimeric influenza glycoproteins. (MF5)

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $7,422,000 |
| External funds | $5,238,000 |
| **Total Expenditure** | **$12,660,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 34% | 36% | 35% |

*estimates as at June 1995

## Objective

**To increase the economic returns to Australia by being the world's most effective multidisciplinary wool, textile, and leather research organisation.**

## Strategy

As the wool industry recovers from the downturn of the last few years, the Division's funds from the International Wool Secretariat, our major source of external funds, will remain at the same level as last year. External resources available to the Division's Leather Research Program will remain approximately constant.

- With the IWS, plan a wool research and development program to achieve the required industry and CSIRO outcomes under the new procedure of management by milestones.
- 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 appropriate, to promote and support their adoption in Australia.
- Ensure that the Division's intellectual property is properly protected and exploited to the benefit of CSIRO and its stakeholders.
- Establish in consultation with the Australian Hides, Skins and Leather Industries a balanced research and development program encompassing strategic, tactical and technology transfer initiatives.
- Provide an environment which recognises achievement and through effective management, guidance and support, strive to attract and retain a practical, innovative, and perceptive workforce in a safe working environment that embraces the principle of equal employment opportunity.
- Ensure effective internal and external communication of the activities of the Division.

## Specific Objectives & Planned Outcomes

**Develop technology and other knowledge aimed at increasing consumer demand for products made from Australian wool.** (45%)

1 A new model described for the detailed structure of the outer surface of clean wool fibres, together with its implications for processes which involve surface treatments.

2 A laboratory-scale process developed for improving next-to-skin comfort of wool garments. (RM4)

3 Australian consortium established to develop products from modified wool.

4 Development of a novel method of inserting creases in trousers.

5 Fibre bundle strength instrument launched at ITMA, Milan.

6 Commercial agreement for the exploitation of the fabric imaging instrument for measuring fabric appearance characteristics.

7 Test method to assess the wrinkle performance of fabrics adopted by IWTO.

8 Sirolan Press Test to assess the pressing performance of fabrics released to industry.

**Improve the efficiency of conversion of raw wool to end products.** (28%)

9 Commercial agreement with yarn clearer manufacturer to develop a UV fluorescence method to detect and remove plastic contaminants from wool during winding.

10 New guidelines for registration of low-residue ectoparasiticides developed in collaboration with the National Registration Authority.

11 Environmental assessment of six Chinese scouring mills and training the best practice provided in collaboration with the International Wool Secretariat under an AusAID Program.

12 High productivity worsted card launched by our commercial partner.

13 Commercial agreement with comb manufacturer to develop and industrially prove high productivity combing technology.

14 Licensing Agreement on the Fabric Rapid Conditioning Process signed with commercial partner.

**Increase the efficiency of raw wool marketing.** (18%)

15 Commercial trials of Style measuring instrument completed.

**Develop new or improved processes for the handling, marketing, preservation and conversion of hides and skins into leather products.** (9%)

16 Commercial trials completed of a total chrome recycling system using evaporation.

17 Commercial trials completed of a new non-swelling salt-free pickling system.

# 24. Division of Wool Technology (IAPP)

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,987,000 |
| External funds | $16,519,000 |
| **Total Expenditure** | **$27,506,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 56% | 54% | 55% |

*estimates as at June 1995

## Objective

**Collaborate with, and provide statistical expertise for scientists in IAPP, INRE and IPPP Divisions located in Armidale, Geelong, Hobart, Melbourne and Sydney.**

## Strategy

In the present climate of scant resources it is essential for scientists to use cost-efficient experimental designs and to extract as much valid information from data as possible. Statistical methodology is vital to achieving these aims. The Unit will:

- Collaborate in Divisional research projects.
- Provide a high quality statistical consulting service.
- Assist Divisional staff in using basic statistical methods and statistical computer packages.
- Carry out biometrical research relevant to Divisional programs.
- Locate staff with relevant Divisions, or visit such Divisions regularly.

## Specific Objectives & Planned Outcomes

**Enhance Divisional research projects by use of efficient experimental designs and good data analysis.** (70%)

1 Consultations and collaboration with scientists.

2 Publications and/or consulting reports.

3 Internal refereeing of relevant Divisional papers and reports, and participation in scientific reviews of research programs as requested.

4 External funding obtained from Divisional research contracts/grants and other sources.

**Assist Divisional staff in their use of basic statistical methods and statistical computer packages.** (10%)

5 Short courses including "Introduction to MINITAB" and "Intermediate Regression in MINITAB" prepared and/or given. At least two courses given.

6 Selected statistical packages supported.

7 On the job (one on one) instruction provided.

**Maintain the Unit's skills base and research output.** (20%)

8 Within Unit training through attendance at conferences and visits to and from other biometricians.

9 New relevant statistical methods developed and published in statistical journals.

10 Computer hardware and software kept up to date.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $483,000 |
| External funds | $14,000 |
| **Total Expenditure** | **$497,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 5% | 5% | 5% |

*estimates as at June 1995

# 26. Institute of Plant Production and Processing

## Objective

**To enhance sustainability, competitiveness and growth of Australia's plant-based agri-food and fibre industries, and to develop technology used for the better management of the nation's natural resources.**

## Strategy

There are exciting opportunities for the agri-based industries despite current pressures. They are major contributors to Australia's export earnings. In addition, pastures contribute nearly half the earnings of the extensive livestock industries. There is widespread awareness of the need for sustainable resource use. The main agri-businesses served by the Institute are those which service or are based on those concerned with wheat, coarse grain, grain legumes, oilseeds, sugar, cotton, timber and horticultural crops, including new crops in these categories. The work on pastures and insect pests serves the wool, beef, sheep meat and dairy industries. The main components of the Institute's strategy are:

- Emphasise outcomes that benefit target industries and the community, by focussing on meeting domestic and international market demands and improving the quality and range of plant products in a sustainable way.
- Work closely with principal clients in agri-food, agri-fibre and agri-industrial industries, to ensure rapid adoption of research results.
- Concentrate on priority areas: highest quality products for specific markets; sustainable production systems; environmentally safe disease, weed and pest control systems; food conversion efficiency of ruminants; effective management of waste and pollution; resource conservation and maintenance of biological diversity; sustainable land and water utilisation and minimisation of off-farm effects; rehabilitation of degraded land including minesites.
- Form strategic alliances with public and private agencies focused on achieving increased benefits for Australia in order to integrate national research programs with those of other agri-industry research agencies.
- Develop inventories of natural resources, in collaboration with other agencies, and with international networks for more effective conservation strategies.
- Promote use of its biological collections as important national resources for both conservation of biological diversity and potential commercial use.

## Planned Outcomes

1 Implementation of restructuring decisions arising from CSIRO Board Evaluation Committee.

2 Development of an appropriate strategy for the management of Tropical Crops and Pastures and Forest Products beyond the current terms of the Chiefs, following the reviews of these Divisions.

3 Implementation of the outcomes of the Review of the Human Resources Function so that operating units have soundly based human resources management systems that will service their future needs.

4 A new training program for young scientists within the Institute aimed at developing relationships with industry through improvement of industry understanding, influencing skills, networking and understanding needs of funding agencies.

5 Joint Institute meetings with senior staff of other research agencies aimed at strengthening linkages between agencies.

6 Resolution of CSIRO's involvement in potential joint venture developments of the Long Pocket/Indooroopilly/St Lucia campus in Brisbane.

7 Development of a coordinated approach to software development with special reference to field crop and pasture systems management.

8 An informal review of the first year's developments in the new initiatives for Murray Darling Basin Forestry and Tropical Agri-exports and of the Institute's involvement in other multi-disciplinary programs. (Eval)

9 An assessment of the effectiveness of the Institute approach to evaluation and accountability. (Eval)

10 An Institute marketing plan for the next triennium based on the determination of priorities and initiatives for the triennium.

11 A strategy for increasing Institute involvement with small companies, aimed at improving the effectiveness with which business opportunities arising from CSIRO technologies are taken up by industry for the nation's benefit.

12 A communication plan for the Institute including development and acceptance of a policy of having communication and commercialisation plans for relevant research projects in Divisions.

13 A reassessment of the approaches to improving technology uptake through extension and technology transfer across the Institute. (Eval)

14 Creation of a firmer basis for financial decision making by improved ability to analyse the financial status of the Institute and its business units.

## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

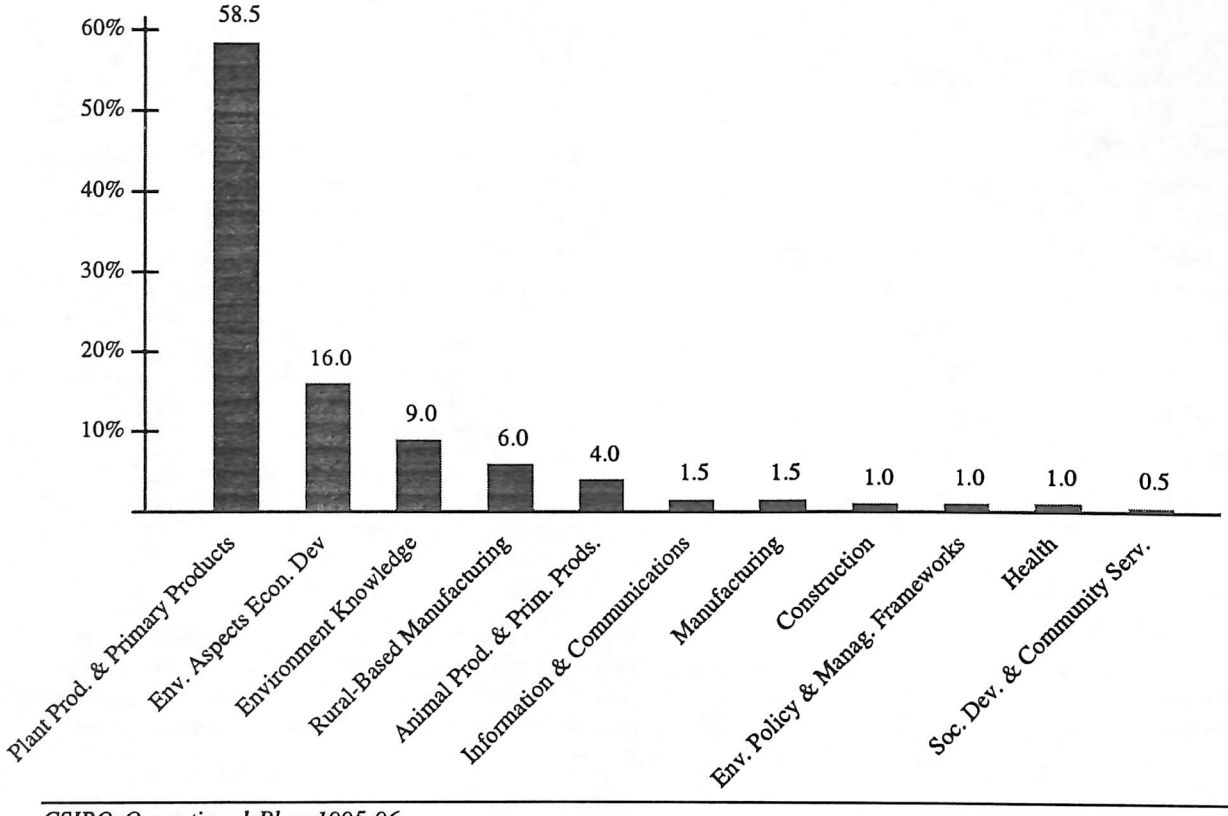
| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Entomology | 253 | 75 | 9 | 337 | 14,958 | 13,750 | 28,708 |
| Forest Products | 72 | 10 | 7 | 89 | 6,638 | 2,750 | 9,388 |
| Forestry | 112 | 47 | 8 | 167 | 9,727 | 4,715 | 14,442 |
| Horticulture | 68 | 24 | 4 | 96 | 5,686 | 3,061 | 8,747 |
| Plant Industry | 330 | 83 | 11 | 424 | 21,909 | 14,075 | 35,984 |
| Soils | 122 | 59 | 7 | 188 | 10,933 | 5,437 | 16,370 |
| Tropical Crops and Pastures | 118 | 55 | 7 | 180 | 11,369 | 6,822 | 18,191 |
| Institute Headquarters[2] | 0 | 4 | 4 | 8 | 3,324 | | 3,324 |
| Biometrics Unit | 5 | 1 | 1 | 7 | 497 | 89 | 586 |
| Supporting Sites[3] | 1 | 31 | 1 | 33 | | | |
| TOTAL | 1081 | 389 | 59 | 1529 | 85,041 | 50,699 | 135,740 |

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

[2]Expenditure figure includes funds not allocated to Divisions at time of table preparation.

[3]Staff estimate includes administration of CSIRO Centre for Mediterranean Agricultural Research and excludes 9.5 staff included in IIT who support Forest Products at Clayton.

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



# 27. Division of Entomology (IPPP)

## Objective

**To generate economic, social and environmental benefits for Australia through our research into insects and their management.**

## 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 utilises 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, universities, state and federal organisations and international and aid organisations, and partly by carrying out directly funded research in the national interest.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Novel Management Techniques for Plant and Plant Product Pests*** - MDP2

***Conserving Biodiversity for Australia's Future*** - MDP18

***Minesite Rehabilitation*** - MDP24

***Improving Forestry*** - MDP25

***Tropical Agricultural Exports*** - MDP33

***CSIRO Aquaculture Initiative (CAI)*** - MDP34

***Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities*** - MDP36

## Specific Objectives & Planned Outcomes

**To develop strategies for managing pests and beneficials of primary production that integrate a knowledge of ecology with all available management techniques.** (21%)

1 Investigation of options for consolidating research for tropical horticulture by redeploying staff and by establishing projects in North Queensland.

2 Identification of research priorities in Australian agriculture for the impact of whitefly, *Bemisia tabaci* type B.

3 Assessment of the impact of spotted clover aphid on pasture production in eastern Australia and identification of the major industries affected.

4 Commencement of a project on screening for novel compounds against the sugar cane mealy bug.

5 Expansion of large-scale field trials for transgenic cottons to three sites and to include Queensland Department of Primary Industries

6 Development of a mass rearing facility in Malaysia and commencement of mass rearing techniques.

**To deliver knowledge on the systematics and ecology of insects and related organisms in order to conserve and sustainably manage natural resources and biodiversity.** (16%)

7 Completion of a taxon character matrix for all adult beetles of all known families, user-friendly illustrations of characters and high quality illustrations of taxa for interactive identification CD-ROM on families of adult beetles of the world.

8 Completion of an interactive CD-ROM *Identification guide to families of freshwater macroinvertebrate families*.

9 A comprehensive reference collection of the noctuid subfamily Heliothinae developed in preparation for a full taxonomic and phylogenetic study.

10 Establishment of an insect conservation unit and commencement of work on population viability and status of threatened and endangered insects and related organisms.

11 Studies on the comparison of the microarthropod communities in agricultural soil and the surrounding remnant vegetation, the effects of conservation farming vs traditional farming practices, and the potential of selected taxa as indicator species.

12 Characteristics of red gums that correlate with enhanced resistance to feeding by psyllids (*Cardiaspina* spp) elucidated and used as an assay for resistance in the absence of insect attack.

**To develop safe and cost-effective methods of pest and quality management for commodity storage, transport and built environment that meet modern and changing needs for the market and community.** (20%)

13 Commercialisation of stored grain intellectual property (COS, Siroflor and others) to provide significant untied income during 1995/96.

14 Completion of studies on the grain fumigant phosphine, on the effects of fluctuating concentration on its toxicity, with particular regard to target species differences.

15 Accredication under ISO 9002 for grain and termite work.

16 Further development of non-chemical barriers and baiting systems for control of termites.

17 Improved understanding of replacements for the fumigant methyl bromide, a potent ozone-depletor, particularly for quarantine treatment of cut flowers, timber and hay.

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

18 Identification of the malathion carboxylesterase gene among several esterase genes cloned from *Lucilia cuprina* and elucidation of the resistance mutation.

19 Identification of a candidate cholesterol esterase-like gene from midgut cDNA of *Lucilia cuprina*, full-length cDNA for the gene cloned and expressed; and the recombinant protein used in a sheep vaccination trial.

20 Host range testing of HaEPV extended to demonstrate safety for key non-target insect species.

21 Generation of recombinant HaNPVs carrying a proprietary toxin that have increased insecticidal activity.

22 Evaluation of the resistance to heliothis of transgenic tobacco expressing various combinations of HaSV genes.

**To understand the ecology of weeds and their natural enemies, and to use this knowledge to increase the sustainability of land management systems.** (20%)

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

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

25 Implementation of collaborative projects to establish biological control of water hyacinth, salvinia and mimosa in developing countries.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $14,958,000 |
| External funds | $13,750,000 |
| **Total Expenditure** | **$28,708,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 43% | 50% | 51% |

*estimates as at June 1995

# 28. Division of Forest Products (IPPP)

## Objective

**The Division's objective is to benefit Australia by increasing the quality and value of forest products.**

## Strategy

The Forest Products industry has a turnover in excess of $10 billion per annum. The market for Australian forest products is largely domestic, but there are opportunities for the Division to play an important role in developing new exports and import replacements, and help overcome the trade deficit in forest products of some $1.8 billion per annum. The commitment of Government to the new Wood and Paper Industries Strategy (WPIS) should set industry on a strong course of development. The Division will actively support the WPIS and assist the proposed Wood and Paper Industries Council to provide industry with a clear focus and enhance its competitiveness. Our strategy in working closely with forest-based industries and the Division of Forestry is to:

- Increase profitability through efficient use of wood resources and technologies for new practices, processes and products derived from diverse forest types.
- Assist in improved performance by optimising use of residues and maximising opportunities for recycling paper and/or utilising spent forest products.
- Collaborate with forest growing agencies to improve the quality of the resource and to address the problems of land degradation.
- Provide support to a range of training and educational bodies associated with the forest industries.

The Division fosters an independent research position to assist in the broad debate on economic development and environmental matters.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Improving Forestry*** - MDP25

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

## Specific Objectives & Planned Outcomes

**To assess resources for pulp and papermaking, understand the relationships between wood, fibre, pulp and paper properties, and develop processes for wood and recycled fibre that increase pulp and paper quality with reduced environmental impact.** (38%)

1 Refined procedures and expanded applications for SilviScan-1; SilviScan-2 developed for hardwood fibre analysis.

2 Improved pulp yield predictions using NIR analysis and determination of yields at both proportionate and fixed heights in trees to develop sampling strategies.

3 Relationships between papermaking properties of pulps and chemical composition established; the effect of fibre length on properties of handsheets determined; and new procedures for pulp and paper evaluation introduced.

4 Through collaboration with industry, development of ways to improve the quality of recycled fibres.

5 The effect of enzymes on bleaching assessed; the strength of non-chlorine bleached pulps increased; and the mechanism of UV-peroxide bleaching process investigated.

**Understand the biology, physiology and interaction of wood attacking organisms to develop realistic bioassay procedures and improved performance of naturally durable and preservative treated timbers.** (18%)

6 Provision of expert bioassays of potential preservatives in the field, laboratory, and AFS, using marine borers, insects, termites and decay fungi.

7 Refined termite control measures - working closely with both timber and pest control industries in the post-organochlorine era.

8 Standard method of durability testing developed; on-going assessments continued; and a new list of durability ratings using novel concepts developed for proposed uptake by industry.

9 Existing contract and long term field trials of various preservatives and treatment systems progressed.

10 New preservatives developed in anticipation of threats to existing systems, specifically through continuation of fundamental work on fixation of copper and immobilisation of boron. (RM6)

11 Industrial collaboration secured for the development of new preservatives based on novel diffusible chelates. (RM6)

**Improve the utilisation of forest industry residues and recyclable products, in producing new composite materials, reformed cellulose fibres and films, improved adhesives, and wood by-products.** (22%)

12 A range of products developed from waste paper and other fibres, including reconstituted hardwood products, with Forest and Wood Products Research and Development Corporation (FWPRDC) funding.

13 Refinement of the SIRON process and construction of a pilot plant to develop data to assist in assessing the economics and the quality of the SIRON fibres.

14 Improved RF, PF, and tannin-based adhesives developed for reconstituted wood products and their commercialisation progressed.

15 Pilot scale quantities of activated carbon provided for local and export market evaluation in a FWPRDC supported project.

**Assist the timber industry to improve efficiencies and values in processing Australian hardwood and softwood resources.** (22%)

16 Wood structure related to collapse and internal checking; fundamentals of drying and methods of collapse amelioration investigated.

17 Parameters to enable rapid hardwood drying using vacuum dielectric techniques established.

18 Drying strategies developed for sawn products from a selection of south-eastern NSW eucalypts.

19 Further development of improved drying and control systems in collaboration with CSR and Windsor Kilns.

20 Processes for high value-added wood products from East Gippsland timbers and Queensland furniture timbers.

21 Codes and standards for appearance of wood products developed in an industry/FWPRDC funded project.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $6,638,000 |
| External funds | $2,750,000 |
| **Total Expenditure** | **$9,388,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 24% | 29% | 31% |

*estimates as at June 1995

# 29. 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 (NFPS) by the Commonwealth and all States the requirements and opportunities for industry development are now well understood. Continued implementation of the NFPS will occur in part through the Wood and Paper Industries Strategy and the negotiation of Regional Forestry Agreements between the Commonwealth and States will determine the size and focus of industry based on native forests. There will be increased emphasis on resource expansion through plantations and the integration of forestry into agricultural systems. The new Forestry and Wood Products Research and Development Corporation is now developing an important role in industry coordination of research activities, priority setting and in creating new research opportunities. The Division will:

- Develop advanced methods of tree breeding for improving economically important characteristics.
- Improve silvicultural and operational systems for increased and sustained productivity.
- Evaluate and select trees for wood production, for the amelioration of land degradation, and investigate the diversity of Australia's trees and their symbionts.
- Develop indicators of sustainable forest management and cost-effective monitoring procedures to allow their operational application. This will enable obligations under the NFPS and international protocols linked to certification of forest products as being sustainably-based, to be met.
- Work with FWPRDC to maximise funding opportunities and to keep research priorities closely aligned with industry needs.
- Improve communication and cooperation with forest industry and develop, where appropriate, commercial opportunities which arise from research.
- Develop long-term business relationships with the major forest land management agencies to facilitate R&D support.
- Implement the Strategic Plan and take advantage of an increased capacity in commercial practices, financial and human resources management to further improve Divisional performance.
- Utilise the refurbishment program at Yarralumla to improve working conditions and the quality and cost effectiveness of Divisional research.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Conserving Biodiversity for Australia's Future*** - MDP18

***Improving Forestry*** - MDP25

***Climate Variability and Impacts*** - MDP29

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

***Dryland Farming Systems for Catchment Care*** - MDP32

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

***Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities*** - MDP36

## Specific Objectives & Planned Outcomes

**To sample, evaluate, conserve and utilise the genetic resources of trees of actual or potential value for planting in Australia and other countries. Develop and communicate improved methods of choosing trees for specific uses and environments.** (26%)

1 Organisation of the Third International IUFRO Casuarina Conference in Da Nang, Vietnam, March 1996 and presentation of results from the international provenance trials of *Casuarina equisetifolia* spp. *equisetifolia*.

2 Publication of four books and manuals: Multipurpose Australian Trees and Shrubs (revision), Australian Trees for Salt-affected Lands, Cyclic and Computer Generated Designs and Assessment Manual for *Casuarina*.

3 Preparation for UNDP/FAO of a comprehensive report on domestication and breeding programs for tropical acacia species for implementation in eleven Asian countries.

4 Publication of the report *Do Trees Need Passports*: a socio-economic study of the role of exotic tree and other plant species in Quang Tri Province, Vietnam.

5 Completion of glasshouse screening for salt and waterlogging tolerance of *Eucalyptus globulus* and *E. grandis* establishment of field trials and final client report submitted to RIRDC. (ED6)

6 Preparation of tree growth prediction models using Plantgro soil and climate files for the Murray Darling Basin. (ED6)

7 Completion of a report on a collaborative survey of the occurrence and potential importance of pathogens of the most important tropical acacia plantation species in several SE Asian countries and Northern Australia.

**Provide options for the sustainable management of native forests for wood production.** (17%)

8 In collaboration with State Forests of NSW, commencement of a network of field experiments in the Eden area to quantify the response of *E. sieberi* regrowth forest to rates of thinning and fertiliser application. (Eval)

9 In collaboration with State Forests of NSW and the Victorian Department of Conservation and Natural Resources, development of preliminary indicators of ecologically sustainable forest use. Contribution to a nationally co-ordinated R&D program to refine these and devise cost-effective monitoring procedures to enable the indicators to be monitored operationally. (Perf)

10 A revised meter and accompanying booklet describing fire behaviour in grasslands. (EN3)

11 Development of RAPD markers for use as probes to distinguish strains of *Phytophthora cinnamomi* and their use to identify mechanisms responsible for genetic exchange.

**Improve methods for optimising the quantity and quality of wood from radiata pine plantations on a sustainable basis by an increased understanding of genetic diversity within the species and the effects of soil, environment and stand management on productivity. To determine design parameters and management strategies for plantations for disposal of effluent as a sustainable land use practice.** (27%)

12 A report on preliminary data from the later-age management study. Completion of negotiations with collaborators to extend this study to a range of sites and establishment of first set of satellite experiments. A major workshop on productivity of later-aged softwood plantations.

13 New measurements of water-use by trees together with water and soil-moisture measurements used to establish stand water balance, water use and the relationship between productivity and transpiration. (ED3)

14 Synthesis of long-term data describing the nature of the growth response of *P. radiata* to phosphorus fertiliser application as a basis for a review of current phosphorus fertiliser practice.

15 Implementation of a major project in conjunction with the Division of Forest Products to improve wood quality of radiata pine through silviculture and genetics. (PP6)

16 Completion of data collection for a major study on the genetics of wood microstructural properties, and completion of a paper on the genetics of heartwood formation in radiata pine. (PP6)

17 Significant progress towards characterisation and mapping of Quantitative Trait Loci controlling growth and wood density in *P. radiata*. (PP6)

18 Substantial integration of the numerous data sets collected in the effluent-irrigated plantation at Wagga Wagga leading to the development of a model for effluent-irrigated plantation design. Publication of several integrative papers on water balance, nitrogen dynamics and site degradation. (ED3, Eval)

**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%)

19 Development of a PCR probe to identify specific strains of the fungus *Laccaria laccata* that form mycorrhizal roots with *Eucalyptus marginata* (jarrah).

20 In collaboration with industry, predictions from a model of nitrogen mineralisation tested over a range of sites in Western Australia. (Perf)

21 Transformation of regenerated plants of *Eucalyptus nitens*, *E. globulus* and *E. camaldulensis* with gene constructs (supplied by Division of Plant Industry) that induce sterility. (PP3)

22 Transfer of improve micro-propagation technology to an industry partner of the CRC for Temperate Hardwood Forestry (CRC-THF) to test the potential for commercialisation. (Eval)

23 Assessment of the patterns of within-tree variation in wood properties of *E. globulus* and *E. nitens* to determine the optimum strategy for sampling standing trees (CRC-THF and CRC for Hardwood Fibre and Paper Science). (PP6)

24 Description of the photosynthetic response of individual leaves and canopies of *E. globulus* and *E. nitens* to environmental variables and silvicultural treatments, for incorporation into a mechanistic model of tree growth.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $9,727,000 |
| External funds | $4,715,000 |
| **Total Expenditure** | **$14,442,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 41% | 32% | 30% |

*estimates as at June 1995

# 30. 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 $3.5b at the farm gate with dramatically improving export performance for some commodities. Expanding markets in S.Asia offer considerable export opportunities, but demand a quality product, consistent production and attention to strict quarantine regulations. Import replacement opportunities also exist. The Division's strategies are to:

- Develop and apply techniques for the selection and breeding of improved horticultural crops.
- Develop new management techniques to improve reliability of production and to reduce costs.
- Develop improved postharvest handling techniques to extend product life and prevent quarantine exclusions.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Gene Shears* - MDP1

*Novel Management Techniques for Plant and Plant Product Pests* - MDP2

*Tropical Agricultural Exports* - MDP33

## Specific Objectives & Planned Outcomes

**Develop superior new varieties of horticultural crops to enhance productivity and quality.** (40%)

1 Sequence requirements determined for efficient replication of a virus-based gene vector. (PP3)

2 New genes constructed, targeted to stop endosperm development in citrus.

3 Transgenic tomatoes produced and established for testing flavour improvement.

4 Grapeberry-specific promoter sequences for control of quality attributes isolated.

5 Anthocyanin pathway genes in grapes characterized.

6 Parthenocarpic hybrids identified from Imperial mandarin x Ellendale tangor progeny.

7 Reciprocal effects of cross pollination between eleven elite macadamia cultivars documented for macadamia industry.

8 Melon selection entered into collaborative trials with commercial partner.

9 Field trial of low browning transgenic potato lines.

**Develop better crop management systems to enhance productivity and quality.** (30%)

10 Optimum irrigation frequency defined for vine vigour control by heterogeneous rootzone wetting.

11 Root distribution of mature cashew trees characterised for development of optimum irrigation and fertilisation regimes. (ED6)

12 Rootstock and nitrogen supply effects on nitrogen status of Shiraz grape juice determined.

13 Book 'Wine grape varieties for Australia' published.

14 Water use efficiency for low pressure, subsurface irrigation characterised in relation to rootstock and vine management systems. (ED6)

**Develop improved strategies for postharvest performance based on an identification of factors controlling ripening, senescence, pests, disease and disorders.** (30%)

15 Citrus budline susceptibility to oleocellosis rind disorder defined.

16 In-seedling effects of temperature, water stress and microbial interactions on mango stem-end pathogen infectivity evaluated.

17 Hot water immersion assessed for disinfestation of surface insects on export citrus.

18 Grevillea cut flowers senescence investigated as a basis for extending longevity.

19 Anaerobisis effects in pears stored in low oxygen atmospheres characterised.

20 Interaction between hormonal and genotypic effects on senescence processes in broccoli determined.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $5,686,000 |
| External funds | $3,061,000 |
| **Total Expenditure** | **$8,747,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 32% | 32% | 34% |

*estimates as at June 1995

## Objective

**To apply strategic research in the plant sciences to promote profitable and sustainable agri-food and fibre industries, develop novel plant products and improve natural resource management.**

## Strategy

The agricultural sector is part of a total agri-business enterprise in Australia that generates $22 billion worth of primary products and $37 billion turnover in the foods and beverages manufacturing industries. These industries have unprecedented opportunities for growth and delivery of high quality products into domestic and export markets, especially in the economic growth centres of Asia. Environmental issues need to be considered in tandem with economics of production. It is essential that we understand the structure and dynamics of our agro-ecosystems so that we can achieve sustainability from our production units. Our agriculture and natural resource management must be based on the best possible biological research. New methods of biological enquiry now allows us to address in a powerful way product quality features as well as efficiency in production systems.

National programs of economic and structural reform are improving Australia's competitive position, and Australian companies both large and small are developing an active and committed recognition of the importance of research for their future viability. In this context the Division will:

- apply a range of basic and applied plant research to the Australian agri-business system and native ecosystem management
- participate in multi-disciplinary programs with other research institutes and industry for economic and community benefit
- implement a communication and technology transfer plan aimed at ensuring that end-user needs are met and that research outcomes are adopted.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Gene Shears* - MDP1

*Novel Management Techniques for Plant and Plant Product Pests* - MDP2

*Climate Change* - MDP17

*Conserving Biodiversity for Australia's Future* - MDP18

*Improving Forestry* - MDP25

*Biosensors* - MDP27

*Climate Variability and Impacts* - MDP29

*Dryland Farming Systems for Catchment Care* - MDP32

*Tropical Agricultural Exports* - MDP33

*CSIRO Aquaculture Initiative (CAI)* - MDP34

*Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities* - MDP36

## Specific Objectives & Planned Outcomes

**To diversify the range of crops and to improve the performance of rainfed crops and pastures in southern Australia.** (17%)

1 Evaluation of advanced breeding lines of wheat in collaboration with regional breeding programs.

2 Quantification of the below-ground biomass nitrogen (BGB-N) in pastures, measurement of N transfer from legumes to grasses and broadleaf species in mixed pasture swards, and measurement of carry-over of BGB-N to cereals.

3 Characterisation of the role of the ss90 P450 gene cloned from *Euphorbia* in seed oil biosynthesis, and continuation of attempts to clone a fatty acid epoxygenase gene.

4 Establishment of whether it is possible for highly nitrogen-restricted native grass swards to sequester more carbon from the atmosphere when atmospheric carbon dioxide concentration increases.

**To transform agri-business enterprises for food and fibre into highly profitable and stable production systems through the development of new ways of managing physical, biological, financial and managerial resources.** (18%)

5 In collaboration with ASCALIP, multiplication of seed of two resistant lines from each of five cultivars of subterranean clover and field trials designed to confirm the damaging impact of allelochemicals released from grass residues on germination and establishment of subterranean clover. (ED6)

6 Establishment of whether novel low toxin phalaris (tryptamine and tyramine derivatives) lines retain this characteristic in the next generation. (ED6)

7 Upgrade of MetAccess to operate under Microsoft Windows, and of GrasFeed to include a revised lactation submodel particularly useful for dairy enteprises and the inclusion of a more comprehensive list of supplements. (ED6)

8 Investigation of the ability of pasture legumes and other plants to use phytate (a major form of organic P in soils) and assess the contribution of phytase genes to P nutrition. (ED6)

**To develop economically viable and ecologically sustainable systems of cotton production for Australia.** (10%)

9 Release and promotion of an upgraded entomoLOGIC incorporating the OZCOT/CERCOT crop model to provide yield prediction, irrigation scheduling and simulation capacity. (PP3)

10 Continued incorporation of Bt and Roundup tolerance constructs into CSIRO cotton lines, and seed increase of advanced lines in preparation for commercial releases. (PP3)

11 Further evaluation of broadly adapted, high yielding, verticillium tolerant replacements for variety CS189+, and an early maturing, verticillium tolerant okra leaf line likely to replace Siokra S324.

12 Investigation of physiology of cotton compensation for pest damage by quantifying crop responses to non-uniform damage to growing tips and squares. (PP3)

**To provide a basis for biological conservation, management and use of the Australian flora and vegetation.** (12%)

13 Establishment of hybrids between as many as possible of the 17 Australian native *Gossypium* species with diploid and tetraploid cotton.

14 Completion of proposed new classification system, with diagnosis of infrageneric groups, for *Eucalyptus*.

15 Determination of phylogeneric relationship between bradyrhizobia isolated from shrubby legume species of south-east Australia.

16 Provision of a national perspective on how plant biodiversity changes with time elapsed after fire occurrence. (EN3)

**To create novel germplasm for increasing the market value of grain products.** (12%)

17 Establishment of the presence of antisense sequences targeted to seed protein in at least six independently transformed wheats, and characterisation of the activity of the antisense sequences and determination of the consequences in seed composition.

18 Determination of the primary structure of wheat starch branching enzymes through isolation of cDNAs, and synthesis of DNA clones suitable for transforming wheat and manipulating the branching enzymes in wheat.

19 Finalisation of the establishment of the small scale extension tester as a valid means of measuring dough extensibility and utilisation of the new equipment to determine the consequences of incorporating specific proteins into the dough mixes.

20 Establishment of an extensive library of monoclonal antibodies using synthetic peptides, the primary structures of which are based on the published sequence of a LMW-glutenin subunit.

**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%)

21 Characterisation of a male-sterility gene.

22 Evaluation of tRNA genes as vectors for cytoplasmic delivery of anti-viral ribozymes. (PP3)

23 Development of transgenic eucalyptus plants expressing the Btt gene.

24 Expression of antisense to DNA methyl transferase and determination of the effects on flowering time and development.

**To enhance plant performance and product quality through gene technology.** (17%)

25 Construction of a plant virus resistance gene designed to interfere with insect transmission of rice ragged stunt virus. (PP3)

26 Performance of a rat feeding trial to test the efficacy of high methionine lupins in promoting efficient animal growth. (PP4)

27 Establishment of transgenic lines of field pea containing high sulfur and herbicide resistance genes.

28 Evaluation of the role of sucrose and other metabolites in controlling primary partitioning of photosynthate.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $21,909,000 |
| External funds | $14,075,000 |
| **Total Expenditure** | **$35,984,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 33% | 37% | 37% |

*estimates as at June 1995

## Objective

**To benefit the nation through research and the development of technologies which contribute to profitable and ecologically sustainable use of Australia's soil and land resources.**

## Strategy

As the rural industries begin a recovery from both recession and one of the most damaging droughts on record, the soil resource will be exploited further as farming enterprises seek to recoup losses. This will increase the need for radical rural adjustment and the need for information on better land management. Further, the government sector, in response to an increasingly environmentally aware urban population, will seek to implement environmentally sound practices in the mining, manufacturing and service industries, particularly with respect to disposal of wastes and pollutants. The provision of information to assist ecologically sustainable development will be achieved by:

- Developing our national base of knowledge on soil properties, processes and distribution.
- Identifying and solving problems for industry and the community using soil science knowledge and related technology.
- Providing national and international leadership and direction in soil science research and technology development.
- Contributing to policy development relevant to soils and land use management.
- Promoting the development of soil science professionals.
- Improving public awareness of the importance of soils as part of our ecosystems and national resource base.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Conserving Biodiversity for Australia's Future*** - MDP18

***Coastal Zone Program*** - MDP21

***Minesite Rehabilitation*** - MDP24

***Climate Variability and Impacts*** - MDP29

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

***Dryland Farming Systems for Catchment Care*** - MDP32

***Tropical Agricultural Exports*** - MDP33

***Strengthening Infrastructure for Mediterranean Agricultural Industry Opportunities*** - MDP36

## Specific Objectives & Planned Outcomes

**To develop integrated, efficient and ecologically sustainable soil management systems for improved rural production and product quality and to identify soil indicators of sustainability.** (32%)

1 Identification of major causal factors of sugarcane yield decline and development of appropriate management strategies to return to an increasing yield trend.

2 Description, quantification and modelling of C and N pools in soils, and the development of management systems to protect soil organic matter and increase productivity of crops and pastures. (ED6, PP5)

3 Assessment of the effects of land management on soil health and the diversity of soil biota, thereby developing the use of specific soil biota to enhance soil processes for optimum plant growth. (EN4)

4 Evaluation of management practices, environmental conditions and biocontrol agents for controlling soil-borne root diseases in dryland farming and nursery production.

5 Provision of a predictive approach to soil degradation caused by sodicity and acidity, and to develop management options to minimise the effects of these processes. (ED6)

**To develop methods for measurement, prediction and effective management of the impacts of agricultural, urban, mining, industrial and tourist activities on landscapes and ecosystems, and to provide strategies for the sustainable rehabilitation of degraded landscapes, disposal of organic wastes, and continued production of clean foods.** (23%)

6 Evaluation of the sustainability of land applications of sewage wastes from knowledge of leaching and runoff of nutrients, salts and heavy metals, and provision of guidelines for maximising the effectiveness of waste re-use schemes. (ED3)

7 Identification of key processes essential to design of rehabilitated, post-mining landscapes that are in dynamic equilibrium with regional environments. (ED7)

8 Identification and characterisation of potentially useful clays which can selectively absorb heavy metals and organic contaminants, and development of techniques to modify the surface properties to enhance their absorption properties.

9 Identification of key factors which affect the mobility of toxic metals and organic contaminants in soils and their uptake by crops, development of amelioration strategies, and production of management guidelines. (HE1)

**To enhance sustainable land management and agricultural productivity, by improved methods**

**of soil resource assessment, soil classification, prediction of degradation risk and knowledge of the relationships between soil properties, geomorphology and landscape behaviour.** (26%)

10 Development of new methods of land and soil resource assessment using digital terrain modelling, radiometric imagery, remote sensing and conventional soil descriptions for use by state agencies and land managers. (ED6)

11 Generation of a modern, national soil database and a soil information system for the Murray Darling Basin which links spatial soil distribution patterns to database information and interpretive guidelines for policy makers and land managers. (ED6, PP5)

12 Development of models and pedo-transfer tools to integrate knowledge of soil physical/chemical behaviour within landscape/catchment frameworks to assist in the minimisation of land degradation and development of sustainable dryland farming systems. (ED6, PP5)

13 Development and application of standard methods for land evaluation through the support and management of the Australian Collaborative Land Evaluation Program. (ED6)

14 Evaluation of the distribution of coastal acid sulphate soils and the development of management strategies for conservation, tourism and other land uses.

**To provide research management, strategic planning, resource management, business development, technical support services and communications for our clients and the Division.** (20%)

15 Completion and distribution of the Division's Strategic Plan (1995-2000).

16 Implementation of the Divisional Human Resource Plan and Strategy including a Staff Training Plan and improved Recruitment and Succession Plans to align with the Division's new Strategic Plan and projected financial expectations.

17 In consultation with Program Managers review and further development of procedures for a monthly financial report, an accounts receivable system, and external grant accounting which tracks both contractual status and reconciliation of debts and credits.

18 Implementation of the approved Capital Works Program for the Davies Laboratory and development of a refurbishment and capital works plan and budget for the Canberra Laboratories.

19 Participation in national quality assurance and NATA accreditation for all ACU units, and complete rationalisation of technical support services at the Canberra Laboratories.

20 Complete introduction and user training for SIM and CD-ROM databases and advanced methods for accessing and transferring information from library services.

21 Establishment of the Division's Archival Soil Store at the Waite Campus with a view to developing a National Soils Collection.

22 Complete implementation of the IT Strategic Plan incorporating universal access principles.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $10,933,000 |
| External funds | $5,437,000 |
| **Total Expenditure** | **$16,370,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 31% | 32% | 32% |

*estimates as at June 1995

## Objective

**To increase the international competitiveness of the beef, grains, and sugar industries of northern Australia by improving the efficiency and sustainability of the production systems, and product quality.**

## Strategy

The major problems facing agricultural industries in northern Australia are nutritional limitations to livestock production, environmental and genetic constraints to crop production, and environmental effects of agricultural production. The three largest industries (beef, grains and sugar), have a combined GVP of about $4b pa. Much of the production is exported to highly competitive markets which are demanding specific product quality. These industries, through structures such as the NABRC, SIRCC and GRF are providing advice to the R & D providers on key industry issues and research priorities. The wider community and industry are increasingly concerned about the long term sustainability of the production systems, and about the off-farm effects on the natural resources. The Division collaborates extensively with other CSIRO Divisions and organisations and from 1995-96 plans to have a significant role in the CRC for Sustainable Sugar Production and the CRC for Sustainable Development of Tropical Savannas.

Reduced Government funding to one of our major RD&E partners, the Queensland Department of Primary Industries (DPI) , is reducing our capacity to deliver outcomes in the beef and grains sections. The Division's strategies are to:

- Improve our understanding of the underlying business systems of the beef, grains and sugar industries.
- Foster participatory planning with industry to identify and prioritise issues requiring R&D.
- Collaborate with other R&D providers in addressing the priority issues identified jointly with industry.
- Develop new and improved mechanisms for technology transfer, in the light of changing industry structures, changes within DPI, and the policies and priorities of the Rural Industry R&D Corporations.
- Develop excellence in the application of molecular biology and genetic engineering to the improvement of plants and rumen micro-organisms.
- Integrate new skills in molecular biology, microbiology, and information technology with traditional skills in plant sciences, ecology, and livestock production, and assemble multidisciplinary teams to conduct research.
- Commercialise and market plant products and information technology developed by the Division.
- Continue to set new standards of excellence in research management, including workforce planning, research prioritisation, and concentration of efforts on critical issues.
- Link management of financial and capital resources to decisions on research priorities.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Gene Shears*** - MDP1

***Fibre Utilisation*** - MDP3

***Coastal Zone Program*** - MDP21

***Minesite Rehabilitation*** - MDP24

***Climate Variability and Impacts*** - MDP29

***Dryland Farming Systems for Catchment Care*** - MDP32

***Tropical Agricultural Exports*** - MDP33

## Specific Objectives & Planned Outcomes

**More profitable and sustainable livestock production through improved nutrition.** (39%)

1 Comparison of the variation in DNA polymorphism of the Australian type A anthracnose population with the genetic diversity of the pathogen at its centre of origin.

2 Generation of new rumen bacterial transformants expressing fungal fibre degrading enzymes.

3 A high affinity phosphate transporter cloned from plant roots.

4 Identification of three high performing *S.aff.scabra* lines for potential commercial release.

5 Assessment of the lignin composition and expression of caffeic acid O-methyl transferase in second generation transgenic *Stylosanthes* plants.

6 Development of a collaborative project with the Division of Tropical Animal Production, NTDPIF and the NT beef industry which addresses the needs of the live-cattle export trade.

**More profitable cropping industries producing a range of marketable product.** (31%)

7 Evaluation of advanced backcross lines of soybean for the tropics and sub-tropics carrying the long-juvenile gene, including screening for *Phytophthora* resistance.

8 Utilisation of *Erianthus* (wild relative of sugarcane) specific markers to identify *Erianthus* genetic material in *Erianthus* x *Saccharum* crosses.

9 Measurement of the genotypic variation in frost tolerance of a wide range of sugarcane lines.

10 Simulation of the potential economic and management value of the genetic variation in N use efficiency in grain sorghum.

11 Production of transgenic plants and clarification, through controlled environment experiments, of the roles of key enzymes involved in sucrose metabolism in sugarcane.

**Adoption of land management practices and cropping systems that are economically and environmentally sustainable.** (30%)

12 Evaluation of the utility and further development needs of the Landassess DSS, through interaction with NT advisory and regulatory agencies and Land Care Groups. (ED6)

13 Specification of the communication interface employed in the farming systems models APSIM and AUSFARM to allow for interchangeability and compatibility of current and new modules.

14 Establishment of a collaborative research program with ICRISAT on crop and soil management issues common to northern Australia, India and Africa that will enhance joint capabilities in the use of simulation modelling in systems research. (ED6)

15 In collaboration with stakeholders, development of a prototype decision support system to evaluate the implications of changes in land use or management strategy on river nutrient loads in the Herbert River catchment.

16 Quantification of the effects of fire on different size classes of woody weeds, with results used to communicate the importance of burning to control the spread of exotic and native shrubs. (EN3)

17 Better estimation of soil N levels, crop N uptake and nitrate redistribution and loss for sugarcane crops using the combined capacity of the APSIM and SWIM models.

**Organise and manage Divisional resources to facilitate effective research, enhance individual performance and promote adoption of the products of research.**

18 Completion of the second phase of land sales at Lansdown Research Station and investment of funds in the support of priority tropical research.

19 Joint North Australia Beef Research Council/DTCP Field Days at Narayen and Lansdown, addressing issues of sustainable management of native pastures and beef production systems from mixed forage resources.

20 Expansion of the role of the Australian Tropical Forages Genetic Resources Centre to encompass seed storage, production and distribution for the QDPI.

21 Transfer of the QDPI plant quarantine activities to Samford, including the erection of new post-entry quarantine glasshouses.

22 Planning for the redevelopment of the Cunningham Laboratory completed and plans approved by the Parliamentary Public Works Committee.

23 Establishment of new standards for Records Management which meet the needs of research, administration and management.

24 Completion of planning for a second five-year involvement of DTCP within the APSRU project (Eval).

25 Revision of Divisional advisory mechanisms, taking account of the changing internal and external environments. (Eval)

26 Industry Awareness training program for middle-level managers run in conjunction with IPPP.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $11,369,000 |
| External funds | $6,822,000 |
| **Total Expenditure** | **$18,191,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 35% | 35% | 36% |

*estimates as at June 1995

## Objective

**Promote the effective and efficient use of experimental resources by CSIRO Biological Divisions, through improved experimental design and more informative methods of statistical analysis.**

## Strategy

The Unit pursues its objectives through the development, application and dissemination of advanced methods of statistical design and analysis. In an environnment of increasing demands for scarce resources, it is more than ever important that CSIRO maximises the information obtained from research data. The Unit will:

- Collaborate in Divisional Research Programmes.
- Conduct biometrical research relevant to the objectives of client Divisions.
- Provide statistical consultancy for Biological projects.
- Train Divisional staff in basic statistical methods, and in the use of statistical computer packages.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Program:

*Climate Variability and Impacts* - MDP29

## Specific Objectives & Planned Outcomes

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

1 Full participation in client research reporting, demonstrating significance of biometrical contribution by senior authorship of some biological papers.

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

**Improve the effectiveness of biological research through timely and relevant statistical consultancy.** (35%)

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

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

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

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

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $497,000 |
| External funds | $89,000 |
| **Total Expenditure** | **$586,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 13% | 9% | 9% |

*estimates as at June 1995

# 35. Institute of Natural Resources and Environment

## Objective

**Provide 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 Institute, in collaboration with other groups, is addressing major issues including air pollution; marine and freshwater pollution; pressures on the coastal zone; urban water and wastewater; water catchment management; land degradation; climate change, variability and impacts; 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 management strategies, to industry, to enable sustainable development of Australian industry across all sectors, and to the community. This work also underpins Australia's capacity to meet its international obligations on environmental issues, and its ability to access the results of international research that potentially affects Australia.

- Consult with key stakeholders to target research and to help ensure its uptake, with particular reference to the INRE, CSIRO Agricultural Sector and Divisional Advisory Committees.
- Apply the CSIRO methodology to assist in setting research priorities.
- Assess and evaluate rigorously the benefits of current and proposed research.
- Increase the focus on winning major international environmental contracts.
- Maintain effective relationships with the tourism industry to help in determining research needs for that industry.
- Continue to develop and effectively manage major multi-Divisional programs intended to provide information concerning, and holistic solutions to, large complex issues - climate change and climate variability, coastal zone management, waste emissions, conservation of biodiversity, algal blooms, aquaculture, air quality, urban water systems and catchment care.
- Maintain close liaison with federal government departments and organisations and increase liaison with state and local government agencies.
- Promote and reward excellence in undertaking and managing science, in transferring our results and in communicating their significance.
- Market our skills and promote their worth to national and international governments and organisations.
- Ensure the effective operation of the Institute and Divisional Advisory Committees.

## Planned Outcomes

1 Collective assessment of Institute management and support processes and identification of improvements in accord with emerging CSIRO structural and management approaches. (Eval)

2 Review of MDP and other matrix management approaches. (Eval)

3 Review of the role and processes of the INRE Project Office in the context of both Corporate and Divisional commercialisation and technology transfer arrangements. (Eval)

4 Review of the Division of Fisheries taking account of the completion of the term of the Chief and current CSIRO structural developments. (Eval)

5 Continuation of stakeholder briefings on selected key environmental issues such as climate change and variability; population, ecology and the economy.

6 Production of awareness raising issues documents to continue the information and profile benefits of the INRE Outlook.

7 Assessment of, and response to, the lessons learned in the survey of INRE customer satisfaction. (Eval)

8 Further development and application of project evaluation processes. (Eval)

9 Development of means for optimising CSIRO's broad-based research support, including environmental factors, for Australia's rapidly privatising and diversifying infrastructure (particularly in the water and energy sectors).

10 Ensuring an effective approach is taken to identifying and meeting the needs of emerging areas of research demand, including tourism.

11 Implementing outcomes of the review of CSIRO's Human Resources Function.

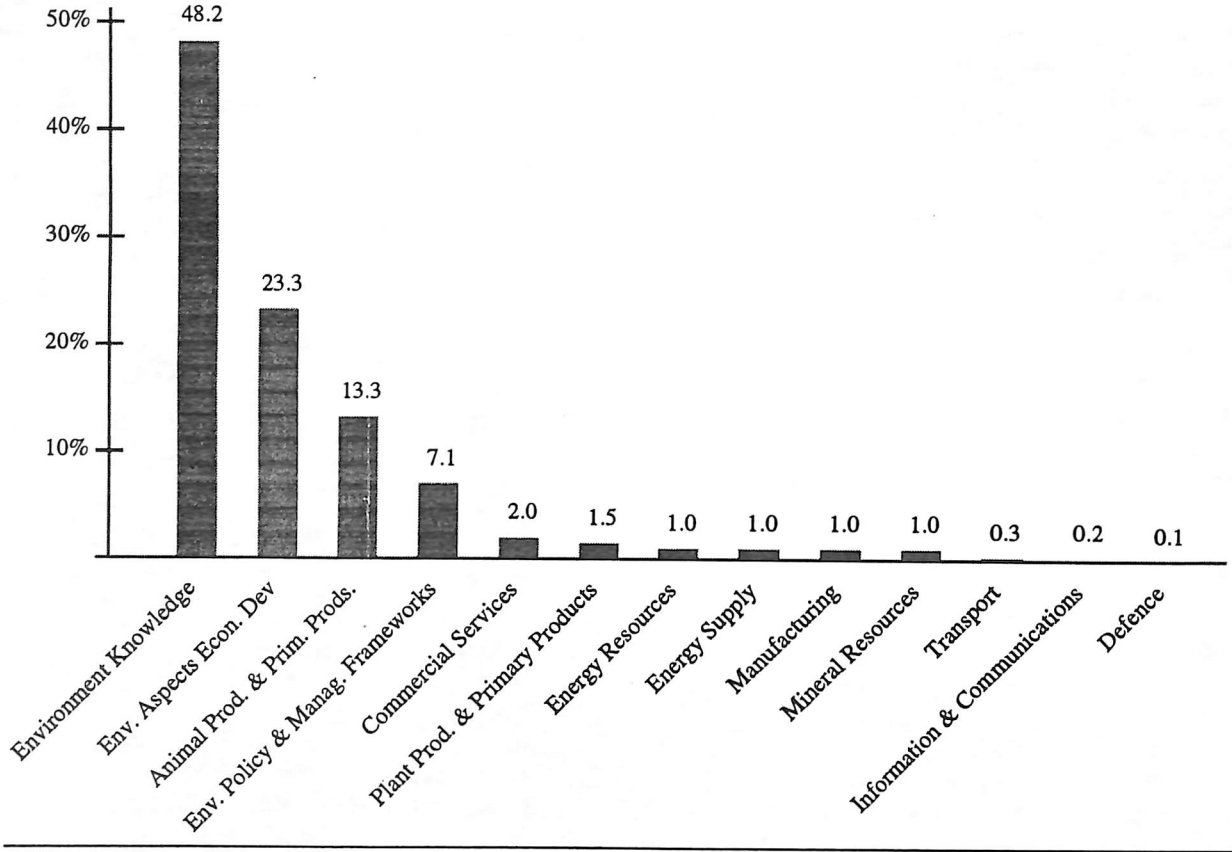
## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Division | Staff by Functional Classification (EFT units)[1] | | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|---|
| | Research Staff | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Atmospheric Research | 89 | 47 | 8 | 144 | 9,002 | 3,774 | 12,775 |
| Fisheries | 119 | 62 | 7 | 188 | 12,577 | 8,586 | 21,163 |
| Oceanography | 44 | 46 | 6 | 96 | 5,282 | 3,827 | 9,110 |
| RV *Franklin* (A National Facility) | 2 | 7 | 0 | 9 | 3,516 | 1,089 | 4,605 |
| Water Resources | 175 | 93 | 9 | 277 | 12,067 | 7,983 | 20,050 |
| Wildlife and Ecology | 175 | 97 | 4 | 276 | 13,611 | 5,341 | 18,952 |
| Environmental Mechanics | 30 | 17 | 1 | 48 | 2,685 | 1,450 | 4,135 |
| CSIRO Office of Space Science and Applications | 4 | 5 | 2 | 11 | 2,197 | 540 | 2,737 |
| INRE Projects Office | 2 | 3 | 4 | 9 | | 2,400 | 2,400 |
| Biometrics Unit | 7 | 0 | 0 | 7 | 474 | 46 | 520 |
| Floreat Park Site Services | 0 | 22 | 0 | 22 | 274 | | 274 |
| Institute specific funds | 0 | 0 | 0 | 0 | 2,417 | | 2,417 |
| INRE Institute Headquarters | 0 | 5 | 4 | 9 | 538 | | 538 |
| TOTAL | 647 | 402 | 45 | 1094 | 64,640 | 35,036 | 99,676 |

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

## PLANNED DISTRIBUTION OF TOTAL EXPENDITURE BY RESEARCH PURPOSE, 1995-96



# 36. 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

- Undertake studies of processes controlling atmospheric behaviour and apply this knowledge to problems concerning weather, climate, atmospheric pollution and water resources.
- Determine the causes of current atmospheric concentrations and predict future trends in climatically-active and ozone-destroying gases and aerosol influenced by human activity.
- Describe and quantify radiative aspects of the atmosphere and surface, especially interaction of radiation with clouds and water vapour.
- 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 improve modelling systems.
- Develop and maintain a hierarchy of climatic models capable of addressing current and perceived developing environmental issues of regional and global concern.
- Provide advice and information to stakeholders on a range of environmental issues, including the enhanced greenhouse effect, ozone depletion, regional air quality and drought.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Climate Change* - MDP17

*Data Acquisition and Utilisation* - MDP19

*Climate Variability and Impacts* - MDP29

*Air Quality* - MDP30

## Specific Objectives & Planned Outcomes

**Investigate factors which influence urban and regional air quality; identify source dispersion and transformation paths; and apply these developments to real world problems.** (16%)

1 Two-particle Lagrangian models of atmospheric dispersion extended to include atmospheric boundary layer flows.

2 Greater understanding of molecular and turbulent mixing in chemically reacting flows.

3 Analyses of field measurements of coastal fumigation made at the Kwinana power station completed and related to numerical and laboratory model descriptions.

4 Completion of Perth haze measurement and wind field modelling consultancies. Further specific air quality consultancies undertaken as they arise.

5 Commencement of a pan-Australian and New Zealand air quality assessment by field measurement.

6 Practical numerical models of pollution dispersion extended to inter-regional scales and to include deposition processes.

7 The roles of momentum and buoyancy fluxes on plume dispersion quantified using laboratory studies of the convective boundary layer.

8 Field studies of deposition and rainwater chemistry in NSW and Malaysia completed; new studies progressed there and in Indonesia.

9 Concentrations of toxic synthetic chemicals in vehicles exhausts determined: completion of consultancy project.

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

10 Improved representation of severe storms in limited-area models, based on east coast low and tropical cyclone simulations and validation against observations.

11 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%)

12 Moisture influences on large-scale atmospheric disturbances identified, with focus on monsoons and major NW-SE cloud band.

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

14 Consolidation of field site for study of surface radiation budget at Hay, NSW; development of Alice Springs field site with Bureau of Meteorology.

15 Satellite observations of the surface radiation budget related to in situ (Hay and Alice Springs) observations ("ground truth").

16 Radiation budget in climate models validated through comparison with other models and with global observations - extension to clear sky fluxes, surface and top-of-atmosphere.

17 The role of water vapour in the climate system investigated using simple energy balance models.

18 An assessment of the observational evidence for determinations of the sign and magnitude of cloud forcing of the climate system.

19 Analysis of summer Phase 2 of Southern Ocean Cloud Experiment, and consolidation of data and interpretations with winter Phase 1.

**Incorporate into climate models improved descriptions of dynamical systems and of the interaction of radiation with clouds and the earth's surface.** (5%)

20 Improved surface specification, through involvement in an international land-surface project.

21 Development and testing of a regional cloud climatology for validation of clouds in climate models.

22 Development of a prognostic cloud scheme for incorporation into the Division's limited-area model and the Mark 3 climate model.

**Apply recent developments in remote sensing instruments to research and commercialisation.** (5%)

23 Application of 3-wavelength lidar to observations of power-station plumes and clouds.

24 Commercialisation agreement and preliminary development work of Airborne Hazards Detection System.

25 Completion of narrow-beam filter radiometer with Stirling cycle cooler (ARM project).

**Develop powerful computer climate models of the global atmosphere and of the combined atmosphere-ocean system to investigate climate variability, including drought and climate change.** (18%)

26 Development and testing of the Mark 3 fully-coupled climate model.

27 Analysis of results from a climate model with transiently increasing carbon dioxide growth until levels are tripled for various model configurations.

28 Examination of ability of models to forecast drought, based on predictions of observed sea-surface temperatures, and development of appropriate coupled models for drought prediction.

**Assess regional extent and impact of future climate change caused by changing atmospheric composition.** (13%)

29 Development and application of new methodologies for analysis of climate change data. Annual report for northern Australia on likely regional climatic impacts.

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

31 Analysis of model experiments designed to reproduce natural climatic variability.

32 Climatic research experiments using a regional numerical model.

**Investigate the past and present composition of the atmosphere, with particular emphasis on sources and sinks of trace gases and aerosol, to provide the basis for assessment of future trends and likely climate impact, and to provide information needed to gauge the efficacy of remedial action.** (16%)

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

34 Analysis of the historical changes of the concentration of trace gases in air extracted from Antarctic ice cores, Antarctic firn and from the Division's archived air, with particular focus on the last one to two thousand years.

35 Numerical modelling of atmospheric transport and exchange for interpretation of observations and predictions of future greenhouse gas trends.

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

37 Studies on the ocean-phytoplankton dimethyl sulfide-aerosol cloud albedo mechanisms of climate regulation over the Southern Ocean.

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

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

40 Scientific support for the Australian Baseline Air Pollution Station.

41 Advice to stakeholders concerning ozone depletion, the enhanced greenhouse effect, and climatically active aerosol.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $9,002,000 |
| External funds | $3,774,000 |
| **Total Expenditure** | **$12,775,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 34% | 39% | 39% |

*estimates as at June 1995

# 37. 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 November 1994 Australia's Exclusive Economic Zone and associated marine territory increased in size to 14 million square kms with an estimated potential to contribute between $50 and $85 billion a year to Australia's economy within 25 years. The Division has a significant role to play in meeting Australia's obligations to research, develop and protect this Zone. The Division will continue to develop new approaches to the sustainable management of marine living resources and the marine environment, to maximise their economic utilisation and minimise threat from over-exploitation.

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

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Climate Change* - MDP17

*Algal Research Program* - MDP20

*Coastal Zone Program* - MDP21

*Management of Marine Living Resources* - MDP23

*Climate Variability and Impacts* - MDP29

*CSIRO Aquaculture Initiative (CAI)* - MDP34

## Specific Objectives & Planned Outcomes

**To understand the ecology and dynamics of Australia's tropical marine resources and to use this knowledge to assist government and industry manage these resources for ecological and economic sustainability.** (16%)

1 Completion of large scale experiments to assess the impact of trawling on tropical benthic, fish and prawn communities and determine the recovery time of impacted benthic communities in simulated trawl-impact treatment plots relative to untrawled control plots.

2 Assessment of the effectiveness of bycatch reduction devices in reducing unwanted bycatch in tropical trawl fisheries.

3 Completion, in collaboration with the Mariculture Program, of a bioeconomic assessment of the feasibility of reseeding tropical prawn fisheries to increase production and stabilise catches.

4 New statistical techniques to estimate mortality from tag recapture data developed to improve stock assessments and general management advice for the Northern Prawn Fishery.

5 Scientific assessments of the state of the stock for the Northern Prawn Fishery, Tropical Rock Lobster Fishery, Northern Demersal Trawl Fishery, Torres Strait Islander traditional fishery and Torres Strait sea turtle populations provided to resource managers.

**To understand the ecology and dynamics of Australia's temperate and deepwater fishery resources and to use this knowledge to assist government and industry manage these resources for ecological and economic sustainability.** (18%)

6 A model of the food web underlying production of orange roughy within the mid-slope ecosystem; and a field survey to assess the habitat requirements of quota species on the southeast Australia shelf.

7 School and gummy shark assessments refined using models that take account of the complex spatial structure and movement patterns of the stocks.

8 Development of stock assessment models for key southeast fishery quota species; fisheries-independent biomass assessments using multi-frequency acoustic system for orange roughy and egg production for blue grenadier.

9 Survey sites identified by industry as important nursery areas for school and gummy shark. Continuation of recruitment monitoring in Tasmania and Victoria.

**To develop and promote the application of techniques for the early detection, prediction of impacts, and assessment of risks and costs associated with introduced marine pest species in**

**Australian waters and to develop methods to limit their spread and minimise their impacts on marine industries and ecosystems.** (12%)

10 Source populations of the Northern Pacific seastar and the European (green) crab screened for parasites and pathogens as potential biological control agents for use against introduced pest populations in Australian waters.

11 Taxonomic analysis of Port Phillip Bay biota undertaken as first step in a national survey to determine the level of infestation of Australian ports by introduced pest species.

**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.** (20%)

12 A scientific assessment of the present state of the southern bluefin tuna stocks provided and effectively presented at international meetings for the management of this population. (AP6)

13 A pilot study of bioregionalisation strategies and production of draft bioregionalisations for the Australian Exclusive Economic Zone as part of the OR2000 Commonwealth Consortium Marine Protected Areas Project.

14 Analysis of the reproductive dynamics of spawning southern bluefin tuna for improving assessments of the state of parental stocks. (AP6)

15 Development of software to visualise and analyse data produced by the CSIRO Archival Tag, in particular the estimation of geoposition. (AP6)

**To develop the scientific and technological basis necessary to expand and improve the performance of the mariculture industry.** (13%)

16 Assessment of trace elements and insertion of insect genes to develop novel biological tags for penaeid prawns.

17 Examination of trophodynamic pathways in aquaculture ponds and effluent as well as assimilation efficiencies of formulated diets using stable isotypes.

18 Development of a locally produced formulated penaeid prawn diet which competes with imported feeds.

19 Development of adult and larval prawn diets and feeding regimes which increase hatchery productivity by enhancing reproductive performance and larval survival.

20 Assessment of the utility of supplemental feeding with unicellular algae as a method of increasing and stabilising the growth rate of juvenile oysters.

**To determine the principles needed to manage the impact of economic development on the marine environment for ecological sustainability, and to assist government and industry to apply these principles.** (21%)

21 Complete analysis and publication of phytoplankton production data from Aurora Australis cruises in the Southern Ocean from 1991 to 1995 and a carbon cycle process cruise in the Southern Ocean undertaken as part of the international ACE-1 Program.

22 Completion of mapping at a scale of 1:100,000 of the underwater features of the coast from Exmouth Gulf to the Victorian border in a Geographic Information System (GIS) format.

23 Methods to determine algal bloom dynamics and associated physical and chemical processes in in-shore and estuarine systems developed and tested.

24 Development and implementation of methods to document the relationships between biological activity, small scale transport and the fate of nutrients in coastal sediments.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $12,577,000 |
| External funds | $8,586,000 |
| **Total Expenditure** | **$21,163,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 34% | 37% | 36% |

*estimates as at June 1995

# 38. Division of Oceanography (INRE)

## Objective

**To provide and apply scientific knowledge required for the environmentally sustainable development of Australia's regional oceans, seas and estuaries, and to develop a thorough understanding of the ocean's role in climate.**

## Strategy

National needs for physical and chemical marine expertise are now very diverse with Australia's Exclusive Economic Zone coming into force in 1994. These needs are best met by integration of core research capability into programs defined by requirements of the users.

A major government requirement is advice for marine environmental protection policy. The coastal zone is an area of particular focus. Offshore industrial development requires estimates of risk of environmental degradation and accurate knowledge of environmental extremes. Synoptic and climatic knowledge of ocean thermal and current structure is needed to assess and predict the sensitivity of the Australian climate to changes in its surrounding oceans. Marine chemistry contributes to fisheries, mariculture and the exploitation of marine resources and byproducts. Marine technology aids local industrial capability and links with the world in areas such as climate research and remote sensing.

Our strategy consists of the following elements:

- Undertake strategic research in ocean observations, ocean dynamics, numerical modelling, organic and inorganic chemical analysis and marine technology, and the integration and application of these disciplines in selected projects of defined environmental, industrial and social relevance.
- Enhance the efficiency and impact of Divisional research through the use of special purpose grants and collaborative links with Cooperative Research Centres, other CSIRO Divisions, national agencies, universities, and with internationally coordinated research programs.
- Provide direct marine research service and scientific advice to industry, and to federal and state bodies, on issues of environmental management and industrial development; and develop marine products in collaboration with industry.
- Promote the Division's work to government, industry, other stakeholders and the general public through a range of communication mechanisms.
- Operate the RV *Franklin* and maintain its capability as a state-of-the-art National Facility for the benefit of Divisional research and Australian marine science.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

***Climate Change*** - MDP17

***Coastal Zone Program*** - MDP21

***Management of Marine Living Resources*** - MDP23

***Climate Variability and Impacts*** - MDP29

***CSIRO Aquaculture Initiative (CAI)*** - MDP34

## Specific Objectives & Planned Outcomes

**Describe and quantify 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.** (40%)

1 Completion of analysis of TOGA-COARE heat and freshwater budgets following a drifter, to an accuracy of better than 10 watts/$m^2$. (EN2)

2 Testing of mixed layer models, using the accurate data on fluxes and advection from TOGA-COARE. (EN2)

3 Test of the use of TOPEX-POSEIDON altimeter data in tracking eddy movements in the Tasman and Coral Seas.

4 Implementation of Division of Oceanography research component of Climate Variability and Impacts MDP, including a new Research Scientist in assimilation and modelling. (EN2)

5 Quantification of the impact in a global ocean-only model of advecting fluid with the Temporal Transformed Eulerian Mean (TTEM) velocity (rather than the Eulerian Mean).

6 Accurate measurements to determine mass, heat, freshwater and nutrient transports from the Pacific to the Indian Ocean north of Australia. (EN2)

7 Estimates of the variability in the stable carbon isotopic composition of surface waters in the Southern Ocean in order to constrain estimates of $CO_2$ uptake by the ocean.

8 Estimates of seasonal changes in the air-sea flux of carbon dioxide in the Seasonal Ice Zone to the south of Australia and the factors controlling the fluxes.

9 Estimates of the relative importance of air-sea exchange and deep convection as carbon sources for Antarctic ocean phytoplankton.

10 Implementation and tests of an eddy-resolving primitive equation ocean model in a region south of Australia. (EN1)

11 Estimates of the meridional eddy heat and momentum fluxes from in situ measurements south of Australia (EN1)

12 Estimates of altimeter-derived momentum fluxes in the Southern Ocean.

**Describe and predict the physical and environmental state of Australia's regional seas including its EEZ and estuaries by modelling and measurement, for applications to offshore engineering, fisheries management, pollution dispersal, and search and rescue.** (30%)

13 Establishment of the scientific team for the EEZ modelling project; significant progress towards developing an ocean climatology for the EEZ region; commencement of development of a full data-assimilative model for the EEZ.

14 Completion of data assembly and interpretation for the bioregionalisation project under DEST's Ocean Rescue 2000 program.

15 Completion of the model development outlined in the Port Phillip Bay P8B task brief, and provision of advice as part of the study Technical Advisory Group.

16 Improved description of the dynamics of larval prawns in Albatross Bay in the Gulf of Carpentaria, with a view to predicting recruitment and its influence on the prawn catch.

17 Development of hypotheses of physical oceanographic influences on recruitment and catchability of Southern Rock Lobster and Tiger Prawns by exploratory data analysis and modelling (Marine Living Resources MDP).

18 Validation of satellite sea surface temperature with in situ measurements off Perth, to assess the accuracy of the satellite-derived values for oceanographic and fisheries applications.

19 Assessment of the role of coastal oceanic processes off Western Australia on recruitment to the tailor fishery.

20 Analysis and publication of results from the ASEAN - Australia Regional Ocean Dynamics Expeditions.

**Undertake research on the chemical composition and biogeochemical cycles of coastal seas and oceans for environmental applications and promote the development of marine resources and products.** (30%)

21 An evaluation of the factors controlling the carbon cycle in the western Equatorial Pacific (JGOFS).

22 Determination of the seasonal variability in the chemical forms and transport of carbon dioxide in the Southern Ocean (JGOFS - WOCE - Antarctic CRC).

23 Integration of chemical data from the Derwent Estuary with physical transport models developed in the Division (Coastal Zone MDP).

24 Development of chemical modules to enable prediction of the sources, fates and chemical transformations of environmentally important compounds in natural waters.

25 Evaluation of Antarctic saline lakes as simplified proxy systems for biogeochemical processes in the marine environment (Antarctic CRC).

26 Investigation of the use of ion-selective electrodes to determine the concentrations of free metal ions (the biologically important fraction) in natural waters.

27 Determination of the influence of different essential polyunsaturated fatty acids on growth rates of juvenile abalone.

28 Installation and commissioning of a new isotope ratio mass spectrometry facility for marine samples containing carbon, nitrogen and sulphur.

29 Determination of the amount of hydrocarbons entering an estuary through stormwater systems from typical urban catchments.

30 Estimation of the contribution of sewage to organic matter in the Derwent estuary.

31 Identification of fatty acid and lipid classes in aquaculture diets for golden snapper to determine why some diets work better than others and to improve fish growth and survival.

32 Refinement of a laboratory purification process for adding value to Australian marine oils enriched in polyunsaturated fatty acids.

33 Further development of coprostanol as an indicator of human faecal pollution in aquatic ecosystems.

34 Commencement of project to improve quality and productivity of software development within the Division, linking with the Division of Information Technology's outreach component of the Software Engineering Initiative.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $5,282,000 |
| External funds | $3,827,000 |
| **Total Expenditure** | **$9,110,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 25% | 30% | 33% |

*estimates as at June 1995

# 39. RV *Franklin* (A National Facility) (INRE)

## Objective

**To ensure the most efficient and cost effective use of the RV *Franklin* as a multi-purpose research platform for the Australian marine science community, Government and marine-related industry.**

## Strategy

- Anticipate national needs within the capability of the vessel, ensure cost effective deployment, and provide competent scientific engineering support and financial management in consultation with, and by participation on, Steering and Users Committees of the vessel.
- Maintain and continually upgrade the technical capabilities of the scientific instruments and systems installed in the vessel.
- Ensure an ongoing program of refurbishment and preventative maintenance in collaboration with the operating contractor (Howard Smith Industries Pty Limited).
- Support the research usage of the vessel through the provision of efficient and quality-controlled standard chemical analysis, calibration, hydrology and data product services.
- Promote collaboration and interaction with other research vessel operators both nationally and internationally.

## Multi-Divisional Collaboration

The Facility participates in the following Multi-Divisional Program:

***Climate Change*** - MDP17

## Specific Objectives & Planned Outcomes

**To fully utilise CSIRO's share of available shiptime (57 days or 28% of the total) in 1995-96.** (100%)

1 A study of Bottom Water in the Indian Ocean - an Australian contribution to WOCE.

2 An investigation into the throughflow of Pacific Waters into the Indian Ocean through the Indonesian Archipeligo.

3 Measurements of mixing and circulation in the Perth Basin.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $3,516,000 |
| External funds | $1,089,000 |
| **Total Expenditure** | **$4,605,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 6% | 7% | 6% |

*estimates as at June 1995

## Objective

**To improve our understanding of water's role in the environment in order to provide managers with a sound basis for developing practical and cost-effective ways to resolve water resource problems.**

## Strategy

The sheer size of Australia and its often difficult terrain make the solving of water resources problems a complicated process. In this environment, maintaining the quality and quantity of urban, rural, and industrial water supplies requires a combination of scientific disciplines.

- The Division investigates all aspects of the hydrological cycle, ranging from rainfall to groundwater, and seeks to balance contributions to theoretical aspects of water resources research with practical involvement with its water industry partners.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Urban Water Systems* - MDP16

*Climate Change* - MDP17

*Algal Research Program* - MDP20

*Coastal Zone Program* - MDP21

*Minesite Rehabilitation* - MDP24

*Climate Variability and Impacts* - MDP29

*Dryland Farming Systems for Catchment Care* - MDP32

## Specific Objectives & Planned Outcomes

**To develop a sound technical basis for better managing our groundwater and associated surface water resources, and for evaluation and remediation of contaminated soil and groundwater.** (21%)

1 Application of evaluation and remediation techniques in demonstration programs in Australia and overseas, with public and private sector partners.

2 More effective ways developed for protecting groundwater quality, particularly from intensive rural industries. (ED3)

3 The expanded Centre for Groundwater Studies established as an internationally recognised centre specialising in research, education, and training.

4 Diffusion cell devices commercialised through the CRC for Waste Management and Pollution Control Ltd, for on-line and in situ monitoring of volatile organic compounds and gases.

**By ecological research, to promote sustainable management and conservation of rivers and wetlands.** (18%)

5 Advice provided on integrated strategies for managing alien invasive plants, alligator weed and primrose willow.

6 Assessments of effects of the water regime on exotic invasive species, including European carp, *Typha*, and exotic waterbirds.

7 A monitoring strategy combining both chemical and biological techniques developed for assessing the status of irrigation drainage water containing pesticides.

8 Advice provided on the biological impact of cotton pesticides on inland rivers.

9 Advice provided to the water industry on the effective identification and management of toxic algal blooms.

10 River flow targets for the prevention of blooms assessed.

11 Commercial water quality instrumentation tested and transferred to Greenspan Technology Ltd.

**Develop land and water use strategies in irrigated areas to reduce salinisation, increase productivity and maintain river water quality.** (27%)

12 Incorporate and test the efficacy of waterlogging and salinity effects on yields in selected models of irrigated crops subject to shallow watertables.

13 Measure the water balance components of irrigated perennial pasture subject to shallow watertables.

14 Develop guidelines for the prevention and control of muddy water in rice which do not significantly increase recharge of the watertable and which minimise the need for surface drainage of turbid water.

15 Develop water-monitoring procedures and contribute to policy development for the Coleambally Irrigation Area which are acceptable to the community and which assist farmers to make informed water management decisions. (ED6)

16 Develop tools to assist irrigators and irrigation area managers make economically and environmentally sound decisions to manage net recharge and salinisation at farm, sub-regional, and regional scale.

17 Develop new techniques for management of effluent irrigation especially in situations with slowly permeable soils and shallow watertables.

18 Develop guidelines to minimise the volume of water and quantity of salt discharged from subsurface drains used to protect and remediate horticultural land.

19 Potential for salinisation of groundwaters in mallee areas of the Murray Basin investigated.

20 Management of saline disposal basins maximised for their usefulness for salt storage.

21 The impact of floodplain management on riparian vegetation health and salinisation of the River Murray floodplain assessed.

22 Recharge under a variety of dryland agricultural systems investigated and modelled.

23 Risk analysis for dryland salinity development in the Loddon-Campaspe catchment of the Murray-Darling Basin developed.

24 Indicators of catchment health tested in catchments.

25 Hydrogeomorphic mapping using GIS technology for rehabilitation of degraded catchments applied in a range of catchments.

26 Salt loads and concentrations in major catchments of the Murray-Darling assessed.

**Monitor nutrients and sediments reaching water supplies, and identify sources, fate, and management strategies; predict the impact of climatic variability and change on water resources.** (21%)

27 Assessment of the change to low and high river flows, and the recharge to groundwater, under enhanced Greenhouse conditions.

28 Improved tools for the assessment of climate change and climate variability impacts developed and tested.

29 Continued development of tracing methods for sediments and phosphorus, and their utility demonstrated by application to the Upper Murray-Darling Basin.

30 The role of natural phosphorus in eutrophication determined and its importance made clear to catchment managers.

31 Practical analytical tools developed and applied to estimate the significance of land use as a source of pollutants reaching the Herbert River Coast in North Queensland.

32 Efficient operational tools for monitoring water quality from airborne data developed, packaged, and tested.

**To develop and evaluate techniques in the information, social and economic sciences and apply them to the resource and environmental issues faced by scientists, managers and users of water and land, with particular emphasis on catchment management, water allocation and urban water systems.** (13%)

33 The CMSS decision support system used in NSW, Qld, Vic., and WA, and handed over to a commercial agent.

34 A small expert system developed for estimating nutrient generation rates.

35 The HYDRA graphical interface for linkage of 'legacy' models applied in Sydney Water Corporation for HSPF and SALMON Q models.

36 MEDLI, an integrated model of effluent disposal for intensive rural industries completed on behalf of the CRC for Waste Management and Pollution Control, jointly with Queensland Department of Primary Industries.

37 A feasibility study of a decision support system for planning environmental flows in the Murray-Darling Basin completed.

38 More effective community-based programs developed for the sustainable use of land and water resources for NSW catchments, leading to a nationally relevant methodology.

39 A preliminary design completed for an institutional and community process for the allocation of near-urban land and water on the Swan Coastal Plain, with special reference to justice evaluation criteria.

40 Report completed on principles for setting developer contributions to urban water infrastructure.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $12,067,000 |
| External funds | $7,983,000 |
| **Total Expenditure** | **$20,050,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 34% | 36% | 34% |

*estimates as at June 1995

## 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.
- Apply and communicate research results through scientific publications, consulting, conferences and the public media.

## Multi-Divisional Collaboration

The Division participates in the following Multi-Divisional Programs:

*Climate Change* - MDP17

*Conserving Biodiversity for Australia's Future* - MDP18

*Data Acquisition and Utilisation* - MDP19

*Coastal Zone Program* - MDP21

*Minesite Rehabilitation* - MDP24

*Climate Variability and Impacts* - MDP29

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

*Dryland Farming Systems for Catchment Care* - MDP32

## 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.** (19%)

1 Initiation of a project to model dynamics of the social, economic and natural resource elements of rangeland regions. (ED6)

2 Delivery of manuals for assessing soil surface condition and landscape dysfunction to State agencies. (ED6)

3 Completion of research on impact of grazing on biological diversity and delivery of report to DEST.

4 Completion of a palatable grass mortality model and validation from demographics of grass populations under grazing.

5 A major contribution to the development of the National Rangeland Strategy Plan. (ED6)

6 Initiation of research on regional scale biodiversity assessment in the MacDonnell Ranges.

7 Establishment of experiments to determine the impact of grazing on soil seed reserves.

8 Support to the Australian government and overseas agencies in developing the International Convention on Desertification.

**To determine the ecological mechanisms governing dynamics of Australia's tropical rainforests and savannas, and establish principles for maintaining their biological diversity, assisting government and other agencies to apply these principles.** (14%)

9 Establishment of CRC projects on: responses of savannas to stress and disturbance; invertebrate indicators of sustainability; riparian vegetation as refuges.

10 Assessment of rehabilitation following control of *Mimosa pigra*.

11 Completion of study on environmental impact and tourist satisfaction on boat tours at Kakadu for Department of Tourism.

12 Publication of book chapter and four journal articles on the impact of rainforest fragmentation on small mammals and tree regeneration.

13 Development of models explaining the distribution of biota in relation to habitat variables in wet sclerophyll vegetation in the wet tropics.

14 Commencement of a study of the ecological implications of fire behaviour adjacent to the wet tropics rainforest.

15 Publication of use of fire as a management tool for pastoralists in north Queensland.

16 Completion of successional studies of remnant rainforest types.

17 Publication of journal articles on root distributions and mycorrhizal infection in secondary rainforest sites.

18 Publication of journal articles on the floristic and functional pathways of secondary succession in montane tropical rainforests on different soils.

**To provide Governments and other land managers with improved strategies and techniques, including novel and environmentally friendly benign biological agents, for controlling introduced or native vertebrate pests.** (26%)

19 Identification of possible agents for biological control of foxes and rabbits and mice using an integrated ecological, virological, reproductive and molecular biological approach. (ED1)

20 Development of a systems analysis of the rabbit-fox-endangered species complex. (ED1)

21 Completion of island trials of rabbit calici virus as a new biological control agent.

22 Development of best farm management practices for controlling mouse plagues.

23 Development of integrated pest management strategies for rodents in SE Asia.

24 Assessment of impact of cane toads on native fauna.

**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.** (19%)

25 Development of a model for integrating agriculture and nature conservation in the WA wheatbelt. (ED6)

26 Development of a landscape-specific simulation model of Blue-breasted Fairy Wren population dynamics in the WA wheatbelt.

27 The re-establishment of a multi-species mammals community on Shark Bay peninsula, comprising species recently extinct on mainland Australia.

28 A theoretical framework and principles for ecosystem and landscape restoration.

29 Report to the World Bank on methods for rapid assessment of biodiversity priority areas.

30 Completion of the book 'Priority area analysis: systematic methods for conserving biodiversity'.

31 Production of statistical models relating forest structure to habitat quality for a range of forest-dwelling fauna.

32 Production of preliminary inferences about effects of disturbance on forest fauna, based on fauna-habitat modelling.

33 Incorporation of modules for effect of topography and nutrient status into the forest dynamics model EDEN.

34 Completion of first year of sampling in an experiment to examine the process of extinction in small populations of mammals. (EN4)

**To develop and test future options for the use and management of Australia's environmental resource sectors at regional and continental scales, and for medium and long term time frames.** (12%)

35 Completion of first round of environmental scenarios of Australia's future.

36 Development of two analytical frameworks for assessing opportunities and impacts for environmental sectors.

37 An operational spatio-temporal model for exploring the implications of population explosion in the coastal zone.

38 A working prototype of SRIAS-2000 for testing regulatory and economic instruments affecting landuse in NSW.

39 A working prototype of the ENVISAGE framework for predicting continental landcover under different landuse scenarios.

**To provide services to government and industry for improved assessment and management of environmental resources in Australia and the South-West Pacific.** (10%)

40 Completion of a stratified survey of the land vertebrates of the Murwillumbah management area for State Forests of New South Wales.

41 A directory and atlas of all regional forms (species and subspecies) of the song-birds of Australia.

42 Completion of preliminary ecological surveys of billabong ecosystems for Energy Resources of Australia Inc.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $13,611,000 |
| External funds | $5,341,000 |
| **Total Expenditure** | **$18,952,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 35% | 37% | 38% |

*estimates as at June 1995

## Objective

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

## Strategy

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

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

## Multi-Divisional Collaboration

The Centre participates in the following Multi-Divisional Programs:

*Climate Change* - MDP17

*Algal Research Program* - MDP20

*Coastal Zone Program* - MDP21

*Climate Variability and Impacts* - MDP29

*Air Quality* - MDP30

*Dryland Farming Systems for Catchment Care* - MDP32

## Specific Objectives & Planned Outcomes

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

1 Second phase of OASIS field experiment program on surface energy balances and trace gas exchanges in a heterogeneous landscape, building on the results of phase one.

2 Development and appliction of techniques for trace gase ($CO_2$, $CH_4$, $N_2O$) flux measurement at patch and regional scales, including eddy correlation and CBL budget methods.

3 Further analysis of air-sea interaction data from TOGA-COARE, leading to integration with mesoscale convection and ocean mixing processes in the west Pacific warm pool.

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

5 Wind tunnel studies of microclimate processes around windbreaks, particularly of scalar transfers and three-dimensional effects; collaboration with State agencies in field studies.

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

6 Theoretical and practical developments of the TDR system completed.

7 Water use and extraction patterns from row crops with various rooting depths described.

8 Acid outflow from river tributary quantified and management options for acid sulphate soils devised.

9 Pyrite oxidation processes studied by analysis of oxygen consumption and sulphate production in relation to the movements of water, gas and reaction products.

10 Applications to salinity disposal identified for model of 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.** (20%)

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

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

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

13 Biennial Report for 94/95 in preparation.

14 Strengthened interactions with the media.

15 Internet and World Wide Web presence developed.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $2,685,000 |
| External funds | $1,450,000 |
| **Total Expenditure** | **$4,135,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 34% | 35% | 35% |

*estimates as at June 1995

# 43. 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

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

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

## Multi-Divisional Collaboration

The Office participates in the following Multi-Divisional Program:

***Data Acquisition and Utilisation*** - MDP19

## Specific Objectives & Planned Outcomes

**Strengthen the ability of CSIRO's space-related research and development to contribute to the sustainable management of Australia's natural resources.** (47%)

1 Implementation of the CSIRO Executive Committee's response to the Prospective Analysis of CSIRO research program requirements for satellite data reception needs. (Eval)

2 Creation of an Earth Observation Centre to assist CSIRO research programs, through the brokerage of support and interchange of resources within CSIRO. (Eval)

3 Commencement of a long-term strategy for the design of space instrumentation with applications in environmental monitoring and resource identification, classification and management. (ED6, ED7)

4 Expanded opportunities for CSIRO research programs to access a greater variety of airborne platforms for research. (ED6, EN1)

5 Completion of the transfer of technology of the Daedalus airborne scanner to the private sector.

6 Establishment and maintenance of an archive of Daedalus airborne scanner data for the research community.

7 Investigation of national and international market opportunities for collaboratively developed satellite reception technology.

**Strengthen the participation by CSIRO and its scientific, technological and industrial collaborators in international space projects and global space programs.** (43%)

8 Chair of the Committee on Earth Observation Satellite (CEOS) from October 1995.

9 Representation of CSIRO interests at the international fora such as the Committee on Earth Observations Satellites (CEOS) plenary in October 1995, the International Astronautical Federation (IAF) Congress in October 1995, and the International Symposium on Spectral Sensing Research (ISSSR) in Melbourne in November 1995.

10 Finalisation of planning for the Australian-hosted CEOS plenary for 1996.

11 With the US Army Topographic Engineering Center, complete preparations for the Australia-hosted International Spectral Research Symposium (ISSSR) in Melbourne in November 1995.

12 Commencement of Geostationary Meteorology Satellite pathfinder project in collaboration with the University of California San Diego Scripps Institute, NASA and the Australian Bureau of Meteorology.

13 Participation in United Nations Economic and Social Commission (ESCAP) Regional Space Technology Applications Program through joint projects and training programs.

14 Planning for a September 1996 specialist aircraft and instrumentation deployment in collaboration with NASA, CSIRO, and other Australian scientific and industry groups.

15 Provision of specialist services for the third Pacific Atmospheric Chemistry Experiment, in collaboration with the CSIRO Division of Atmospheric Research, the Meteorological Research Institute of Japan, and Japanese and Australian aviation companies.

16 Provision of specialist services for the first stage of collaborative Australian/Japanese satellite sensor calibration/validation field experiments.

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

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

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $2,197,000 |
| External funds | $540,000 |
| **Total Expenditure** | **$2,737,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 24% | 26% | 9% |

*estimates as at June 1995

## Objective

**To promote the effective use of statistical methodology in CSIRO's agricultural, biological and environmental Institutes.**

## Strategy

CSIRO's agricultural, biological and environmental Institutes require advanced statistical methodology in support of their national priority research. Biometrics Unit staff support this effort by performing and promoting efficient design of experiments and effective data analysis and modelling, and by maintaining a high level of collaboration and communication both inside and outside CSIRO.

- Collaborate in Divisional and Multi-divisional research programs, both appropriation and externally funded.
- Provide high quality statistical consulting.
- Assist Divisional staff in their use of basic statistical methods and statistical computer packages.
- Contribute to the planning and evaluation of CSIRO's research.
- Perform biometrical research relevant to Divisional programs.
- Undertake direct external consultancies consistent with the objectives of IAPP, INRE and IPPP.

## Specific Objectives & Planned Outcomes

**Collaborate in Divisional research projects and provide high quality statistical consulting.** (65%)

1 Staff located part-time or undertaking regular visits in major locations of Divisions, as required for collaboration and consulting.

2 Full statistical analysis and reporting of major projects.

**Assist Divisional staff in the use of basic statistical methods and statistical computer packages.** (5%)

3 The short courses "Design and Analysis of Experiments", "Introduction to Genstat 5", "Introductory Statistics" and "Regression Modelling" offered at least once in Adelaide and Canberra, and in other locations as required.

4 Maintenance of organisational licences for Genstat 5.

**Contribute to the planning and evaluation of CSIRO's research.** (10%)

5 Advice on experimental design and sampling for individual projects provided when requested.

6 Divisional research proposals and drafts of publications and reports refereed when requested.

7 Participation in reviews of Divisions, programs, projects and subject areas by direct involvement when requested, and by making submissions when relevant.

**Perform biometrical research relevant to Divisional programs.** (10%)

8 Methodological publications, including one on non-linear functional relationships.

**Undertake external consultancies consistent with the objectives of IAPP, INRE and IPPP.** (10%)

9 At least one consultancy in risk assessment.

10 One consultancy on heavy metals in crustaceans.

## Summary of Planned Expenditure 1995-96*

| | |
|---|---|
| Direct Appropriation | $474,000 |
| External funds | $46,000 |
| **Total Expenditure** | **$520,000** |

## External Earnings as a Proportion of Total Income*

| 1994-95 | 1995-96 | 1996-97 |
|---|---|---|
| 9% | 10% | 9% |

*estimates as at June 1995

# 45. Corporate Services Department

## Objective

**Provide high quality, timely and responsive corporate policy advice and management services in support of CSIRO's goals.**

## Strategy

CSIRO's Corporate Services provides support to CSIRO in a number of functional areas such as financial, human resource, property and information technology and services management, etc. This support is focussed on meeting CSIRO's organisational needs in these areas. Typically, it includes developing policies for the Executive Committee, providing specialist advice to line management, and coordinating and delivering services best handled centrally.

The Department operates under a set of principles set out below.

- Corporate Services only undertakes activities that significantly affect the Organisation's core business, performance, accountability or effectiveness.
- Corporate Services' main activities will be undertaken for specifically defined customers in close consultation with line management and will be restricted to areas of strategic importance to the conduct of the core business.
- Corporate Services will advise the Chief Executive on the performance of the Organisation and compliance in key policy and statutory areas.
- Corporate Services will advise and support the Chief Executive and Institute Directors on issues of organisational significance.
- Corporate Service will provide services to CSIRO best delivered centrally on the basis of their strategic significance to the Organisation's efficiency and effectiveness or for which a clear demand exists and full costs can be recovered from users.
- Except in cases covered by the preceeding point, services that are available from Australia's private sector or from elsewhere in the Organisation generally will not be provided by Corporate Services.
- All services provided by Corporate Services will be fully costed and these costs recovered or identified through one of the following means:
  - attribution at corporate level for services or costs most efficiently provided or charged corporately;
  - attribution at Institute or Division level of costs of services performed on behalf of Institutes and/or Divisions;
  - client billing, ie charging the full costs of the service to the service user.
- Corporate Services will, regularly review with the Organisation's line management, the nature, level of resources and requirement for the activities it conducts centrally.
- Corporate Services will regularly seek customer feedback on the quality and effectiveness of its activities and its services.

Note: In late 1994 the report on the Review of CSIRO's Human Resources Function was released. When implemented it will establish a structure fundamentally different from that which currently exists and will require a different *modus operandi*. The Human Resources Branch will disappear and be replaced by a small HR Strategy Group and a small Service Group. Many of the routine HR activities will be devolved to Business Unit HR staff and line managers. The Strategy Group will adopt a far more collaborative approach to the development of HR strategy and policy with such work being driven by business unit needs and progressed through task forces comprising business unit representatives, with co-ordination provided by the Strategy Group.

## Specific Objectives & Planned Outcomes

**Provide professional advice and services to support financial planning and financial management within CSIRO.** (6%)

1 Support for the Chief Executive and Board through the development of financial planning options for the current (1994-97) and following (1997-2000) triennia, consistent with the Organisation's priorities.

2 Continually improving financial planning in CSIRO, by enhancing the periodic budgeting and accounting practices for both revenue and expenditure.

3 Preparation of the Organisation's budgetary documentation to meet Government timetables in the prescribed format for Commonwealth Budget Papers.

4 Monitoring of CSIRO's financial position and production of financial performance reports to the Executive Committee (monthly) and Board (quarterly), and CSIRO statutory financial reports.

5 Operation and extension of commercial accounting policies, procedures and systems relevant to CSIRO's business and statutory requirements.

6 Continued development of financial management skills of finance managers in Divisions and elsewhere.

7 Promulgation of CSIRO *Financial Directions* and *Financial Procedures Memoranda* that are current and consistent with business and statutory requirements.

8 Initiation and management of major Organisation-wide contracts where there are benefits in doing so, e.g. insurances, travel, etc.

**Specify and implement financial systems to meet the Organisation's needs.** (3%)

9 Support and development of UNIBIS and financial systems in general to meet the needs of users at all levels.

10 Support for participative processes of user involvement in financial systems development.

11 Implementation of project information and management tools as a core CSIRO system for users at all levels facilitated.

**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 1995-96.

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.

**Support CSIRO's corporate and statutory responsibilities in relation to international matters.** (1%)

18 Provision of advice to the Chief Executive and Directors and support for the development of corporate policy on international matters.

19 Fostering of CSIRO's contributions to international scientific collaboration and technical co-operation.

20 Representation of CSIRO and Australia at international meetings, conferences and on government missions.

21 Provision of a corporate focus to assist in the development of alliances with selected countries.

22 Establishment and maintenance of an international activities database to identify potential new linkages of advantage to CSIRO.

23 Provision of opportunities for staff of Institutes and Divisions to exchange information and experience with respect to international activities.

**Assist business units to develop and implement the Human Resources Plans and associated strategies and policies to attract, retain, develop and deploy high quality staff while ensuring maintenance of corporate values and principles.** (19%)

24 Implementation of HR Review recommendations for HR Strategy and Services Groups. (Eval)

25 Provision of consultancy service to senior corporate managers and business units on organisational change, interactive strategic planning, team building and human resource management (on a full cost recovery basis from 1 January 1996).

26 Provision of strategic and operational support to business units on industrial relations issues and representation of CSIRO before the Australian Industrial Relations Commission.

27 Development of proposals for negotiation in the context of enterprise bargaining, co-ordination of CSIRO's approach to enterprise bargaining and representation of CSIRO in discussions with the other parties.

28 Development of new strategy for succession planning and "top team" development.

29 Conduct of research management, project leadership and middle-management development programs (on a full cost recovery basis from 1 January 1996).

30 Completion of 1994/95 Leadership Development program, and conduct of 1995/96 program.

31 Assistance given in identifying and providing training and development opportunities for Chiefs, Directors and the Chief Executive.

32 Completion of review of OHS policies and publication in consolidated form using plain English text which clearly identifies the "corporate mandatory" from the guidelines on best practice implementation.

33 Management of Consultative Council and its associated Sub-Committees and the Corporate OHS Committee.

34 Conduct and review of new travel arrangements.

35 Provision of support services to business units relating to payroll, workers compensation, superannuation, redundancy and redeployment, appeals and grievances (until December 1995) and advertising and recruitment selection processes (until December 1995).

36 Management on behalf of business units of the network of Health & Safety Advisers.

37 Development of a new IR strategy.

38 Development of strategic remuneration policy to provide line managers with flexibility to attract and reward key performers in line with business needs.

39 Development of proposals for team-based rewards and awards to recognise scientific and commercial success in team-based activities.

40 Conduct and review of pilot of team-based PPE.

41 Development of new competency-based tools for managers to apply in classifying, rewarding and developing staff.

42 Review of all current corporate HR manuals and documentation. Development of consolidated, plain English material to supplement or replace existing material wherever possible.

43 Analysis of CSIRO's HR performance through appropriate benchmarking studies.

44 Development/review of policies to improve workplace flexibility for staff with family responsibilities and those who carry out work from home.

**Specify and implement human resource systems to meet the Organisation's needs.** (3%)

45 Identification of system development needs through interaction with human resources systems users. Determination of appropriate service levels and priorities for HR systems development. Supervision of contract with ITSB to provide maintenance and enhancements.

**Assist in the transfer of research results through the provision of an information infrastructure for science and technology within CSIRO, and in Australia, which is engaged in the active publishing, collecting, disseminating and communicating of science information through a variety of media.** (37%)

46 Publication of the twelve Australian Journals of Scientific Research, *Australian Journal of Experimental Agriculture* and *Australian Journal of Astrophysics*.

47 Publication of at least twenty-five CSIRO monographs.

48 Development of new products and services using emerging technologies such as multimedia, electronic transfer of files, networks and CD-ROMs.

49 Quarterly issues of the science magazines *Ecos* and *Rural Research*.

50 Production of bibliographic and research in progress databases on behalf of external customers and CSIRO.

51 Communication of CSIRO's research through multimedia displays, corporate videos and printed publications.

52 Active marketing of CSIRO's science publishing through a Bookshop service.

53 Provision of cost savings in centralised acquisition of library journals and management of the CSIRO library network catalogue.

54 Effective preservation and dissemination of CSIRO research publications and organisational records.

55 Effective access to and delivery of electronic information sources.

**Specify and implement library and information dissemination systems to meet the Organisation's needs.** (3%)

56 Implementation of Voyager as a replacement for the GEAC library system by September 1995.

57 Support to users of databases and documents managed by SIM software.

**Provide a professional, cost effective and efficient information technology service to CSIRO.** (21%)

58 Planning for and management of corporately required information technology services and contracts for CSIRO.

59 Replacement of the Fujitsu mainframe with Unix servers by August 1994. Provision of and support of the Unix operational environment for corporate applications.

60 Provision of and maintenance of the Corporate network infrastructure for the transmission of voice, data and image Australia wide. Continued replacement of PABXs.

61 Integration of the voice and data networks and establishment of a single CSIRO network utilising AARNet and the Virtual Private Network.

62 Management of the relationship with AARNet and continued liaison with Divisions to jointly provide cost effective networking.

63 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.

64 Development of corporate strategic plans for information technology, and networks and telecommunications.

65 Maintenance, in consultation with the relevant System Owners, of corporate application systems such as UNIBIS, Pay and Library systems. Expert technical advice provided for proposed systems and, where required, cost effective solutions developed and implemented.

**Provide a corporate property management service to ensure adequate and cost effective research accommodation and facilities.** (5%)

66 Facilitation of the Board approved Property Management Plan emphasising rationalisation, consolidation, cost minimisation, effective site management and the exploitation of collaborative opportunities.

67 Management of the Approved Capital Investment plan of $115 million over the Triennium, as part of a long term rolling capital works program.

68 Management of the internal leasing scheme for CSIRO's accommodation.

69 Management of North Ryde redevelopment through executive participation in the Project Control Group, and ongoing co-ordination of project management.

70 PPWC approval for redevelopment of Minerals (Clayton) and Tropical Crops and Pastures (St Lucia).

71 Facilitation of projects recently submitted to PPWC.

72 Implementation of a self funding strategy for the relocation of Animal Health facilities from Werribee/Maribyrnong to State Agriculture land at Werribee.

73 Completion of master strategy plans for all major sites as part of a total estate exercise.

74 Revaluation of all land and buildings assets for accrual accounting and property management purposes.

## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Branch/Unit | Staff by Functional Classification (EFT units)[1] | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|
| | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Corporate Finance | 22 | 2 | 24 | 2,223 | 120 | 2,343 |
| Government Business and International Scientific Liaison | 6 | 3 | 9 | 1,200 | 917 | 2,117 |
| Human Resources | 27 | 3 | 30 | 4,503 | 2 | 4,505 |
| Information Services | 103 | 2 | 105 | 4,318 | 5,629 | 9,947 |
| Information Technology Services | 68 | 2 | 70 | 4,993 | 16 | 5,008 |
| Corporate Property | 13 | 2 | 15 | 1,291 | 17 | 1,307 |
| Corporate Library | 4 | | 4 | 251 | 14 | 265 |
| Site Administration - Limestone Avenue | 24 | | 24 | 2,161 | 55 | 2,216 |
| Director CSD | 3 | 4 | 7 | 479 | 17 | 496 |
| Research Support Other | | | | 1,350 | 100 | 1,450 |
| **TOTAL** | 270 | 18 | 288 | 22,769 | 6,887 | 29,654 |

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

# 46. Corporate Business Department

## Objective

**To assist CSIRO, in partnership with the Australian business community, to position itself to take maximum advantage of opportunities in current and emerging fields of R&D.**

## Strategy

Recognising both the fundamental importance of science and technology in enhancing the competitiveness of Australian industries, and the critical role of good commercial practice in maximising effective interactions between CSIRO and the business community, the Corporate Business Department will:

- Strengthen and expand CSIRO's relationship with the Australian business community.
- Conduct professional analysis and evaluation of strategic business opportunities in areas of R&D relevant to CSIRO.
- Identify key areas of business opportunity to guide CSIRO's R&D and technology transfer strategies.
- Identify and assist in developing international alliances of advantage to CSIRO and Australian business.
- Promote best commercial, legal and IP management practice at all levels of CSIRO.
- Promote sound strategic planning and evaluation practice at all levels of CSIRO.
- Inspire interest in, and support for, CSIRO's research among key stakeholders and the general community.

## Specific Objectives & Planned Outcomes

**Corporate Business Development: To identify and assist in developing relationships of mutual advantage to CSIRO and the Australian business community, both nationally and internationally.** (16%)

1 In association with Institutes and Divisions identify and initiate a number of significant new projects with major Australian companies.

2 Restructuring of major commercial projects where necessary.

3 Implementation of recommendations from the recent review of intellectual property management.

4 Establishment and strengthening of overseas representation for CSIRO intellectual property through panels of attorneys in the Asian region.

5 Increased contacts with international technology transfer and R&D organisations with priority given within the Asian region.

6 Development of a strategy to improve CSIRO's access to international business opportunities.

7 Professional advice with regard to the pursuit of business opportunities in specific technologies and/or market segments.

**Corporate Legal Service: To ensure that CSIRO's activities comply with legislative and other legal requirements and that CSIRO's interests are adequately protected from a legal perspective.** (12%)

8 Provision of advice to the Chief Executive, the Board, Directors, Chiefs and General Managers on all legal aspects of their management and commercialisation responsibilities including compliance with legislation, administrative and general law, safeguarding the legal interest of CSIRO and avoiding unnecessary exposure to legal risks.

9 Provision of advice and drafting assistance to business managers in relation to commercialisation activities.

10 Management of litigation and administrative law proceedings on behalf of CSIRO

11 Preparation of model agreement embodying principles outlined in the Commercial Practice Manual and reflecting CSIRO policy, for use throughout the organisation.

12 Provision of drafting and advisory services to support Cooperative Research Centres and other substantial contract negotiations.

13 Provision of drafting, instruction and interpretation services in relation to the Science and Industry Research Act and other legislation.

14 Provision of legal educational services to CSIRO.

15 Ongoing review of the CSIRO Commercial Practice Manual.

16 Liaison with external solicitors to ensure timely and appropriate advice.

17 Provision of assistance to promote compliance with the Commercial Practice Manual.

18 Fulfillment of CSIRO's responsibilities under administrative law (Freedom of Information, Administrative Decisions, Judicial Review, Ombudsman, Privacy) and Income Tax Assessment Act for Approved Research Institutes.

**Commercialisation: To promote the development and application of good commercial practice at all levels in CSIRO and provide executive assistance to the Director Corporate Business.** (4%)

19 Updates of the *CSIRO Commercial Practice Manual* - twice per annum.

20 A public version of the *CSIRO Commercial Practice Manual* and a capability brochure. Distribution of this material to clients and CSIRO staff by 30 September 1995.

21 Maintenance of a database to control ownership of the *CSIRO Commercial Practice Manual*.

22 Development of a corporate database of contractual arrangements (contracts database) and its subsequent maintenance.

23 Establishment of effective links between the contracts database and other CSIRO information sources, specifically with the PIMS project.

24 Provision of secretarial assitance to the Corporate Business Committee - 5 meetings per annum.

25 An annual report to the Board on interactions with SMEs.

26 Provision of advice on the accessibility of business information sources across the Organisation.

27 Investigation of the value of a quality management approach to commercial practices.

**Strategic Planning and Evaluation: To promote strategic thinking and enhanced evaluation practices at all levels of CSIRO; to provide planning and evaluation services for CSIRO managers; and to co-ordinate the preparation of statutory planning and evaluation documents.** (5%)

28 Implementation of the first CSIRO Annual Business Review.

29 Agreement by EC on revisions to the priorities process and preparation for the determination of research priorities for the next triennium.

30 Development of a strategy to meet the Minister's requirements for information on the costs and benefits of contracts submitted for his approval, and to enhance evaluation practices generally.

31 Implementation of generic performance indicators across CSIRO.

32 Assistance provided to Institutes, Divisions and selected external clients (e.g. ASTEC) in design and exercise or facilitation of strategic planning, priority setting, scenario planning or evaluation.

33 Implementation of enhancements to the content and functionality of the SEO module of the EIS, leading to increased use of SEO data in Institutes and Divsions.

34 Specific compilations and analyses of data on CSIRO's research effort (SEO, FOR, TOA) provided in response to internal and external needs.

35 Greater responsibility for data quality demonstrated by Divisions.

36 Preparation of the annual CSIRO Operational Plan and a new CSIRO Strategic Plan.

**Corporate Public Affairs: Inspire interest in and support for CSIRO's research among key stakeholders and the general community, and provide an effective corporate communications service.** (48%)

37 Positive media coverage of CSIRO's research with emphasis on relating CSIRO's work to public issues.

38 Opportunities created for interaction of CSIRO staff with parliamentarians, industry and government officials. Increasing emphasis of meetings with, and publications for industry.

39 Provision of information about CSIRO and scientific/technical matters through a customer focused service from regional offices handling approximately 40,000 enquiries per year.

40 Twelve media items about CSIRO's education programs including the Double Helix Science Club, Student Research Scheme, CSIRO Education Centres and the BHP Science Awards.

41 25,000 members of the Double Helix Club and 27,000 sales of the The Helix magazine.

42 100,000 visitors to the CSIRO Science Education Centres or attending CSIROSEC sessions at schools per year; 450 students in the Student Research Scheme, 1100 students in the BHP Science Awards; 900 students undertaking CREST projects.

43 Student project enquiries handled through the sale of curriculum related science information packs and publication of topic books.

44 Preparation and delivery of the CSIRO Annual Report according to parliamentary guidelines and EC decisions.

45 Production of the staff magazine 'CoResearch' and its extension to partial electronic delivery.

46 Production of corporate promotional documents to assist in relations with stakeholders and the public.

47 Regular meetings of CSIRO's Divisional Communicators on a regional basis to promote internal communication and a corporate approach to CSIRO's communication.

48 Provision of media skills, presentation skills and receptionist skills training for CSIRO staff on a cost recovery basis.

**Head Office Administration Services: Develop and maintain effective Head Office facilities and administration services.** (15%)

49 A safe and efficient working environmnet for Head Office staff and visitors.

50 Effective management of the CSIRO Head Office budget within 5% of target expenditure.

51 Participation in travel trial and a sound evaluation of its effectiveness.

52 Provision of high quality meeting facility for CSIRO staff and VIPs, both national and international.

# 46. Corporate Business Department

## SUMMARY OF RESOURCES, 1995-96

(estimates as at June 1995)

| Branch/Unit | Staff by Functional Classification (EFT units)[1] | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|
| | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Corporate Business | 4 | 2 | 6 | 1,314 | | 1,314 |
| Public Affairs | 62 | 2 | 64 | 1,443 | 1,654 | 3,097 |
| Strategic Planning and Evaluation | 1 | 2 | 3 | 337 | | 337 |
| Legal Affairs | 7 | 2 | 9 | 758 | | 758 |
| HO General | 10 | | 10 | 963 | | 963 |
| TOTAL | 84 | 8 | 92 | 4,815 | 1,654 | 6,469 |

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

## Objective

**Support the Chief Executive in managing the Organisation and protecting the Organisation's assets; and assist the Chairman and Board members in the efficient conduct of their responsibilities.**

## Strategy

To enhance the development and implementation of corporate policies and procedures for Australia's largest and most diverse research and development organisation, the Chief Executive's advisory units will:

- Provide an effective and efficient system of liaison between the Chief Executive and the Board, Corporate Departments, Institutes and Divisions.
- Facilitate interactions of the Chairman and Chief Executive with Australian Industry, governments and international organisations.
- Provide all necessary support and ensure coordination of the relevant activities of the Board Audit Committee.
- Maintain awareness of relevant scientific, technological, social, political and management developments in Australia and overseas.
- Evaluate the adequacy and effectiveness of the Organisation's systems of internal control and of the performance of Organisational programs and functions.

## Specific Objectives & Planned Outcomes

**Support the Chief Executive (CE) in managing the Organisation and in the efficient conduct of the responsibilities of Office.** (20%)

1 Briefings or action advice on all meetings, correspondence and events involving the CE.

2 Successful interactions of the CE with Australian industry, governments and international organisations.

3 Efficient operation of the office of the CE.

4 Assist the new CE (when appointed) in assuming her/his responsibilities and establishing the personal operational procedures required in the office of the CE.

**Manage the business of the Board and Executive Committee and provide policy and administrative support to the Chairman, Chief Executive, Board Members and Directors.** (11%)

5 Briefing for the Chairman and CE for Board meetings and for the CE for Executive Committee meetings.

6 Briefing or action advice on meetings, correspondence and events involving the Chairman, Board members or CE.

7 Efficient operation of the CE's Canberra Office and effective co-ordination of Canberra-based activities.

**Assessment of all risks (other than those associated with the success of research) and the evaluation of controls in significant areas.** (13%)

8 Divisional and Organisational risk profile.

9 Management action plans addressing significant risks.

10 Development of a "risk management culture" across the Organisation.

11 Reduced exposures/improved controls to mitigate.

**Audit of commercial practices and procedures particularly as they relate to the identification and management of CSIRO risks in the undertaking of commercial ventures.** (5%)

12 Improvement of compliance to CSIRO commercial practices and policies.

13 Better understanding of best commercial practice.

14 Reduced exposure to significant commercial risks.

**A comprehensive audit program, as approved by the CSIRO Audit Committee, encompassing reviews of compliance, effectiveness and efficiency.** (5%)

15 Improved control over systems, procedures and practices.

16 Development of an internal control policy for the organisation.

17 Compliance with statutory, legal and internal audit requirements.

# 47. Chief Executive Advisory Units

**SUMMARY OF RESOURCES, 1995-96**
(estimates as at June 1995)

| Branch/Unit | Staff by Functional Classification (EFT units)[1] | | | Expenditure Estimates ($'000) | | |
|---|---|---|---|---|---|---|
| | Research Support | Management | Total Staff | Direct Approp | External Funds | Total Funds |
| Office of the Chief Executive | 3 | 2 | 5 | 1,295 | | 1,295 |
| Corporate Executive Office | 2 | 2 | 4 | 720 | | 720 |
| Risk Assessment and Audit | 6 | 4 | 10 | 1,445 | | 1,445 |
| Senior Staff Arrangements | | | | 1,060 | | 1,060 |
| Corporate Funds | | | | 1,859 | | 1,859 |
| **TOTAL** | 11 | 8 | 19 | 6,379 | 0 | 6,379 |

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

## STRATEGIC PLAN IMPLEMENTATION

This annex reproduces the major planned outcomes published in the CSIRO Strategic Plan 1991-92 to 1995-96. The planned outcomes are grouped and numbered by research purpose. In the left hand column the research purpose is identified by a two letter code. The right hand column includes references to planned outcomes in the present document which represent specific progress towards the Strategic Plan planned outcomes.

For example, for the research purpose "Commercial Services", the Strategic Plan includes the following planned outcome:

| | | |
|---|---|---|
| CS1 | Use of CSIRO decision support systems by 75 percent of water agencies in Australia in developing their catchment management strategies. | **2**:3 (DIT/IISE) |

The code "**2**:3 (DIT/IISE)" refers to the third planned outcome for operational unit entry number 2 (the Division of Information Technology, Institute of Information Science and Engineering). The cross-reference in the Division's entry appears as:

| | |
|---|---|
| 3 | Demonstration of a decision support system for applying multiple hydrological models in planning of urban water systems. (CS1) |

## Strategic Plan Planned Outcomes

### PLANT PRODUCTION AND PRIMARY PRODUCTS

| | | |
|---|---|---|
| PP1 | New varieties of sugar cane with a 10 percent higher yield of sugar worth more than $100m a year to the sugar industry. | |
| PP2 | Genetically modified rumen micro-organisms to improve the digestion of low-quality tropical forages worth around $120m a year to the livestock industries. | **MDP3**:1,2,3,4,5,6,7,8,10<br>**23**:29,30,31,33<br>(DTAP/IAPP) |
| 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. | **MDP33**:1,4<br>**29**:21 (DFo/IPPP)<br>**30**:1 (DH/IPPP)<br>**31**:9,10,12,22,25<br>(DPI/IPPP) |
| PP4 | Genetically engineered high sulphur protein pasture legumes with the capacity to lift wool production from improved pastures by 20 per cent. | **31**:26 (DPI/IPPP) |
| PP5 | Cropping management systems that minimise disease and improve soil water availability to improve yields by 10 per cent in southern NSW and northern Victoria. | **MDP35**:2<br>**32**:2,11,12 (DS/IPPP) |
| PP6 | Automated techniques for assessing small wood samples to enable important properties for industrial use to be incorporated into tree-breeding programs. | **29**:15,16,17,23 (DFo/IPPP) |

# Annex

## ANIMAL PRODUCTION AND PRIMARY PRODUCTS

| | | |
|---|---|---|
| AP1 | Improved sheep-breeding techniques to control fibre diameter and other qualities in Australian merino wool. | **MDP26**:5,6,7<br>**20**:10,12 (DAP/IAPP)<br>**23**:19 (DTAP/IAPP) |
| AP2 | Genetic markers for meat quality attributes to enable rapid genetic improvement in the quality of Australian beef - a project estimated to be worth around $800m a year to Australia when fully adopted. | **MDP26**:2,7<br>**23**:16,17,19 (DTAP/IAPP) |
| AP3 | Genetic markers for disease resistance in sheep and cattle to enable breeders to supply rams and bulls highly resistant to specific diseases without the loss of other desirable attributes such as fleece and meat quality and productivity. | **MDP26**:1,4,5,7<br>**19**:4 (DAH/IAPP)<br>**23**:19 (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. | **23**:1,2,3,4,6,7 (DTAP/IAPP) |
| AP5 | Anti-hormone vaccines designed to enhance meat quality and production efficiency including the reduction of weight loss in cattle resulting from poor dry-season pastures. | **20**:8 (DAP/IAPP)<br>**23**:25 (DTAP/IAPP) |
| AP6 | Quantitative predictive models for the sustainable management of the tuna fishery. | **37**:12,14,15 (DF/INRE) |

## RURAL-BASED MANUFACTURING

| | | |
|---|---|---|
| RM1 | Expansion of export markets for Australian food manufacturers based on information on the sensory preferences of a range of Asian markets and practical methods of evaluating food to meet these preferences. | **MDP33**:2,6 |
| RM2 | Active packaging systems for perishable goods which will open up export markets (especially for horticultural products) of over $100m a year. | **11**:22 (DMST/IIT) |
| 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. | **24**:2 (DWT/IAPP) |
| RM5 | Support for the food industry in developing new fibre-enriched foods and implementing corporate strategies on nutrition. | **22**:3,4,5 (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. | **28**:10,11 (DFP/IPPP) |

## MINERAL RESOURCES

| | | |
|---|---|---|
| MI1 | Development of a magnesium metal demonstration production plant industry in Gladstone, in collaboration with QMC, MIM, and UBE Industries - Japan. | **MDP10**:1,2,3,4,5<br>**16**:7,13,15 (DM/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)<br>**14**:3,5 (DCET/IMEC)<br>**16**:3,15 (DM/IMEC) |
| MI3 | A major research role in the support and development of SIROSMELT technology to achieve a minimum of two new installations per year with an expected benefit of $12m a year. | **16**:8,9,11 (DM/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**:12 (DM/IMEC) |
| MI5 | Improved metalliferous mining efficiency by addressing the issues of integration of geology and mine design and of dilution during the mining process. | |

## ENERGY RESOURCES AND SUPPLY

| | | |
|---|---|---|
| EX1 | Development of Australia's research capacity for an upstream oil and gas industry, with a focus on the prediction of accumulations by fluid-flow modelling and basin evolution and on improving production via reservoir characterisation, stimulation of tight reservoirs, and wellbore engineering; facilities to be initially in Sydney and Melbourne. | **17**:1,2,3,5,6,7,8,9,10,11, 12,14 (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. | **14**:20 (DCET/IMEC)<br>**17**:3,12,13,14,15 (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**:1,2,3,4,5,6,7,8,9,13,14, 15 (DCET/IMEC)<br>**16**:8 (DM/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. | **9**:1 (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. | **10**:1,2,5 (DMT/IIT) |

| | | |
|---|---|---|
| MF4 | Gains in quality and productivity in Australian manufacturing industry through new approaches which synthesise measurement, data capture and statistical sciences. | **MDP15**:3<br>**MDP27**:1<br>**3**:21 (DMS/IISE) |
| MF5 | Development and commercialisation of new systems to achieve effective delivery of antigens and optimum immune responses from vaccines. | **MDP27**:4<br>**MDP28**:3<br>**19**:11,12,13 (DAH/IAPP)<br>**23**:4,34,35,36 (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**:1,2,5,6,7,11 (DR/IISE) |
| IC2 | Antennas and associated sub-systems for satellite-based, mobile person-to-person communications. | **4**:4,7,24,25,27 (DR/IISE) |
| IC3 | Advanced spatial database systems for improved management of land-related information for applications developers throughout CSIRO, Government and industry. | **2**:2 (DIT/IISE) |
| IC4 | Transfer of high-performance, interactive visualisation and modelling software to the software and services industry for applications in the resource and environmental management industries. | **2**:12,13 (DIT/IISE) |
| IC5 | Transfer of advanced hypermedia tools for navigating complex databases transferred to the information services industry. | **2**:8,15 (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. | **2**:3 (DIT/IISE) |

## ECONOMIC DEVELOPMENT - ENVIRONMENTAL ASPECTS

| | | |
|---|---|---|
| ED1 | Demonstration of the ability to substantially reduce rabbit and fox populations by means of fertility control. | **41**:19,20 (DWE/INRE) |
| ED2 | A comprehensive set of management strategies to prevent or ameliorate outbreaks of toxic blue-green algae in inland water systems. | **MDP27**:2 |
| ED3 | Widespread adoption of CSIRO's sewage and other waste treatment processes and formulation of guidelines for setting up and managing biologically productive effluent disposal schemes to divert the 4.5 billion litres of sewage and other effluent currently discharged daily into Australian waterways. | **9**:13 (DCP/IIT)<br>**29**:13,18 (DFo/IPPP)<br>**32**:6 (DS/IPPP)<br>**40**:2 (DWR/INRE) |
| ED4 | Solutions to environmental and technical issues to ensure the effluent from proposed kraft pulp mills will not have a detrimental impact. | |
| ED5 | Plasma technology suitable for high temperature destruction of organic chemical wastes at the plant scale. | **10**:16,17 (DMT/IIT) |
| ED6 | New agricultural systems and management techniques to assist the ecologically sustainable development of Australia's rural industry, particularly in relation to problems of salinity, erosion and restoration of degraded pastures. | **MDP18**:2,4<br>**MDP19**:2,3,4<br>**MDP33**:5<br>**MDP35**:2<br>**3**:17,19 (DMS/IISE)<br>**29**:5,6 (DFo/IPPP)<br>**30**:11,14 (DH/IPPP)<br>**31**:5,6,7,8 (DPI/IPPP)<br>**32**:2,5,10,11,12,13 (DS/IPPP)<br>**33**:12,14 (DTCP/IPPP)<br>**40**:15 (DWR/INRE)<br>**41**:1,2,5,25 (DWE/INRE)<br>**42**:10 (CFEM/INRE)<br>**43**:3,4 (COSSA/INRE) |
| ED7 | Improved capability to help mining companies in the environmental management and rehabilitation of mine sites. | **MDP19**:4<br>**14**:28,30,33,35,36 (DCET/IMEC)<br>**32**:7 (DS/IPPP)<br>**43**:3 (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. | **MDP19**:2,3,4,5<br>**38**:10,11 (DO/INRE)<br>**43**:4 (COSSA/INRE) |
| EN2 | Improved drought forecasting ability through participation in a major international exercise studying the interaction between oceans and the atmosphere. | **MDP19**:4,5<br>**38**:1,2,4,6 (DO/INRE) |
| EN3 | Scientific principles for effective fire management regimes to help in the maintenance of Australia's conservation areas. | **MDP19**:2,3,4<br>**29**:10 (DFo/IPPP)<br>**31**:16 (DPI/IPPP)<br>**33**:16 (DTCP/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. | **MDP18**:3<br>**32**:3 (DS/IPPP)<br>**41**:34 (DWE/INRE) |

# Annex

| | HEALTH | |
|---|---|---|
| HE1 | Development of nutrition based strategies to reduce genetic damage from environment and chemical exposure and to reduce cardiovascular disease. | **22**:1,2,3,4 (DHN/IAPP)<br>**32**:9 (DS/IPPP) |

The **CSIRO Information Network** provides a free access point to CSIRO for scientific and technical enquiries.

## CSIRO Information Network

| | |
|---|---|
| **NSW and ACT Region**<br>Bradfield Road, Lindfield<br>PO Box 218<br>Lindfield NSW 2070 | Tel: (02) 413 7528<br>Fax: (02) 413 7635 |
| **Vic and Tas Region**<br>407 Royal Parade, Parkville<br>PO Box 53<br>Parkville VIC 3052 | Tel: (03) 662 7116<br>Fax: (03) 662 7140 |
| **Qld Region**<br>306 Carmody Road<br>St Lucia QLD 4067 | Tel: (07) 377 0390<br>Fax: (07) 377 0387 |
| **WA Region**<br>Underwood Avenue, Floreat Park<br>Private Bag, PO<br>Wembley WA 6014 | Tel: (09) 387 0710<br>Fax: (09) 383 7894 |
| **SA Region**<br>32 Audley Street, Woodville North<br>PO Box 4<br>Woodville SA 5011 | Tel: (08) 303 9116<br>Fax: (08) 303 9200 |
| **NT Region**<br>McMillans Road, Berrimah<br>Private Bag No 44<br>Winnellie NT 0821 | Tel: (089) 22 1720<br>Fax: (089) 22 1714 |

# The Task

CSIRO, Australia's principal scientific research organisation, will be a leader in developing the scientific and technological capability Australia must have to meet the challenges of this decade and the next century.
Our work will be essential to improving Australia's economic performance and, at the same time, its care of the environment. The future quality of life of all Australians will depend on the nation's success in this task.

# Role

CSIRO's main role will be the conduct of strategic research to:
- develop technologies for all sectors of Australian industry;
- improve the management of its natural resources;
- protect Australia's unique environment; and
- promote the well-being of the Australian people.

CSIRO is recognised nationally and internationally for its contributions to science and Australia's development. We will build on this reputation through close collaboration with industry, government and other research institutions to ensure the nation derives the greatest benefit from our research.

# Community

CSIRO will honour the trust Australians have placed in the Organisation. We will provide authoritative and independent advice and information on matters of national importance that are within our expertise. We will take an active part in public debate on the actions and changes that are necessary if Australia is to seize its opportunities and overcome its difficulties.

# People

CSIRO's ability to carry out its role rests on the creativity of its staff and the quality of its management. We will attract and retain the best people by providing strong leadership, clear direction, and the resources, facilities and conditions required to encourage and enable all staff to fulfil their potential.

# Mission

CSIRO's ethos will affirm, above all, the qualities of service and excellence – service to all the Australian people through scientific excellence.
Our goal will be to give Australians a better future.

CSIRO
AUSTRALIA