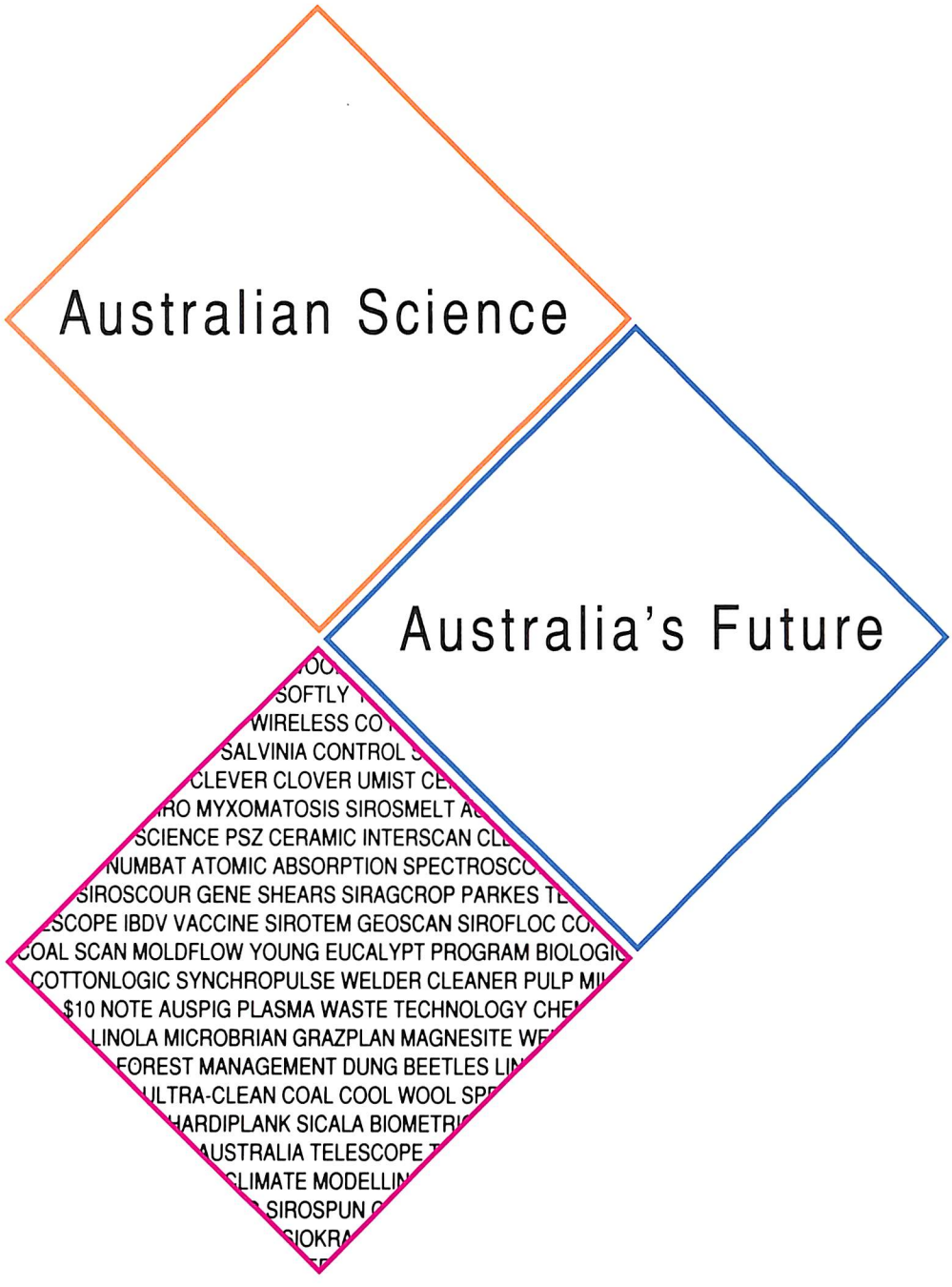
CSIRO Operational Plan

1992–93

CSIRO
AUSTRALIA



CSIRO's greatest hits

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

- **SIROSPUN** — the basis of Cool Wool: a fabric for all seasons
- **'Softly'** — popular fabric softener
- **SIROSMELT** — cleaner and cheaper way of producing tin, copper, lead and zinc
- **forest management** — improving productivity of our native regrowth forest by 30% to 60%
- **Siokra** and **Sicala** — new cotton varieties earning big export dollars
- the **Synchro-Pulse Welder** — winner of Australian design award, winning big market share for developer
- the **$10 note** — longer lasting bank note that's difficult to forge
- **SIROFLOC** — making water cleaner at home and abroad
- **MicroBRIAN** — processing satellite images to monitor erosion, crops, forests and other vegetation
- **dung beetles** — not glamourous, but reducing fly numbers and producing cleaner pasture for cattle
- the **Parkes Telescope** — discovering quasars, and now part of the internationally recognised Australia Telescope
- **Hardiplank** — fibre cement product to replace asbestos-based building materials
- **biological weed control** — award-winning program to control salvinia, world's worst water weed, at home and overseas
- **atomic absorption spectroscopy** — most significant advance in chemical analysis this century, saved many lives and earned $150 million in export sales
- **myxomatosis** — controlling rabbit numbers for four decades
- **Interscan** — system that allows aircraft around the world to land more quickly and safely

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

OPERATIONAL PLAN

1992-93

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FOREWORD

In the present planning cycle CSIRO will first focus on how well it has met the great expectations set for it five years ago by government, industry and the community. We will also identify and examine current and emerging expectations, potential world challenges over the next twenty years, how these will effect Australia, and how *CSIRO as a whole* should maximise its effort to help Australia face these challenges.

This Operational Plan documents the objectives and outcomes of activities to be undertaken by CSIRO in the financial year ahead and is a requirement of our governing Science and Industry Research Act 1949. The activities represent an annual step in the implementation of the goals and strategies set out in our Strategic Plan for 1991-1996. The priorities described in the Strategic Plan are reflected in a changing allocation of resources to high priority research areas. The Operational Plan thus not only meets the requirements of the Science and Industry Research Act but is also a working document for use by senior research managers in guiding their decision making during 1992-93.

In 1992-93 we intend to determine Organisational research priorities for 1993-94 and revisions to priorities for the next triennium. We will integrate into this planning process, workforce planning, further development of inter-Divisional collaboration in research, and improvements to the effectiveness with which we relate to our external stakeholders.

Our current Strategic Plan is a statement of the Organisation's research priorities determined within the context of a CSIRO perspective on Australia's national research priorities. The research priorities framework is the key to CSIRO's continued efforts to pursue major research projects in high priority areas across Institute and Divisional boundaries. Our greatest sustainable competitive advantage is our ability to bring together multidisciplinary teams of scientists to focus on the most important national research issues. CSIRO has taken the lead in developing a framework for determining national research priorities. Other organisations in the public and private sectors, in Australia and overseas, have adopted and modified this framework for their own purposes. We take pride in the lead we have established.

Ensuring effective linking of the research effort and priority setting to workforce planning and human resource management is high on the agenda of important issues in 1992-93. The staff of CSIRO are its most valuable resource and as the Organisation responds to changes in its external and internal environments such as changes in funding levels, decisions on research priorities and changes in industrial awards, staffing changes are inevitable. A special task force has been set up by the CSIRO Consultative Council to improve the effectiveness of our workforce planning. Mechanisms for workforce planning are being developed to complement long term research planning so that in future the Organisation can respond more effectively to changes in its environment.

With the current economic recession, reductions in sponsored research funds from traditional sources and the slow rate of recovery expected over the next couple of years, the achievement of external funding targets will pose a major challenge in 1992-93. CSIRO's success in attracting external funding is but one indicator of its effectiveness in relating to industry and other users of its research. Partly in response to recommendations of a report by the Australian National Audit Office, a range of indicators of our effectiveness in interacting with users of research will be trialled this year. On the basis of this trial, we intend to adopt several effectiveness indicators as CSIRO policy and incorporate these into planning and review processes in 1993-94.

The ANAO also recommended that the external funding targets for the organisation be specified as an aid to management of resources. The estimated expenditure on sponsored research is now fully incorporated into the plan.

Planning for our place in the future is essential if CSIRO is to deliver the most effective support for the management of Australian resources. Research planning, strategic thinking and careful deployment of our Organisation's human and physical resources will help to ensure that CSIRO delivers the maximum return to the nation on its investment in research.

John W Stocker
CHIEF EXECUTIVE
June 1992

CONTENTS

1. CORPORATE OVERVIEW

1.1 INTRODUCTION

CSIRO's annual Operational Plan is produced in accordance with the requirements of the Science and Industry Research Act. The 1992-93 Operational Plan presents the objectives, strategies and planned outcomes for CSIRO Institutes and Divisions (including programs) as well as a corporate overview of the year ahead. The Operational Plan is the annual implementation of the CSIRO Strategic Plan, currently covering the period 1991-92 to 1995-96.

Operational planning extends deep into CSIRO, down to project level in most cases. This Plan extends down to research program level, although the level of detail presented is limited. Only the key planned outcomes are included, with much of the detail synthesised. The finer details on programs and projects are contained in Divisional, program and project operational plans.

The audience for the Plan is largely internal. Therefore, it is structured by management unit rather than by research purpose. By contrast, the Strategic Plan is structured by research purpose, being for a much wider audience, including external stake-holders. In giving effect to the Strategic Plan, the Operational Plan includes a number of cross references between management units and research purposes, such as in the resource distribution tables and reporting achievements towards the planned outcomes of the Strategic Plan.

The 1992-93 Plan features several changes to format and content of former Operational Plans. First, revisions to the Strategic Plan are included in the Corporate Overview. This encompasses changes to corporate goals and planned outcomes for research purposes as approved by the CSIRO Board. Second, the lists of planned outcomes reported by Institutes and Divisions include expected progress towards the planned outcomes of the Strategic Plan. Third, charts are included to show the distribution of research activities by research purpose at corporate, Institute and Divisional levels. Together, these three changes form the Operational Plan's strategic context, providing the key linkages to the Strategic Plan. The place of the Operational Plan in the overall planning process in CSIRO is shown in Figure 1. In this year's Plan there is a new section which deals exclusively with CSIRO's Multi-Divisional Programs (MDPs). It follows the Corporate Overview and lists CSIRO's principal research programs involving extensive collaboration between Institutes and Divisions. These programs are cross-referenced to programs in the Institutes and Divisions.

1.2 CSIRO GOALS AND STRATEGIES

CSIRO's goal is to give Australians a better future. The current Strategic Plan provides the blueprint to achieve this goal.

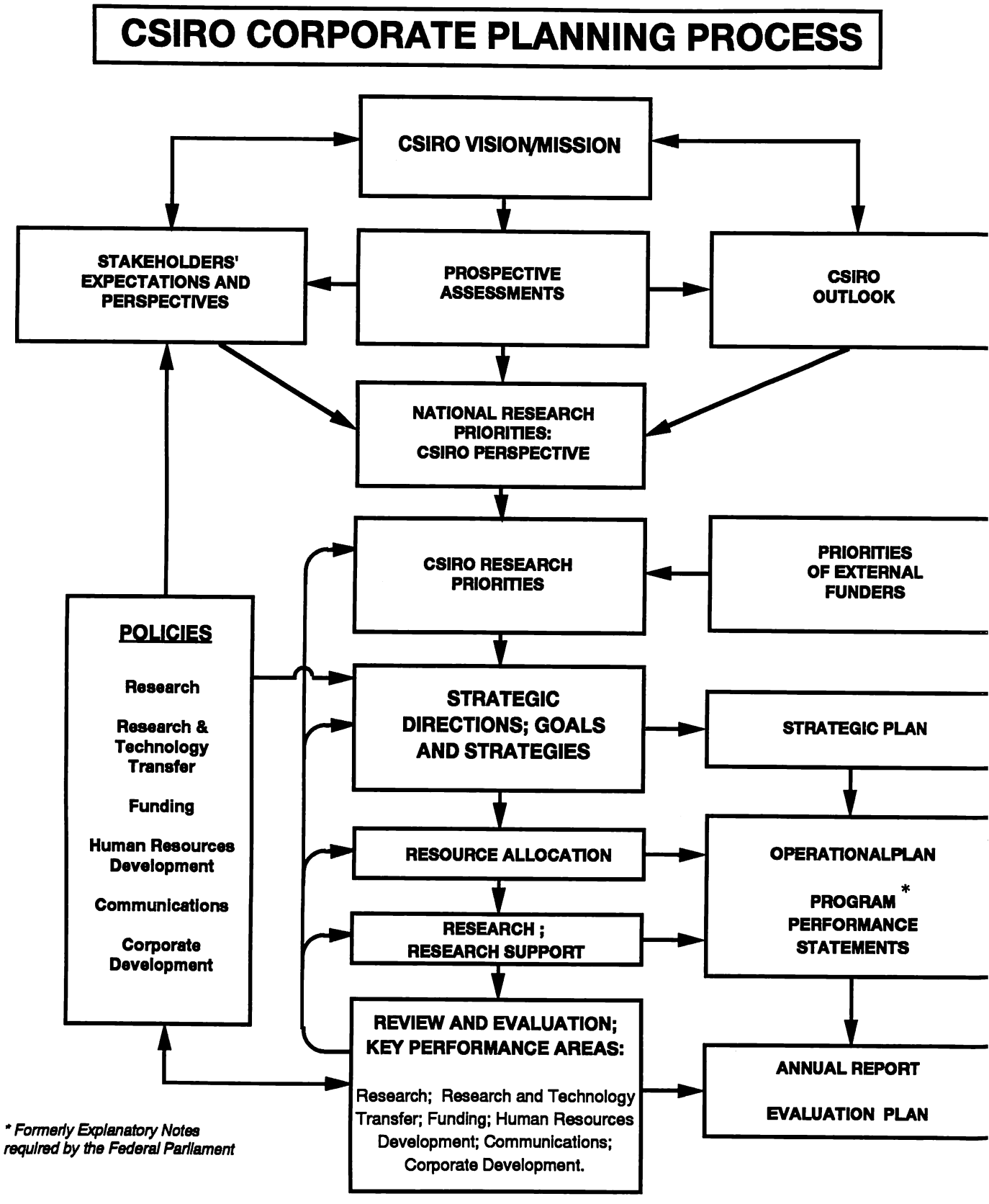
Sectoral goals are formulated for ten research purposes and in relation to four major research facilities. For each goal, enabling strategies focus on three key performance areas: research activity, technology transfer and research funding. Three research support goals and enabling strategies are formulated with a focus on three further key performance areas: human resource development, communication and corporate development. The linkages between the ten research purposes of the Strategic Plan and CSIRO's 17 research purposes are explained in Box 1.

Research Purpose Goals

The CSIRO Strategic Plan provides the following condensation of the 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.
- Reduce the trade deficit of the information and communication industries.
- Enhance productivity and effectiveness in provision of infrastructure and services, particularly health and construction.

Figure 1 CSIRO Corporate Planning Process



Box 1: The CSIRO Research Purpose Classification

CSIRO Strategic Plan Research Purposes / Priorities Research Purposes	1. Plant Pdn & Primary Prods PP	2. Animal Pdn & Primary Prods AP	3. Rural-Based Mnfg RM	4. Minerals Industry MI	5. Energy Resources and Supply ERS	6. Manfng Industries MF	7. Info and Communicn Industries IC	8. Econ Dev - Env Aspects EDEA	9. Envnmt ENV	10. Infrastruct and Services IS	Major Res Facilities & Services MRFS
1. Plant Pdn & Primary Prods											
2. Animal Pdn & Primary Prods											
3. Rural-Based Manufacturing											
4. Minerals Industry											
5a.Energy Resource Industry											
5b. Energy Supply Industry											
6. Manufacturing Industry											
7. Info & Comunicat Industries											
8. Econ Dev - Env Aspects											
9. Environment											
10. Transport Industry											
11. Construction Industry											
12. Commercial Services											
13. Health											
14. Defence											
15. Social Development											
16. Advancement of Knowledge											

The CSIRO Research Purposes:

The first stage in the CSIRO research priorities exercise was to identify the broad areas and sectors to which CSIRO currently and potentially delivers research outputs. At the corporate level, CSIRO identified 17 research purposes relevant to its work, based on the Australian Bureau of Statistics socio-economic objectives research classification. These research purposes are sub-divided into groups and, at the next level, classes. For the Strategic Plan some of the research purposes were amalgamated. The two energy purposes (Energy Resources and Energy Supply) were combined, while Transport, Construction, Commercial Services, Health, Defence and Social Development were combined into one purpose, called Infrastructure and Services. The CSIRO Strategic Plan also includes Major Research Facilities and Services as a research purpose which includes the priorities research purpose, Advancement of Knowledge. The above chart shows the linkages between the Strategic Plan and the priorities research purposes.

Research Support Goals

The Research Support goals have also been summarised in the CSIRO Strategic Plan as:

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

1.3 RESEARCH PRIORITIES

The CSIRO research priorities process focuses on the redistribution of resources from low to high priority research purposes. Decisions on priorities for 1992-93 were made in accordance with the CSIRO Board's earlier approval to allocate approximately one-third of priority levy funds to strategic research for the minerals industry, one-third to research on environmental aspects of economic development, and one-third to priority areas in the remaining research purposes. The priority funds are raised by applying a 1.5% levy on all CSIRO appropriation funds.

1992-93 allocations

In each year of the triennium the Executive Committee reviews the original priority decisions and then assesses the merits of individual research proposals which bid for a share of the priority funds available for allocation in the next year.

This is the second year of the implementation of CSIRO's research priorities for the current triennium. Funds raised from the levy, after allowing for exemptions, amounted to $4.606 million to be distributed in 1992-93. Following consideration and discussion of research proposals, some 30% was allocated to projects addressing strategic research for the Minerals Industry, 29% to Economic Development - Environmental Aspects, and 41% among 8 other research purposes. With Institutes required to match priority funds allocations dollar for dollar with funds from lower priority activities, some $9 million will be redirected to high priority research purposes this year, as a direct result of the priorities process. In addition, Institutes and Divisions will continue to shift resources into priority research areas independently of the specific priority funds available at the corporate level.

The priorities framework was also used to allocate $5.1 million non-recurrent Board Initiative Funds. Of those funds, 29% was allocated to research projects for the Minerals Industry, 34% to Economic Development - Environmental Aspects, and 34% among 9 of the other research purposes.

The distributions of the recurrent priorities funds and the non recurrent Board Initiative Funds (i.e., funds provided to projects for 1992-93 only) are presented in Table 1.

1993-94 and beyond

The Board's attempt to identify major challenges facing Australia which CSIRO can address with its current or potential capabilities will provide a key input to the next triennial review of CSIRO's research priorities.

During 1992-93, preparations will be made for the next triennial review of CSIRO's research priorities. The Executive Committee will revisit the Organisation's research priorities at a series of workshops commencing in March 1993. Decisions on priority allocations for 1993-94 (the final year of the current triennium) will be finalised and approved by the board in December 1992.

The CSIRO Board has approved changes to arrangements for implementation of priorities decisions commencing with proposals for 1993-94. Revisions to the process have been made in response to concerns raised by Divisions and Institutes, including the need to:

- avoid excessive workloads for Divisions,
- reduce the level of detail considered by the Chief Executive and the Executive Committee, and
- ensure a consistent approach across CSIRO.

As a result of the changes, which are designed to streamline the implementation of research priorities, the efficiency of the process should improve. In particular, emphasis should shift away from the large number of small projects of the past two years towards fewer, major (sometimes Multi-Divisional) project areas.

Table 1: DISTRIBUTION OF PRIORITY RESEARCH FUNDS AND BOARD INITIATIVE FUNDS, 1992-93.

Research Purpose	Priority Funds	Board Initiative Funds	Total Funds
	($'000)	($'000)	($'000)
Plant Production and Primary Products	342	510	852
Animal Production and Primary Products	222	228	450
Rural-Based Manufacturing	140	244	384
Strategic Research for the Minerals Industry	1342	1572	2914
Energy Resources and Supply	0	75	75
Manufacturing Industries	511	296	807
Information and Communication Industry	350	260	610
Economic Development - Environmental Aspects	1320	1844	3164[a]
Environment	269	120	389
Health	110	236	346
TOTAL	**4606**	**5100**	**9706[a]**

a Includes $285 000 allocated to research into algal growth from contingencies.

1.4 CORPORATE MANAGEMENT PLANNED OUTCOMES FOR 1992-93

The CSIRO Operational Plan presents planned outcomes for each major research program in each Division. These outcomes are in the three key performance areas of Research, Technology Transfer, and Funding. Planned outcomes in the key performance areas of Corporate Development, Human Resource Development and Communication which relate to the Organisation as a whole are recorded as Corporate Management planned outcomes in this Plan. Corporate level outcomes in the areas of Research,Technology Transfer and Funding are included under Corporate Development. Institute and Divisional activities and outcomes in Corporate Development, Human Resources and Communication are reported in their operational plans.

The cross referencing of the Strategic Plan planned outcomes to the Operational Plan planned outcomes is described in Chapter 3.

During 1992-93 CSIRO expects to achieve the following planned outcomes at the corporate management level:

Corporate Development

- Implementation of 1992-93 Research Priorities decisions (as described in Section 1.4 of this overview) and commensurate resource allocations to priority areas.
- Board approval of decisions on 1993-94 research priorities.
- Board approval of revisions to broad research priorities for the next triennium 1994-95 to 1996-97.
- Inclusion of international aspects in the research priorities process.
- Establishment of four new Multi-Divisional Programs.
- Review of Triennium funding arrangements.

- Reviews of the following Divisions:
  - Atmospheric Research
  - Food Processing
  - Water Resources
- Reviews of the following discipline areas:
  - The potential contribution of soil biology as a focus for future research of the Institute of Plant Production and Processing.
  - The future role of CSIRO's research in Human Nutrition.
  - The future role for CSIRO research in dryland farming systems based on pasture/grain production in SE Australia.
- Participation in 29 of the 34 Cooperative Research Centres established to date.
- A CSIRO strategy in response to the Government's Ecologically Sustainable Development process.
- Implementation of new policies in the areas of:
  - Pilot effectiveness and efficiency indicators of CSIRO's links with users of research, leading to the establishment of suitable measures for implementation in 1993-94.
  - Pilot guidelines for the pricing of research.
  - Pilot policies for setting targets for achieving the overall level of 30% external earnings across the Organisation.
  - Implementation of accrual accounting across the Organisation by 30 June 1993.
- Strategies to address the projected decline in CSIRO's financial resource base over the remainder of the triennium.
- Implementation of the recommendations of the MIS review.

Human Resource Development

- Introduction of improved processes for dealing with the human resources consequences of Divisional restructuring associated with workforce planning.
- Revision of stages 2 and 3 of Performance Planning and Evaluation Program (PPE) and improve its effectiveness and links to research and human resources planning.
- Introduction of mechanisms to reward team performance.
- Establishment of a video program for ongoing PPE training.
- Achievement of 100% adoption/uptake of Performance, Planning and Evaluation.
- Introduction of new training and development programs in the areas of:
  - Development programs for Chiefs
  - Personnel/Human Resources Managers Program
  - Workforce planning skills
  - Industrial relations training for senior managers
- Training and Development of CSIRO staff in the areas of:
  - Research Management
  - Leadership Development
- Evaluation of workforce planning pilot study and assessment of its application to CSIRO Divisions.
- Implement revised Human Resource Plan for CSIRO.

Communication

- Build on CSIRO's existing contribution to government policy development, e.g., :
  - Follow through on CSIRO's contribution to the working groups on Ecologically Sustainable Development (ESD) by involvement in implementation of the recommendations.
  - Follow CSIRO's public report on its contribution to ESD with a prospectus on what role CSIRO can play in the future.
- Development of a new publication to succeed the *Guide to CSIRO*, which complements Institute/Divisional prospectuses, and places them in a corporate context.
- Develop an internal communication plan through the CSIRO Consultative Council, on workforce planning with particular attention on the impacts on staffing of changes in the Organisation's internal and external environments.
- Review progress in the implementation of recommendations from the internal audit of CSIRO's communication activities.
- Continued encouragement of staff participation in Project Ambassador:
  - Develop a traveling display on the minerals industry and on CSIRO's contribution to Northern Australia.
  - Continue the traveling exhibition on genetic engineering.
  - Provide further media and public presentation training to CSIRO staff.
- Review the level and cost of information services to the Australian public, small business and other non-commercial stakeholders.
- Promote science as a career for young people:

- Open two new science education centres, with a capacity of about 65,000, to raise annual student visits,
- Improve television coverage of the Double Helix Club and hence raise membership.

- Further communication of the CSIRO research priorities framework to Divisions

1.5 PERFORMANCE REVIEW

Evaluation of performance against objectives and planned outcomes of the Operational Plan is conducted by Institutes and Divisions as part of their annual review process and preparations for the next year's operational plans, including contributions to the corporate Operational Plan.

Reviews of Divisional and program performance focus on outcomes and activities beyond those reported in this corporate Operational Plan. All relevant planned outcomes and objectives are governed by a set of performance measures against which outcomes are evaluated.

The performance measures in each of the six key performance areas incorporate the 1991 recommendations of the Australian National Audit Office in regard to external funding ('external funding targets for organisational units be specified in the operational plan to increase its use as an aid to management' - part of R.5, and '[that CSIRO] develop economy, efficiency and productivity indicators to be used in decision making' - part of R.9.) During 1992-93, a range of effectiveness and efficiency indicators relating to CSIRO's links to the users of research will be trialled.

Major reviews and evaluations planned for 1992-93 are included among each Institute's and each Division's list of planned outcomes.

CSIRO prepares an **Evaluation Plan** each year. This year the results of evaluations completed during 1991-92 and details of evaluations planned for 1992-93 will be included. This plan is required as a result of a Cabinet Decision, administered by the Department of Finance. The CSIRO Evaluation Plan is incorporated in the Evaluation Plan of the Industry, Technology and Commerce Portfolio.

Performance measurement and evaluation of individual staff members in CSIRO is conducted through a formal Performance Planning and Evaluation (PPE) program. Individuals link their personal objectives and milestones to their work objectives and planned outcomes. Advancement and reward is then based on demonstrated achievements.

1.6 RESOURCES SUMMARY

All resource figures reported in this Plan are provisional estimates of expenditure, as at 11 May 1992. The final budget estimates are included in the Organisation's Program Performance Statements one of the Government's budget related papers.

The sources of funds for 1992-93 include estimates of appropriation funds provided to CSIRO from the Federal Government's 1992-93 Budget, and estimates of external funds. Expenditure of external funds, which comprise earned revenues and sponsored research funds, are estimated to be X% of CSIRO's total expenditure in 1992-93.

This year, estimates of Institute and Divisional appropriation expenditure include an annual charge for building costs, called the ILS charge (Internal Lease Scheme). As a consequence of this annual charge, capital is no longer uniquely identified in resource tables and budgets, but is included in annual appropriation figures. This approach better identifies the real cost of research capital by Institutes and Divisions, and will facilitate better resource management and more efficient pricing of research to external collaborators.

Table 2 summarises the distribution of expenditure across Institutes and the Corporate Centre for 1992-93. Table 3 sets out the estimated distribution of resources by Research Purpose at the Sub-division level for each Institute for 1992-93. Figure 2 indicates the distribution of CSIRO's total research activities by research purpose for 1992-93. Finally, Table 4 presents a summary of provisional estimates of staff numbers, in equivalent full-time units, for 1992-93.

1.7 STRUCTURE OF THE OPERATIONAL PLAN

The Operational Plan includes contributions from each of CSIRO's Institutes and Divisions, the Corporate Service Department and its Branches and Units, the Chief Executive Advisory Groups and Sirotech. The Operational Plan complements CSIRO's corporate structure, as shown in Figure 3. Objectives, strategies and planned outcomes are presented for each Institute. This is followed by an entry for each Division of the Institute, covering its objective and strategy followed by the specific objectives and planned outcomes for major programs of the Division. Institutes present estimates of expenditure by Divisions from appropriation and non-appropriation sources. Institutes also illustrate the distribution of research activities by research purpose at the sub-division level for the Institute as a whole as well as for each

Division. Divisions broadly indicate the distribution of total resources by specific objective (program) as well as by research purpose. The Corporate Services Department and the Chief Executive Advisory Groups, provide similar details with the exception of research purpose distributions, which are not relevant to these units.

At the end of the Operational Plan is a directory of CSIRO Institutes, Divisions and management units.

Table 2: ESTIMATED EXPENDITURE BY INSTITUTE 1992-93

(Provisional estimates as at 11 May 1992)

	APPROPRIATION TOTAL[a]	SPONSORED RESEARCH	TOTAL FUNDS
	($'000)	($'000)	($'000)
Institute of Information Science and Engineering	39508.0	8450.0	47958.0
Institute of Industrial Technologies	69428.0	19000.0	88428.0
Institute of Minerals, Energy and construction	74416.3	34144.0	108560.3
Institute of Animal Production and Processing	82444.0	45768.3	128212.3
Institute of Plant Production and Processing	93971.3	30271.5	124243.3
Institute of Natural Resources and Environment	68038.7	20110.0	88148.7
Corporate Services Department	30445.0	1728.2	32173.2
CEAG [b]	3969.4	5.0	3974.4
Corporately Managed Funds	6779.7		6779.7
Chief Executive Contingency Funds	1500.0		1500.0
Centrally Funded Capital	7407.3		7407.6
TOTAL	477908.7	159476.0	637385.0

a Includes earned appropriation revenue; also includes Internal Lease Scheme charge, totalling $39.5 million.
b Chief Executive Advisory Group.

Table 3: DISTRIBUTION OF RESOURCES BY INSTITUTE AND RESEARCH PURPOSE

(Provisional estimates as at 11 May 1992)

RESEARCH PURPOSE	IISE	IIT	IMEC	IAPP	IPPP	INRE	CC	TOTAL
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
Plant Production and Primary Products		71	22	385	56779	2468	5287	65012
Animal Production and Primary Products	518	867		47310	25520	9229	7387	90830
Rural Based Manufacturing			228	44874	6709		4587	56398
Minerals Industry	3141	8188	43641			620	4921	60512
Energy Resource Industry	911	875	14927			621	1535	18869
Energy Supply Industry	283	1379	7360	513			844	10380
Manufacturing Industries	4004	54401	11073	12437	671	933	7393	90913
Information and Communications Industries	20632	3493	662		3727	529	2571	31614
Economic Development - Environmental Aspects	810	7428	10216	15001	19009	25545	6906	84915
Environment	810		293		9442	46389	5040	61975
Infrastructure and Services	4043	11735	20139	7692	393	1724	4048	49773
Advancement of Knowledge	12805					89	1141	14035
International Aid					1988		176	2164
TOTAL	47958	88428	108560	128212	124243	88148	51835	637385

Note: Columns may not add to totals due to rounding.

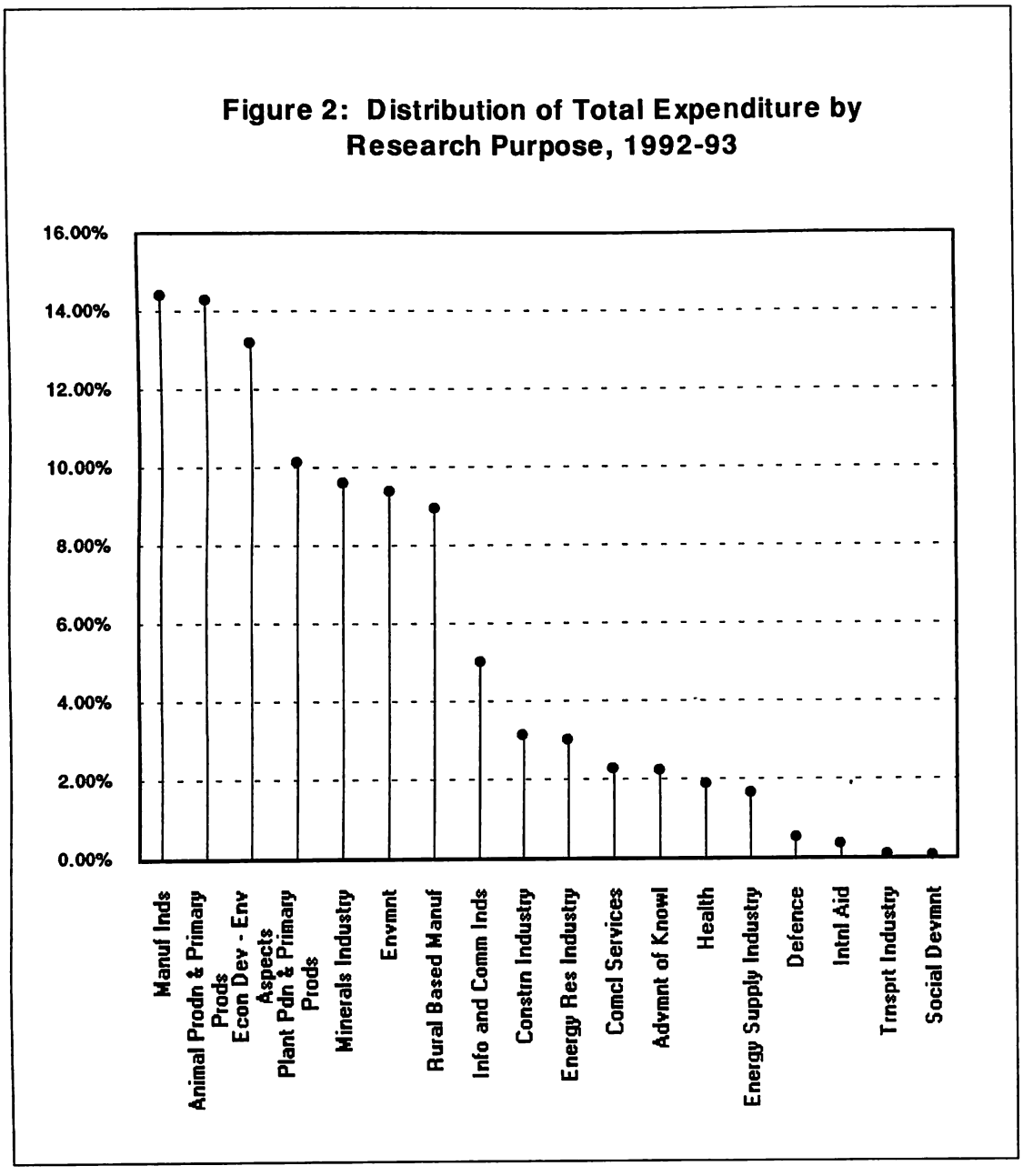


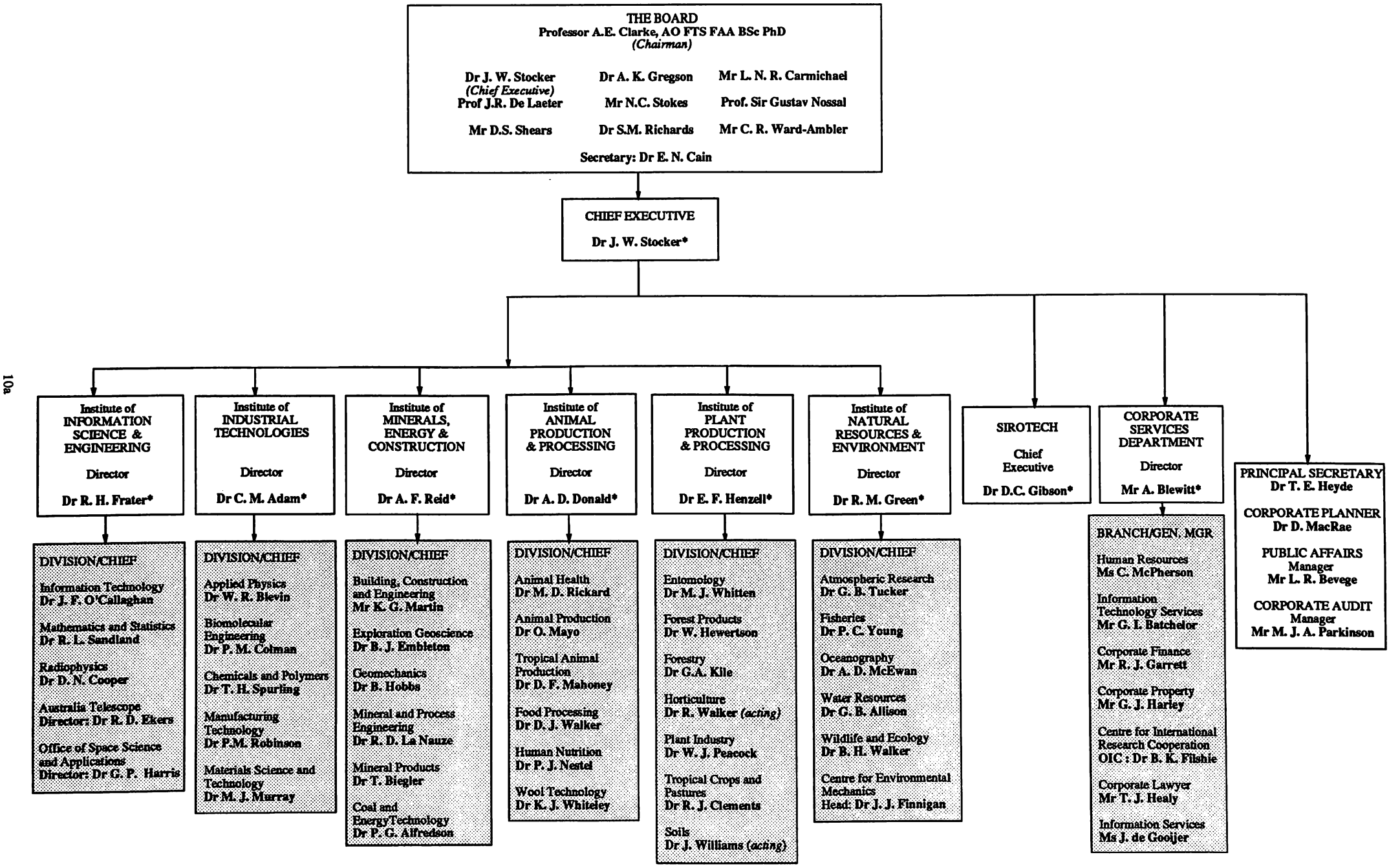
Table 4: CSIRO STAFF NUMBERS, 1992-93
(Equivalent full-time units, provisional estimates as at 11 May 1992)

	IISE	IIT	IMEC	IAPP	IPPP	INRE	CSD	CEAG[a]	Total
Professional Staff	267	498	587	610	650	507			3118
Other Staff	196	432	509	929	846	521	311	40	3784
Total Staff	463	930	1096	1539	1496	1028	311	40	6902

a Chief Executive Advisory Groups

Figure 3: CSIRO ORGANISATIONAL STRUCTURE

(As at June 1992)



* *Member of the CSIRO Executive Committee*

2. MULTI-DIVISIONAL PROGRAMS

CSIRO's ability to assemble multi-disciplinary teams to address research issues and problems which cross the boundaries of its management structure is one of its great strengths. The CSIRO research priorities process is likely to provide an impetus to the establishment of new Multi-Divisional Programs MDPs.

Details of inter-divisional research at the program level are provided in this Plan. These programs involve more than one Division and have a formal management structure or steering committee. During 1992-93, 21 MDPs will be operating across CSIRO.

Program Title: ***Active Packaging***

Participants:
Division of Materials Science and Technology
Division of Horticulture
Division of Food Processing

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

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

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

Development of high strength biodegradable packaging.

Completion of trials of packaging systems for selected crops.

Resource Details:
DMST - $447,300; DH - $210,000; DFP - $453,000.

Program Title: ***Algal blooms***

Participants:
Divisions of Water Resources
Division of Fisheries
Centre for Environmental Mechanics

Objective:
To help develop the scientific basis for management strategies to control and ameliorate algal blooms.

Planned Outcomes:
Being developed as part of a national strategy under the coordination of the Australian Water Resources Council.

Resource Details:
$3M over 3 years (1992-93 to 1994-95).

Program Title: ***Alumina Production***

Participants;
Division of Mineral Products
Division of Coal and Energy Technology
Division of Mineral and Process Engineering
Division of Materials Science and Technology

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

Planned Outcomes:
Establishment of the protocol and apparatus to assess inert anodes for aluminium smelting and evaluation of candidate materials developed by the Division of Materials Science and Technology.

Quantification of intrinsic effects of both composition and temperature on current efficiency in aluminium smelting, using a novel laboratory technique.

Resource Details:
Total Program Resources $2.2M.

Program Title: ***Aluminium Production***

Participants:
Division of Mineral Products
Division of Mineral and Process Engineering
Division of Building, Construction and Engineering

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

Planned Outcomes:
Establishment of a major external funding base for a new project on alumina precipitation, through involvement in the AJ Parker CRC for Hydrometallurgy.

Technical-scale assessment of a new process for ameliorating the red mud residue from the Bayer process.

Resource Details:
Total Program Resources $3.8M.

Program Title: ***Applied Optics Research***

Participants:
Division of Applied Physics
Division of Materials Science and Technology
Division of Manufacturing Technology

Objective:
Develop and apply optical technology in order to expand the manufacturing and export opportunities of Australian industry.

Planned Outcomes:
Application of modern optical techniques to the measurement of shape and dimension in industrial environments, and to aerospace and remote-sensing technology.

Application of vision systems to improve the industrial infrastructure.

Application of Optical Variable Devices to security and other fields.

Increase the national capability in the design, manufacture and use of optical systems, components and thin-film coatings.

Resource Details:
Program being established mid-1992.

Program Title: ***BHP MOU Research***

Participants:
Divisions from: Institute of Industrial Technologies,
Institute of Minerals, Energy and Construction,
Institute of Information Science and Engineering, and
Institute of Natural Resources and Environment

Objective:
Under Memorandum of Understanding with BHP Ltd conduct joint research in selected areas.

Planned Outcomes:
Research addresses waste management, site remediation, subsurface radar and imaging spectrometry, and is subject to regular review by joint management team.

Resource Details:
Current total budget is approximately $10M over 5 years.

Program Title: ***Boeing MOU Research***

Participants:
Division of Applied Physics
Division of Chemicals and Polymers
Division of Materials Science and Technology
Division of Manufacturing Technology

Objective:
Under Memorandum of Understanding with Boeing Commercial Airplane Company conduct joint research activities linked to the development of local manufacturing and exports.

Planned Outcomes:
Research addresses composites, carbon fibres, aluminium castings, non-destructive testing, matrix resins, and microstructure studies and is subject to regular review by a joint management team.

Resource Details:
Current total budget for the project is $25M over 6 years.

Program Title: *Climate Change*

Participants:
Division of Atmospheric Research
Division of Oceanography
Division of Fisheries
Division of Water Resources
Division of Wildlife and Ecology
Centre for Environmental Mechanics
Division of Plant Industry

Objective:
To provide regional estimates of climate change and climate change impacts for the Australian region.

Planned Outcomes:
Continued development of 4-level and 0-level general circulation models and limited area nested models.

First quantitative assessment of the representation of heat transport processes in global ocean circulation model.

Complete in-situ field observations of primary production and carbon fluxes at strategic locations in the Western Equatorial Pacific and the Southern Oceans by December 1993.

Assess the impact of plausible climate change scenarios on specific water resources.

Development and application of new methodologies for analysis of climate change data. Third reports to WA, NT and NSW and fourth report to Victoria.

Resource Details:
$12M per annum.

Program Title: *Coastal Zone*

Participants:
Centre for Environmental Mechanics
Division of Fisheries
Division of Oceanography
Division of Coal and Energy Technology
Division of Tropical Crops and Pastures
Division of Wildlife and Ecology
Division of Soils

Objective:
To quantify the effects of human-induced impacts on catchment-estuary systems and produce tools to manage the problems that ensue.

To provide a coherent information base for management of the Australian coastal zone.

Planned Outcomes:
Establish a functional mesocosm tank system to allow rigorous and cost-effective testing of marine environmental impacts by June 1993.

Compilation of physical and chemical data from the Derwent River Estuary study.

A prototype hydrodynamic and water quality model of an estuarine system.

Develop and test process models to predict nutrient and sediment flushing from soils by leaching and surface run-off.

Realistic understanding of major physical processes exchanging materials between estuarine sediments and overlying water.

Initiate development of the coastal and marine resources information system (CAMRIS).

Resource Details:
$1.9M per annum.

Program Title: *Energy Storage*

Participants:
Division of Mineral Products
Division of Minerals and Process Engineering
Division of Building, Construction and Engineering

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

Planned Outcomes:
Commercial implementation of an advanced plate curing process for increasing the efficiency of lead/acid battery production.

Resource Details:
Total Program Resources $2.3M.

Program Title: ***Fibre Utilisation***

Participants:
Division of Tropical Animal Production
Division of Animal Production
Division of Tropical Crops and Pastures

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

Planned Outcomes:
Insertion of a model gene into a target rumen bacteria (DTCP).

Assessment of esterases and etherases from rumen and non-rumen microbial sources in facilitating depolymerisation of lignin model compounds and forage lignin (DTAP).

Development of methodology for search of *Neocallimastix patriciarum* cDNA for the gene hydrolysing coumaryl ester bonds (DTCP).

Isolation of new strains of anaerobic fungi that have a high capacity to degrade fibre and determination of the effect of inoculating the rumen with such a strain of anaerobic fungus on voluntary feed intake and digestibility (DAP).

Development and application of DNA probes to detect, identify and quantify anaerobic fungi (DAP).

Determination of the growth rate and amino acid composition of components of the rumen microbial population that differ in cell size (DAP).

Measurement of net protein synthesis by bacteria, protozoa and anaerobic fungi when concentrates are added to a hay diet (DAP).

Determination of the relative numbers of methanogenic, acetogenic and sulphate-reducing bacteria in the rumen (DAP).

Demonstration of the proposition that secondary phenolic compounds are utilised by rumen microbes and are not merely inhibitory (DTAP).

Resource Details:
DTAP - $85,400; DAP - $144,300; DTCP - $900,500.

Program Title: ***Gene Shears Technology***

Participants:
Division of Plant Industry
Division of Wildlife and Ecology
Division of Biomolecular Engineering
Division of Animal Production
Division of Food Processing
Division of Entomology
Division of Tropical Crops and Pastures
Division of Tropical Animal Production

Objective:
To demonstrate the potential of the ribozyme technology and to apply the control of gene action to development of higher plants and animals, increasing resistance to pests and pathogens in plants, animals and humans and particularly initially to obtaining virus resistance in plants.

Planned Outcomes:
Strengthened strategic research base in molecular biology in general and in ribozyme-related research in particular.

New developments in ribozyme technology and enhanced understanding of structure and function.

Demonstration of the feasibility of the gene shears approach for a variety of applications in pharmacy and agriculture, and conferring both commercial and social benefits.

Pre-competitive demonstrations of the applicability of the technology.

Commercial support for individual projects.

Resource Details:
$9.2 million over four years (1989-90 to 1992-93) from May Statement funds (1989).

Program Title: *Heavy Mineral Processing*

Participants:
Division of Mineral Products
Division of Minerals and Process Engineering

Objective:
Improve productivity in the processing of Australia's mineral sands, allow value-added products to meet changing market specifications, and enhance prospects of further local downstream processing.

Planned Outcomes:
Development of a new process route to treat high-magnesia ilmenites.

Commercial implementation of a novel process to remove impurities from mineral sand concentrates and products.

Resource Details:
Total Program Resources $2.5M.

Program Title: *Iron Ore Processing*

Participants:
Division of Mineral and Process Engineering
Division of Exploration Geoscience
Division of Mathematics and Statistics
Division of Soils

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:
Establishment of the DMPE Comminution and Physical Separations Project at Pinjarra Hills to develop stronger linkages with JKMRC.

Identification of productive pre-competitive research areas.

Development of a whole plant model of iron ore dry processing operations.

Resource Details:
Total Program Resources $1.6M.

Program Title: *Land and Water Care Program*

Participants:
Division of Soils
Division of Water Resources
Division of Forestry
Division of Plant Industry
Division of Tropical Crops and Pastures
Division of Animal Production
Division of Wildlife and Ecology
Centre for Environmental Mechanics

Objective:
To develop practical ways to:

- manage soil productivity and sustainability, and minimise and ameliorate salinity;
- sustain production within land capability, and restore degraded areas in Australia's temperate agricultural regions;
- maintain livestock and pasture productivity and sustainability in the arid and semi-arid rangelands; and
- maintain production and re-establish trees on land that is eroded, waterlogged or saline.

Planned Outcomes:
Enhanced ability to predict salinity risk rate and consequences.

Develop an exemplary project in the Murray-Darling Basin aimed at matching land resource assessment with production opportunity to ensure that cereal and pasture production are developed sustainably within the land's capability and suitability.

Resource Details:
May Statement (1989) funding $9.48M for 1989-90 to 1992-93.

Program Title: *Magnesite Processing*

Participants:
Division of Mineral Products
Division of Minerals and Process Engineering

Objective:
Develop processes, products and product applications that will ensure maximum value to Australia of the unique Kunwarara magnesite deposit.

Planned Outcomes:
Development of methods for producing anhydrous magnesium chloride feedstock for magnesium metal production.

Completion of the construction of laboratory-scale electrolysis equipment to assess feedstocks for magnesium metal smelting processes.

Demonstration of the effectiveness of caustic magnesia in the treatment of industrial wastes.

Completion of a mini-pilot plant for producing flame-retardant grade magnesium hydroxide for applications polypropylene.

Resource Details:
Total Program Resources $4.5M.

Program Title: *Mapping Geological Modelling and Mine Design*

Participants:
Division of Geomechanics
Division of Exploration Geoscience
Division of Information Technology

Objective:
A fully integrated three-dimensional exploration and mining software system for improved interactive visualisation and modelling of geoscientific data derived from and required for such operations.

Planned Outcomes:
Development of a prototype Geoscience Spatial Information System (GeoSIS) for integration of exploration and mining information.

Resource Details:
Total Resources $1.7M.

Program Title: *Minesite Rehabilitation*

Participants:
Division of Soils
Division of Water Resources
Division of Geomechanics
Division of Coal and Energy Technology
Division of Wildlife and Ecology
Division of Mineral Products

Objective:
Establish key geotechnical-geomorphic-hydrological-pedological-biological processes needed to effectively rehabilitate minesites; ensure that resulting landforms and ecosystems evolve in equilibrium with surrounding environments with minimal impact on these environments.

Planned Outcomes:
Development of holistic strategies for rehabilitating Australian minesites in climatic zones ranging from tropical to arid.

Demonstration of the effectiveness of the work through direct research collaboration with mining companies.

Transfer of research results and technology to mining companies and environmental regulatory authorities.

Resources:
Total Program Resources $1.8M.

Program Title: ***Reducing Dependence of Pesticides***

Participants:
Division of Entomology
Division of Horticulture
Division of Plant Industry
Division of Biomolecular Engineering

Objective:
To lessen the dependence of certain major Australian agricultural industries on synthetic pesticides and other agricultural chemicals by providing alternative control agents or improved management technologies and practices.

Planned Outcomes:
Development and pre-commercialisation of fungi for the control of termites and other soil dwellers.

Generic technology for engineering pox viruses for pest control and pharmaceutical production and genetic engineering of viruses for control of sugar cane grubs, pasture grubs and grasshoppers.

Validation of flystrike management model.

Biocontrol of *Heliothis* in cotton and transgenic cottons.

Mating disruption in orchard moths, development of equipment for disinfestation of fresh fruit, and improved control of fruit fly.

Resource Details:
May Statement (1989) funding $9.48M for 1989-90 to 1992-93.

Program Title: ***SAW/ELISA Biosensors***

Participants:
Division of Food Processing
Division of Applied Physics
Division of Chemicals and Polymers
Division of Plant Industry

Objective:
To develop an Australian-based research and development capability in sensing of air and liquid-borne contaminants.

Planned Outcomes:
Signing on of a commercial partner following third year of project and establishment of generic sensing technology.

Resource Details:
DFP - $453,000; DAP - $261,200; DCP - $149,900; DPI - $3,800.

Program Title: ***Vaccine Technologies***

Participants:
Division of Animal Health
Division of Animal Production
Division of Tropical Animal Production
Division of Biomolecular Engineering

Objective:
To develop generic systems for the delivery of antigens and to enhance the immune response to vaccines.

Planned Outcomes:
Development of an assay for protective antigen and assess the effect of purified antigen on *in vitro* culture.

Production of monoclonal antibodies to clenbuterol protein conjugates and quantification of antidiotyic response in sheep.

Evaluation of the fimbriae/LHRH - fatty acid preparations as a vaccine in sheep.

Determination of the structure of the Fv antibody fragment/neuraminidase complex.

Production of monoclonal antibodies to ovine IgE.

Cloning and sequencing of the cDNA for ovine 1L-5 and 1L-10.

Incorporation of new hapten-carrier complexes into ISCOMS and examination of the T cell response to these in sheep.

Examination of the biodegradable polymers for the encapsulation of recombinant vaccine antigens.

Purification of various peptide-and-protein polyvirus coat protein hybrids and assessment of their immunogenicity in mice.

Resource Details:
DAH - $171,750; DAP - $41,294; DTAP - $32,000; DBE - $146,500.

3. STRATEGIC PLAN IMPLEMENTATION

In this chapter the planned outcomes from the CSIRO Strategic Plan 1991-92 to 1995-96 are cross-referenced to the "specific objectives" and "planned outcomes" of the Institutes/Divisions as shown in this Plan. An example of how the cross-references on the following pages work is shown below:

CSIRO Strategic Plan planned outcomes	Institute and Division Cross Reference		
AP-3	(DAH-86, Division of Animal Health - page 86 of this Plan	DAP-89, Division of Animal Prodn - page 89 of this Plan	DTAP-104) Division of Tropical Animal Prodn - page 104 of this Plan

As the CSIRO Strategic Plan contains only a selection of planned outcomes for each of 10 research purposes, (see Box 1, p. 3) not all "specific objectives" and "planned outcomes" of Divisions are cross-referenced. An example of how the cross-reference under a "specific objective" for a Division is traced back to a CSIRO Strategic Plan planned outcome is shown below:

SPECIFIC OBJECTIVE - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To develop system architectures, tools and techniques for image-based visualisation and interactive user interfaces. - *25%* - *MI-5; IC-4*	*Image-based visualisation toolkits for parallel architectures designed and two demonstrator projects for the toolkits established.* *A feasibility study on fractal-based techniques for three dimensional representations in mine planning completed in collaboration with the Division of Geomechanics.* A three year R&D contract on colour device modelling and display techniques completed.

Explanation: As in previous years the percent of total resources (in this case 25%) refers to the proportion of the Division's resources to be allocated to achieving this specific objective. MI-5 refers to the fifth planned outcome in the Minerals Industry research purpose as stated in the CSIRO Strategic Plan and reproduced in the following pages. IC-4 signifies that this specific objective also contributes to the achievement of the fourth planned outcome for the Information and Communication Industries research purpose of the CSIRO Strategic Plan. The Division's "planned outcomes" for this "specific objective" which relate to the planned outcome of the CSIRO Strategic Plan are emphasised by italicised text.

Codes for the 10 research purposes of the CSIRO Strategic Plan are as follows:

Code		Research Purpose
PP	-	Plant Production and Primary Products
AP	-	Animal Production and Primary Products
RM	-	Rural-based Manufacturing
MI	-	Minerals Industry
ERS	-	Energy Resource and Supply Industry
MF	-	Manufacturing Industry
IC	-	Information and Communications Industries
EDEA	-	Economic Development - Environmental Aspects
ENV	-	Environment
IS	-	Infrastructure and Services

CSIRO STRATEGIC PLAN PLANNED OUTCOMES BY RESEARCH PURPOSE		INSTITUTE & DIVISION CROSS REFERENCE
PLANT PRODUCTION AND PRIMARY PRODUCTS		
PP-1.	New varieties of sugar cane with a 10 per cent higher yield of sugar worth more than $100m a year to the sugar industry.	IPPP (DTCP-132)
PP-2.	Genetically modified rumen micro-organisms to improve the digestion of low-quality tropical forages worth around $120m a year to the livestock industries.	IAPP (DTAP-105)
PP-3.	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 agricultures and horticulture on pesticides by up to 50 per cent.	IPPP (DPI-126, 127, 128, DE-115, 116, 117)
PP-4.	Genetically engineered high sulphur protein pasture legumes with the capacity to lift wool production from improved pastures by 20 per cent.	IPPP (DPI-126)
PP-5.	Cropping management systems that minimise disease and improve soil water availability to improve yields by 10 per cent in southern NSW and northern Victoria.	IPPP (DPI-127, DS-130)
PP-6.	Automated techniques for assessing small wood samples to enable important properties for industrial use to be incorporated into tree-breeding programs.	
ANIMAL PRODUCTION AND PRIMARY PRODUCTS		
AP-1.	Improved sheep-breeding techniques to control fibre diameter and other quality attributes in Australian merino wool.	IAPP (DAP-89)
AP-2.	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.	IAPP (DTAP-92, 104)
AP-3.	Genetic markers for disease resistance in sheep and cattle to enable breeders to supply rams and bulls highly resistant to specific diseases without loss of other desirable attributes such as fleece and meat quality and productivity.	IAPP (DAH-86, DAP-89, DTAP-104)
AP-4.	New or improved vaccines against cattle ticks, tick fever, sheep nematodes and sheep blowflies - parasites estimated to cost Australia $650m a year.	IAPP (DAH-85, 86, DTAP-103, 106)
AP-5.	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.	IAPP (DAP-91, 92, DTAP-105)

CSIRO STRATEGIC PLAN PLANNED OUTCOMES BY RESEARCH PURPOSE		INSTITUTE & DIVISION CROSS REFERENCE
AP-6.	Quantitative predictive models for the sustainable management of the tuna fishery.	INRE (DF-143)
RURAL-BASED MANUFACTURING		
RM-1.	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.	IAPP (DFP-96, 97)
RM-2.	Active packaging systems for perishable goods which will open up export markets (especially for horticultural products) of over $100m a year.	IPPP (DH-123); IAPP (DFP-96); IIT (DMST-55)
RM-3.	Automated beef-carcass boning procedures incorporated in new versions of FUTUTECH.	IAPP (DFP-96)
RM-4.	Specification 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.	IAPP (DWT-107)
RM-5.	Support for the food industry in developing new fibre-enriched foods and implementing corporate strategies on nutrition.	IAPP (DHN-99, 100)
RM-6.	Preservatives that impart durability and appearance qualities to local plantation timber so it can compete with imported timbers in the $100m Australian market.	IPPP (DFP-118)
MINERALS INDUSTRY		
MI-1.	Development of a magnesium metal demonstration production plant industry in Gladstone, in collaboration with QMC, MIM and UBE Industries - Japan.	IMEC (DMP-79)
MI-2.	Establishment of Pinjarra Hills laboratories as a leading centre for mineral and coal mining and processing, mineral waste management and light metals research.	IMEC (DGM-76, 77); IIT (DMT-53)
MI-3.	A major research role in the support and further development of SIROSMELT technology to achieve a minimum of two new installations per year with an expected benefit of $12m a year.	IMEC (DMPE-77)
MI-4.	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.	IMEC (DMPE-77)
MI-5.	Improved metalliferous mining efficiency by addressing the issues of the integration of geology and mine design and of dilution during the mining process.	IMEC (DGM-73); IISE (DIT-30)

CSIRO STRATEGIC PLAN PLANNED OUTCOMES BY RESEARCH PURPOSE		INSTITUTE & DIVISION CROSS REFERENCE
ENERGY RESOURCES AND SUPPLY		
ERS-1.	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.	IMEC (DGM-74)
ERS-2.	Establishment of a coal-bed methane industry in Australia, especially to support the development of pilot schemes in Queensland with MIM, and in NSW.	IMEC (DGM-74)
ERS-3.	Improved underground coal-mining efficiency by realising the potential offered by the longwall mining system.	IMEC (DGM-72)
ERS-4.	Improved productivity of Australian coal-preparation plants and, in co-operation with industry, improved marketing of Australian coals for new clean coal technologies.	IMEC (DCET-65, 66)
ERS-5.	Demonstration of the 5KW solid oxide fuel cell system, which has high efficiency and low pollution loads, with a view to widespread commercial uptake.	IIT (DMST-55)
MANUFACTURING INDUSTRIES		
MF-1.	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.	IIT (DCP-50)
MF-2.	An anti-influenza drug, developed in collaboration with Glaxo, Biota and the Biomolecular Research Institute.	IIT (DBE-47)
MF-3.	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.	IIT (DMT-53)
MF-4.	Gains in quality and productivity in Australian manufacturing industry through new approaches which synthesise measurement, data capture and statistical sciences.	IISE (DMS-32); IIT (DMT-53)
MF-5.	Development and commercialisation of new systems to achieve effective delivery of antigens and optimum immune responses from vaccines.	IAPP (DAH-85, 86, 87, DTAP-106)

CSIRO STRATEGIC PLAN PLANNED OUTCOMES BY RESEARCH PURPOSE		INSTITUTE & DIVISION CROSS REFERENCE
INFORMATION AND COMMUNICATIONS INDUSTRIES		
IC-1.	Australian trials of an integrated system for the delivery of wideband width, networked communication and information services, for example, wireless systems for local area networks and broadband access to customer premises.	IISE (DRP-34, 35, 36)
IC-2.	Antennas and associated sub-systems for satellite-based, mobile person-to-person communications.	IISE (DRP-35, 36)
IC-3.	Advanced spatial database systems for improved management of land-related information for applications developers throughout CSIRO, Government and industry.	IISE (DMS-32, DIT-29)
IC-4.	Transfer of high-performance, interactive visualisation and modelling software to the software and services industry for applications in the resource and environmental management industries.	IISE (DIT-30)
IC-5.	Transfer of advanced hypermedia tools for navigating complex databases transferred to the information services industry.	IISE (DIT-29)
ECONOMIC DEVELOPMENT - ENVIRONMENTAL ASPECTS		
EDEA-1.	Demonstration of the ability to substantially reduce rabbit and fox populations by means of fertility control.	INRE (DWE-158)
EDEA-2.	A comprehensive set of management strategies to prevent or ameliorate outbreaks of toxic blue-green algae in inland water systems.	INRE (DWR-152, 153, 154, CEM-161, DF-144, COSSA-162)
EDEA-3.	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.	INRE (DWR-152, 153, 154); IAPP (DWT-107); IIT (DCP-51); IPPP (DF-121)
EDEA-4.	Solutions to environmental and technical issues to ensure that effluent from proposed kraft pulp mills will not have a detrimental impact.	INRE (DOc-147, 148; DF-144)
EDEA-5.	Plasma technology suitable for high temperature destruction of organic chemical wastes at the plant scale.	IIT (DMT-52)
EDEA-6.	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.	INRE (DWR-151, 152, 153, 154; DWE-156, CEM-161); IAPP (DAP-91);
EDEA-7.	Improved capability to help mining companies in the environmental management and rehabilitation of mine sites.	IPPP (DS-130); INRE (DWR-152,DWE-157); IMEC (DGM-75)

CSIRO STRATEGIC PLAN PLANNED OUTCOMES BY RESEARCH PURPOSE		INSTITUTE & DIVISION CROSS REFERENCE
ENVIRONMENT		
ENV-1.	Regional forecasts of climate change with certainty sufficient to stimulate governments and the private sector to adopt response and adaptation strategies.	INRE (DAR-139, 140, DOc-147, DWE-158, CEM-16(DWR-152, DF-144)
ENV-2.	Proved drought forecasting ability through participation in a major international exercise studying the interaction between oceans and the atmosphere.	INRE (DOc-147, CEM-161, DAR-140)
ENV-3.	Scientific principles for effective fire management regimes to help in the maintenance of Australia's conservation areas.	INRE (DWE-157); IPPP (DF-120)
ENV-4.	Methods for identifying Australian flora and fauna at risk of extinction and the design of reserve networks to best ensure their protection.	INRE (DWE-158, 159)
INFRASTRUCTURE AND SERVICES		
Construction		
IS-1.	Establishment of a Building Research Association and interaction with the newly launched building industry reform process to enhance R&D within the industry.	IMEC (DBCE-63)
IS-2.	Major research and advisory input to the Better Cities Program.	INRE (DWR-153); IMEC (DBCE-63)
IS-3.	Establishment of the CSIRO Division of Building, Construction and Engineering as Australia's premier research organisation for the building and construction industry.	
Health		
IS-4.	Development of nutrition based strategies to reduce genetic damage from environment and chemical exposure and to reduce cardiovascular disease.	IAPP (DHN-99, 100)
Commercial Services		
IS-5.	Use of CSIRO decision support systems by 75 per cent of water agencies in Australia in developing their catchment management strategies.	INRE (DWR-153)

4. INSTITUTE OF INFORMATION SCIENCE AND ENGINEERING

OBJECTIVE

The Institute aims: -

- **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 the Australian information and telecommunications industries.**
- **to assist other industry sectors to improve their competitiveness through the use of advanced computer and communication systems.**

STRATEGY

- *Value-added opportunity areas are the driving force for the Institute's research. Services have been identified as a major value-added opportunity. Particular emphasis will be placed on the converging areas of telecommunications and information services. Significant opportunities will be sought in commercial services, especially financial services.*
- *The appropriate generic technology base has been identified and established. The Institute will maintain itself at the forefront of international research on information and communications technologies 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 telecommunications industries.*
- *Research groups in the Institute will be built-up to a size that will ensure their viability and maximise the impact of their work. The Institute will encourage pre-competitive R&D in Australia, particularly in conjunction with groups of companies. This is especially pertinent at present because of the short-term focus and fragmented effort of the majority of relevant private sector research and development.*
- *Australia faces a critical shortage of skilled people in the computing and engineering areas. Consequently, it is vital that the Institute works together with active research teams possessing complementary skills in academic and other research establishments. To this end joint research centres will be established in conjunction with tertiary educational institutions. This will involve, in particular, improvement of software engineering and collaboration technology environments and practices. The Institute will also become involved in education and training, both undergraduate and postgraduate.*
- *The Institute has a "conceive new approaches - deploy prototypes with users -evaluate results" approach to undertaking research and development. This leads to demonstrator projects as a prime mechanism for initial deployment of the Institute's technology.*
- *The Institute conducts its research programs in collaboration with other CSIRO Institutes, academic institutions and industrial research groups, and encourages education and training in its key technologies. It plans to exploit the results of its research through joint ventures, collaborative research, development projects and consultancy with Australian industries.*
- *The growth of the Institute will take place by evolution from existing areas of strength since this maximises the commercial impact of the Institute's work.*

PLANNED OUTCOMES

- Selection and launch of the second set of Institute demonstrator projects.
- Consolidation of the CSIRO-Macquarie University Joint Research Centre, with relocation of components of the Division of Information Technology and Mathematics and Statistics into purpose-built accommodation on the Macquarie University campus.
- A substantial joint project with the Institute of Industrial Technologies.
- A major industry link in communications services.
- A five-year strategic/business plan incorporating a fresh assessment of national research priorities.
- Implementation of a total quality approach to management of the Institute.
- A hyper-media, interactive catalogue covering the results of the Institute's research.
- A new approach to the production and distribution of ICON (the Institute's quarterly newsletter).

INSTITUTE OF INFORMATION SCIENCE AND ENGINEERING

SUMMARY OF RESOURCES, 1992-93

(estimates as at 11 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Information Technology	73	90	7213	2000	9213
Mathematics and Statistics	61	76	5784	2300	8084
Radiophysics	76	157	11056	3200	14256
Australia Telescope (National Facility)	56	135	10914	950	11864
CSIRO Supercomputing Facility	4	4	3210		3210
Institute Headquarters	4	12	1331		1331
TOTAL	**274**	**474**	**39508**	**8450**	**47958**

Note: Columns may not add to totals due to rounding.

[a]Appropriation includes earned appropriation revenue plus the Internal Lease Scheme allocation and May Statement Funds.

INSTITUTE OF INFORMATION SCIENCE AND ENGINEERING

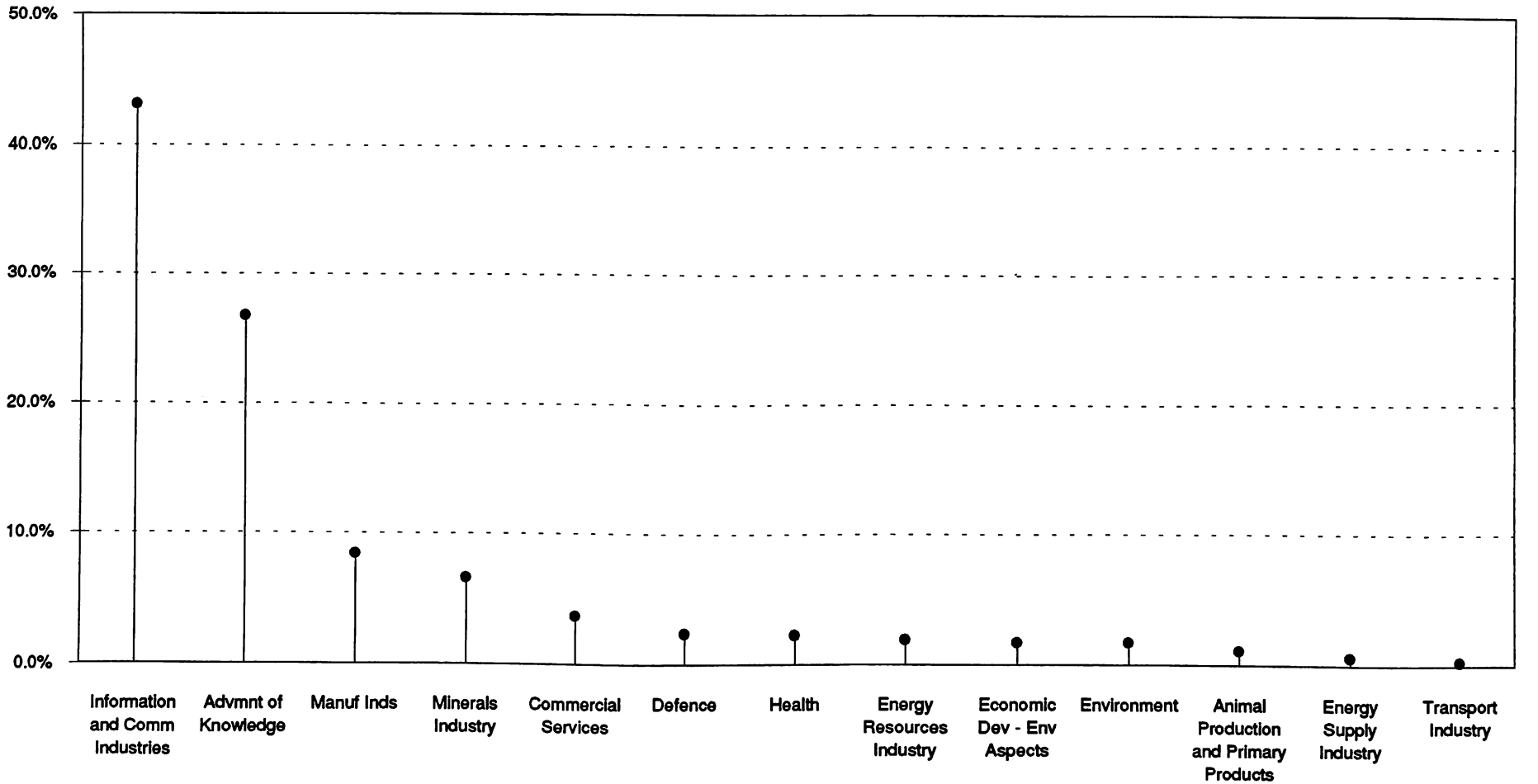
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE

(estimates as at 11 May 1992)

RESEARCH PURPOSE	DIT	DMS	DRP	ATNF	CSIRO SUPER COMP FACILITY	TOTAL
	($'000)	($'000)	$'000)	($'000)	($'000)	($'000)
Animal Production and Primary Products						
- Livestock		277	206			483
Minerals						
- exploration		598				598
- mining and extraction	712	698				1410
- processed minerals		316				316
- basic metal products		607				607
Energy Resource Industry						
- mining and extraction			848			848
Energy Supply Industry		266				266
Manufacturing Industries						
- generic	475	1130	214			1819
- fabricated metal products		798				798
- instrumentation			1118			1118
Information and Communication Industries						
- generic	2845	424	1785			5054
- computer hardware and electronic equipment			2250			2250
-communications equipment			2524			2524
- computer software and services	3084	1221	631			4936
- communications services	475	424	3159	430		4488
Transport Industry		116				116
Commercial Services	948	515	156			1619
Economic Development						
- Environmental Aspects	475		283			758
Environment	474	283				757
Health		348	646			994
Defence			1040			1040
Advancement of Knowledge - physical sciences			99	11849		11948
Unallocated					3210	3210
TOTAL	**9488**	**8304**	**14676**	**12279**	**3210**	**47958**

Note: Columns may not add to totals due to rounding.

Distribution of Total Expenditure by Research Purpose, 1992-93



4.1 DIVISION OF INFORMATION TECHNOLOGY

OBJECTIVE

To contribute to the international competitiveness of Australian industry by increasing the effectiveness of utilisation of advanced information technologies, systems and services.

STRATEGY

- Focus research on the demonstration and development of advanced information systems and associated services, particularly for the environment, minerals, manufacturing and commercial services sector.
- Form strategic relationships with other research and industrial groups and participate in major Australian research centres in information technology.
- Participate in industrial consortia addressing significant commercial opportunities for advanced information systems and services.

SPECIFIC OBJECTIVE - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To develop system architectures, tools and techniques for processing spatial (geographic) data in problem-oriented spatial information systems. - *20%* - *IC-3 (see page 18 for code)*	*A prototype a spatial database server for public access to land-related data.* *Demonstrated integration of object-oriented data management and spatial planning techniques for applications in military command support and commercial services planning.*
To develop methodologies, tools and techniques for engineering knowledge-based information systems. - *25%* - *IC-5*	*A collaborative project in knowledge modelling for intelligent documentation systems with French and Australian partners.* *A prototype customer advisory system using hypertext and knowledge-based technologies for service-based organisations.* *A business plan for the utilisation of knowledge-based systems in publishing, information and commercial services.*
To develop system architectures, tools and techniques for high-performance computing problems. - *20%*	A data parallel meta-language for high-performance implementations of stochastic optimisation techniques specified and evaluated for commercial potential in manufacturing and process control. Initial investigations on improving the computational performance of photochemical models completed.
To demonstrate and develop "open system" architectures and emerging standards for distributed information systems. - *10%*	An R&D program on "open systems aimed at communications services for distributed information systems established.

To develop system architectures, tools and techniques for image-based visualisation and interactive user interfaces. - *25%* - *MI-5; IC-4*	*Image-based visualisation toolkits for parallel architectures designed and two demonstrator projects for the toolkits established.* *A feasibility study on fractal-based techniques for three dimensional representations in mine planning completed in collaboration with the Division of Geomechanics.* A three year R&D contract on colour device modelling and display techniques completed.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes appropriation Revenue)	$7,213,000
Sponsored Research	$2,000,000
Total Budget	**$9,213,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 25% of its annual budget will be spent from external funds in 1992-93.

4.2 DIVISION OF MATHEMATICS AND STATISTICS

OBJECTIVE

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

STRATEGY

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

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To formulate mathematical models and develop computational algorithms and functional software for industrial applications, and to deliver the benefits of this research to users. - *28%*	Mathematical models to help understand and improve specific processes and products; metal casting, the aluminium reduction cell, buckling of sheet metal, electromagnetic stirring of molten steel, design and fabrication of progressive spectacle lenses, metal rolling. Publication of the Proceedings of the 1992 Mathematics-In-Industry Study Group (MISG). Completion of the second year's scheduled work on GIRD-funded FASTFLO project, "New Computational Fluid Dynamics Algorithms for Industrial Applications". Models and software for specific fluids problems; pulsed combustion, pumps, convection in cavities. Optimisation algorithms and software for specific applications; scheduling of trains, airline crew, temperature variation in the distribution of fuel, planning the location of facilities. Presentation of short courses to targetted industries on scheduling of production, forwarding of freight and equipment maintenance.

To carry out research into aspects of quality improvement which will have a significant impact on Australian enterprises, to carry out research in anticipation of their needs and to communicate the importance and benefits of statistical thinking to Australian enterprises and the community.
- *36%*
- *MF-4*

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

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

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

A method for predicting recoverable reserves of coal, based on models of fracture sets affecting mining, developed and implemented in software.

To develop new methods, algorithms and environments for the modelling, processing and analysis of high dimensional data and to apply these methods in relevant industrial and environmental contexts.
- *25%*
- *IC-3*

Increased utility of the NESSIE system for the design of lakes for pollution control.

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

Methods for determining efficient sampling plans for measuring water quality parameters in waterways.

Tested algorithms for robust, real-time estimation of signal amplitude.

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

Methods of mapping dryland salinity in the WA wheatbelt and used to provide maps for the spatial extent of salinity in the WA wheatbelt.

Methods for assessing, representing and combining uncertainty in the data layers of a GIS

To develop new components for interactive graphical data analysis software that will provide better visualisation of complex data and models, and develop a network system for the Division's computers to enhance the environment for research collaboration between locations.
- *11%*

An intuitive point and click interface style for applications based on the S-PLUS software.

The first release of a geostatistics module for mineral exploration companies that enhances the S-PLUS software and fulfills the needs of this industry sector.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenues)	$5,784,000
Sponsored Research:	$2,300,000
Total Budget:	**$8,084,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 29% of its total annual budget will be spent from external funds in 1992-93, based on estimates at 31 March 1992.

4.3 DIVISION OF RADIOPHYSICS

OBJECTIVE

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

STRATEGY

- Conduct research into generic technologies appropriate to telecommunications and image forming systems (including ultrasonic imaging systems).
- Recognise emerging trends in services relevant to the Division's strengths and adapt its technology research to meet the future needs.
- Collaborate with industry, Universities, Government business enterprises and bodies such as DSTO, and foster the formation of research partnerships.
- Maximise the exploitation of its research through partnerships giving access to international markets.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Stategic Plan)*
To develop advanced wireless and untethered communications systems for • **mobile and portable computing networks** • **telecommunications customer access and other short-haul network links** **and investigate enhanced applications for wireless access computing.** - *10%* - *IC-1 (see page 18 for codes)*	*Wireless LAN system designs for both high performance and low power mobile computing networks produced in conjunction with university and industry partners.* *Demonstration of wireless links for high bit rate applications such as real time video transfer.* *A system design for mm-wave telecommunications links.* *One or more consortia of academic and industry partners formed to commence development of prototype systems.*
To develop advanced GaAs based semiconducter devices and MMIC's for application in defence and communications systems. - *23%* - *IC-1*	Sub-quarter micron quantum-well-doped devices and MMICs for low noise and moderate power applications, and refined semiconductor process technology enabling routine high-yield fabrication. Low noise and moderate power MMIC amplifiers for the 33-50 GHz band designed and fabricated. *Hybrid integrated circuits and MMICs for prototype transceiver for a high-bit-rate wireless local area network.*

To develop new and improved ultrasonic imaging, Doppler, tissue characterisation and transducer techniques for medical diagnosis and industrial applications.
- *18%*

A subcutaneous tissue aberration removal technique demonstrated using clinical data.

Completion of a project on improvements in ultrasonic evaluation of meat.

Vector velocity imaging of blood flow implemented using clinical data.

Clinical evaluation phase of intravascular tissue characterisation study completed.

Linear array transducers constructed using piezoelectric ceramic tape material.

To provide professional co-ordination between industry and the Division and provide project management for key Divisional projects.
- *8%*
- *IC-2*

Refined vehicle-mounted electronically tracking antennas for the OPTUS L-Band mobile satellite system and extension of the technology to the global INMARSAT system.

Wideband orthomode transducers developed and manufactured for Jet Propulsion Laboratories, USA.

To apply advanced signal processing technology in the following areas:
- **digital electronics**
- **telecommunications**
- **communications and mine safety technologies for the minerals industry.**

- *22%*

Commercialisation of the A4 audio processing chip, and investigation of possible derivative chips.

Board and system level products involving the A4 chip developed, in conjunction with Industry.

Novel methods for improved compression of high resolution images.

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

Application of information fusion techniques in a variety of areas, such a radio imaging in geological exploration and medical imaging, where prior knowledge is used in the reduction and presentation of undetermined data.

Develop robust and adaptive methods for telecommunications and control, as part of the activities of the Co-operative Research Centre for Robust and Adaptive Systems.
- *8%*
- *IC-1*

Robust modulation for wireless communication schemes.

Methods from radioastronomy used to estimate the shape of towed sonar arrays.

Adaptive signal processing methods for echo cancellation in telecommunications systems.

Nonlinear dynamical systems in the vicinity of phase transitions, studied and applied to a variety of areas.

To develop techniques for the design and manufacture of antennas and passive microwave devices for communications systems.
- *11%*
- *IC-1, 2*

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

Technology for the design and manufacture of a dual-band feed system for the Geraldton ADSCS earth stations.

Compact planar antennas for satellite and wireless communications.

Wave propagation measurements at millimetre-wave frequencies for use in wireless communications.

1992-93 RESOURCES SUMMARY

Appropriation Total Allocation (includes appropriation Revenue)	$11,056,000
Sponsored Research	$3,200,000
Total Budget	$14,256,000

DIVISION EXTERNAL EARNINGS TARGET

The Division expects that 23% of its total annual budget will be spent from external funds in 1992-93.

4.4 THE AUSTRALIA TELESCOPE (A NATIONAL RESEARCH FACILITY)

OBJECTIVE

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

STRATEGY

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

Use the strong basic scientific research program to direct the instrumental development and ensure a high profile for radio astronomical research in Australia.

The ATNF's broad system engineering design capability and sophisticated end users, in combination with key technologies provided by the Division of Radiophysics, result in an extraordinary degree of vertical integration. This generates great opportunities for future developments and technology transfer and provides a showpiece for Australian technology.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To pursue a program of research in astronomy and astrophysics. - *9%*	The properties of radio stars, pulsars, supernovae remnants, galaxies and quasars investigated. Complete 80% of a definitive new survey of southern pulsars. Collaborative agreements (both National and International) for use of ATNF antennas as part of the global VLBI network and the USSR RADIOASTRON and Japanese VSOP space VLBI programs.
To operate the Parkes and Narrabri telescopes as National Facility. - *60%*	A level of access to the facilities which satisfies the community of scientific users.
To operate and develop the joint ATNF-RP computing facility. - *6% (ATNF component only)*	Hardware and software for the network of computers needed to satisfy the operational and research environment requirements at the three sites operated and maintained .
To develop the next generation of instrumentation. - *20%*	An 80-115 GHz observational capability for the MOPRA 22m antenna. Prototype a new receiver system for the band 12-25 GHz, using HEMT devices fabricated by the Division of Radiophysics. Hardware and software for phase stable satellite links for the LBA.

To actively pursue a public relations and education program.
- 5%

Operate the Parkes and Narrabri visitor centres.

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

Provision of educational opportunities at the high school, undergraduate, graduate and post doctoral levels. This will include; a work experience programme, training for sandwich-course engineering students, a summer undergraduate programme, collaborative PhD programmes in engineering and astronomy and post doctoral positions.

1992-93 RESOURCES SUMMARY	
Appropriation Allocation (includes appropriation Revenue)	$10,914,000
Sponsored Research	$950,000
Total Budget	**$11,864,000**

DIVISIONAL EXTERNAL EARNING TARGET

The ATNF expects that 13% of its total budget will be spent from external funds in 1992-93.

5. INSTITUTE OF INDUSTRIAL TECHNOLOGIES

OBJECTIVE

The Institute aims:-

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

STRATEGY

- *Manufactured goods are the fastest growing export sector and now exceed the value of our traditional rural exports. Improvement in Australia's current account position will rely increasingly on exports of manufactured products.*

- *There is significant potential for the Institute to help improve the international competitiveness of Australian manufacturing industry in the production of value-added goods and services, and the Institute intends to work with world-class Australian companies to expedite their entry into new technologically intensive markets.*

- *The Institute aims to increase its interaction with the manufacturing sector through research collaboration on strategic projects. This will facilitate the exchange of knowledge and technology and enable the finer focusing of research on industry problems where special opportunities exist. The Institute aims to improve the skills and practices necessary for enhanced interaction with industry while at the same time helping build the scientific knowledge and skill base in industry, which is necessary for internationally competitive performance.*

- *Research areas within the Institute include:*

  - *design and manufacture of scientific, industrial and medical instrumentation;*

  - *biotechnology, waste management and recycling;*

  - *the design and production of specialty chemicals and of agricultural and pharmaceutical products;*

  - *integrated manufacturing systems and their introduction for specific company applications;*

  - *the properties, production, and fabrication of materials (metals, ceramics, polymers and composites) as engineering components and manufactured products.*

- *The Institute is committed to working extensively with private sector companies to facilitate the transfer of advanced technology, aided by the existence of various Government-sponsored assistance schemes including tax deductions for research and development, the Grants for Industry Research and Development (GIRD) and the National Industry Extension Service (NIES).*

PLANNED OUTCOMES

- Establishment of $21m research syndicate with Australian financial consortia, using syndicated R&D legislation, directed toward the development of anti-viral pharmaceutical compounds.

- Under Memorandum of Understanding with BHP, continued development of joint research activities including steel strip processing, remote sensing, and waste management technology.

- Production of prototype scientific equipment to Australian and US Research Institute standards for Australian and US field trials.

- Continue joint research activities with the Boeing Company, Seattle, to support Australian manufacturing opportunities with Aerospace Technologies of Australia and Hawker de Havilland for exports related to the international aerospace community.

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

- Finalise strategic alliances with Sydney Water Board and Pacific Power in support infrastructure development and expansion of export opportunities for water/waste management technology.

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

- Establish Ceramic Fuel Cells Limited as an incorporated venture between CSIRO, BHP, Pacific Power, Energy R&D Corporation and the Victorian Government funded Strategic Research Foundation.

- Coordinate CSIRO wide activities in environmental waste management, notably in urban sewage and water treatment.

- Ensure productive research links with academic institutions and industry through several CRCs directed in support of manufacturing export opportunities.

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

- In conjunction with the Institute of Minerals, Energy and Construction, continue planning development of a new advanced metals/minerals.

- Continue formal Divisional Scientific and Technology Reviews and, Business Area Reviews and Project Report system as precursor to Institute resource allocation decisions.

INSTITUTE OF INDUSTRIAL TECHNOLOGIES

SUMMARY OF RESOURCES, 1992-93

(estimates as at 11 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Applied Physics	129	286	21822	4300	26122
Biomolecular Engineering	97	168	11351	3300	14651
Chemicals and Polymers	92	169	10854	4000	14854
Manufacturing Technology	81	140	9790	4000	13790
Materials Science and Technology	94	157	11511	3400	14911
Institute Headquarters	5	10	4100		4100[b]
TOTAL	**498**	**930**	**69428**	**19000**	**88428**

Note: Columns may not add to totals due to rounding.

[a]Appropriation includes earned appropriation revenue plus ILS (Internal Lease Scheme) allocation and May Statement Funds.

[b]Includes $2.8M managed by the Institute for Divisions.

INSTITUTE OF INDUSTRIAL TECHNOLOGIES

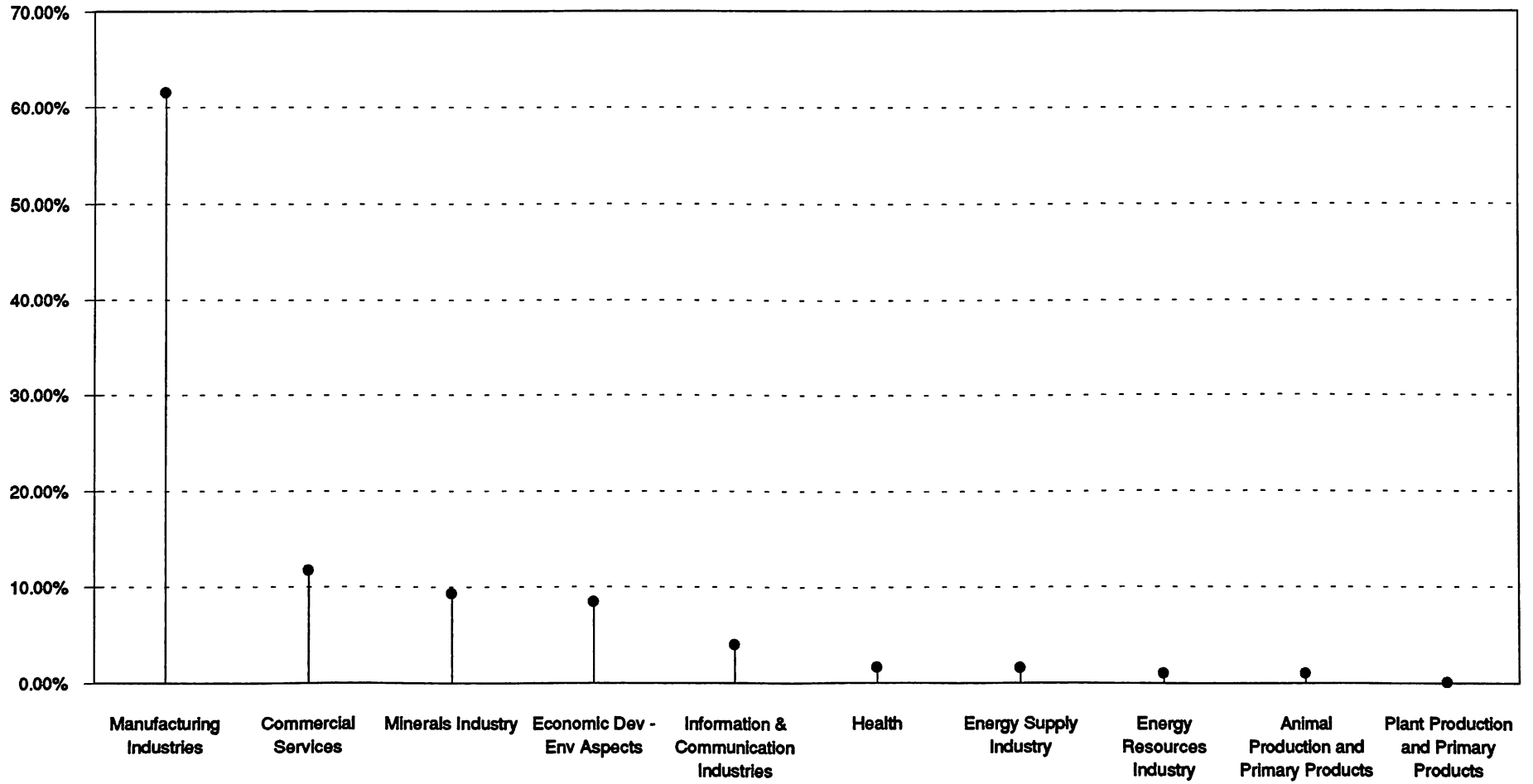
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE 1992/93

(estimates as at 11 May 1992)

	Applied Physics	Biomolecular Engineering	Chemicals & Polymers	Manufacturing Technology	Materials Science & Technology	TOTAL
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
PLANT PRODUCTION AND PRIMARY PRODUCTS					67	67
ANIMAL PRODUCTION AND PRIMARY PRODUCTS		799			67	866
RURAL BASED MANUFACTURING						0
MINERALS INDUSTRY	1315			3651	3271	8237
ENERGY RESOURCES INDUSTRY	877					877
ENERGY SUPPLY INDUSTRY	712				666	1378
MANUFACTURING INDUSTRIES	10436	14196	11994	7449	10295	54370
INFORMATION AND COMMUNICATION INDUSTRIES	740			1898	880	3518
TRANSPORT INDUSTRY						0
CONSTRUCTION INDUSTRY						0
COMMERCIAL SERVICES	10272					10272
ECONOMIC DEVELOPMENT - ENVIRONMENTAL ASPECTS	1616	369	3583	1462	388	7418
ENVIRONMENT						0
HEALTH	1424					1424
DEFENCE						0
SOCIAL DEVELOPMENT						0
TOTAL	27392	15364	15577	14460	15634	88428

Note: Columns may not add to totals due to rounding

Distribution of Total Expenditure by Research Purpose, 1992-93



5.1 DIVISION OF APPLIED PHYSICS

OBJECTIVE

To apply the Division's expertise in physical sciences and related disciplines to the development of the technological base of Australian Industry.

To establish, maintain and disseminate Australia's physical standards of measurement, including those required under the National Measurement Act 1960.

STRATEGY

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

INTER-DIVISIONAL COLLABORATION, 1992-93

During 1992-93 the Division expects about 6% of its research and development activities to involve collaborations with CSIRO Divisions of Chemicals and Polymers, Materials Science and Technology, Food Processing, Animal Health, Plant Industry, Exploration Geoscience, and manufacturing Technology.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO strategic Plan)*
Develop electrotechnology of current or potential value to Australian industry, and provide standards and calibration services for electrical potential and impedance, and for time interval and frequency - *21%*	Demonstration with an industrial collaborator of the potential of SQUID-based magnetometers for mineral prospecting. Completion of trials of carbon-fibre-reinforced carbon prostheses and establishment of a development program with a complimentary research group overseas. Completion of the present stage of collaborative research project to develop high-energy-density ceramic capacitors and, based on commercial potential, extension of the project over a medium term. Development, field trialling and assessment of the commercial potential of prototype sub-surface radar systems, with particular attention to mining applications in collaboration with CSIRO Geomechanics and an industrial partner. Introduction of new measurement systems to upgrade the efficiency of the national standards of impedance and voltage.

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

Development of a field instrument for detecting dissolved gas in oil as a means of identifying pre-breakdown activity in large electrical plant.

Completion of a contract with University Paton Instruments to develop a commercial three-phase precision calibrator.

Investigation of novel electrical induction cooking systems, which are reliable, highly efficient, and have low radiated electrical emissions.

Establishment of a facility to calibrate test equipment for the measurement of electromagnetic emissions.

Development of a microwave chemical processor for processing fine chemicals, with the Division of Chemicals and Polymers.

Restructuring of a consortium with the University of Technology, Sydney, to develop advanced designs of electrical machines and drives. First stage development of a novel electromechanical controller in collaboration with AMICAL, Australian Defence Industries and Brook Crompton Betts.

Develop plasma, thin films and thermometric technologies of current or potential value to Australian industry, and provide standards and calibration services for temperature
- 23%

Completion of collaborative project with Boeing on aspects of atmospheric ozone depletion, including delivery of a state-of-the-art, two-dimensional model of the stratosphere and predictive calculations.

In collaboration with IBM, development of new protective films for magneto-optical media and investigation of the commercial potential of the intellectual property.

Completion of prototype die-coating plant in collaboration with the Royal Australian Mint and Dynamic Engineering Ltd

Completion of research on arc-electrode phenomena in collaboration with BHP, including assessment of prospects for commercial outcomes. Identification of potential industrial partners for plasma-technology-related projects.

Develop acoustical, ultrasonic, and surface-mechanical technologies of current or potential value to Australian industry, and provide standards and calibration services for acceleration, acoustics, dimensional metrology, hardness, mass and related quantities
- 20%

Continuation of a major collaborative research project with Boeing on the non-destructive testing of bonded structures, using acoustical and ultrasonic techniques and involving Australian aerospace component manufacturers ASTA and Hawker de Havilland and the Australian sub-contractor Vibro Acoustic Sciences Ltd.

Establishment of a tripartite research collaboration on non-contact ultrasonic testing techniques with a major Australian company and a large overseas research organisation.

In collaboration with a major Australian company, the performance of pre-production field trials and the commencement of small-scale production for a confidential invention expected to have a significant penetration into a large international market.

Establishment of new marketing arrangements overseas for the UMIS-200 ultra micro-indentation system, and the achievement of sales of at least 12 systems per year.

Develop optical and electro-optical technology of current or potential value to Australian industry and provide relevant standards and calibration services for length, optical quantities, photometry and optical radiometry. *- 18%*	Establishment of collaborations leading to uptake of new optical profiling technologies by companies in the aerospace and automotive sectors. In collaboration with DSTO , production of a Lyot filter for the Laser airborne Depth Sounder (LADS) system. Demonstration of laser cooling of ytterbium (Yb+) in a linear ion trap, commencement of experiments to evaluate the frequency stability of the microwave transition in laser cooled Yb+. Calibration of part of the Electromagnetic Distance Measurement (EDM) baseline suing techniques that provide traceability to the national standard for length.

1992 93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned and appropriation revenues)	$21,822,000
Sponsored Research:	$4,300,000
Total Budget	**$26,122,000**

DIVISIONAL EXTERNAL EARNING TARGET

The Division expects that 23% of its annual budget will be spent from external funds in 1992-93. The expenditure of external funds on projects other than standards is expected to be 28%.

5.2 DIVISION OF BIOMOLECULAR ENGINEERING

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 the Biomolecular Research Institute.

INTER-DIVISIONAL COLLABORATION

During 1992-93 the Division expects about 14% of its resource and development activities to involve collaborations with the Divisions of Chemicals and Polymers, Animal Health, Animal Production, and Plant Industry.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To acquire knowledge of the structure of protein molecules relevant to the development of new pharmaceuticals. - *11%* - *MF-2 (see page 18 for code)*	*This program forms part of the Biomolecular Research Institute, a joint venture between CSIRO and the Strategic Research Foundation (SRF). The percent resources shown do not include the matching funds from the SRF.*
To devise new pharmaceutical agents and diagnostic strategies based on the structural analysis and engineering of proteins and to design and develop valuable products and processes using engineered proteolytic enzymes and peptide-fat conjugates. - *16%*	Negotiated collaborative agreements relating to Discretionary, Generic IR&D Grants and a CRC proposal for diagnostic applications of engineered antibodies with appropriate commercial partners, including AGEN Biomedical Ltd. Evaluation of expression vector technology with local and international partners for the production of therapeutic reagents. Development and commercialisation of novel methods for coupling fats to peptides and nucleic acids.

To develop and exploit an understanding of gene control mechanisms to create novel opportunities in the therapy of human and animal disease. *- 21%*	Production of protease's with novel sequence specificities in collaboration with Peptide Technology Ltd Acquisition of essential knowledge of gene structure gene regulatory mechanisms and pathways of information flow in eukaryotic and bacterial systems.. Development and evaluation of ribosymes ("Gene Shears") and other regulatory RNA's in manipulating gene expression in mammalian model systems. Development of research aimed at the delivery of artificial regulators of gene expression into animal somatic cells. Transfer of technical innovation, as appropriate, to commercial partners in the "Gene Shears" May statement funded projects. Completion of initial commercial assessment of rotavirus vaccine approach. Determination of feasibility of commercial applications from the carnosine project. Establishment of collaborative/contract research with Gene Shears Pty Ltd.
To develop anti-viral compounds based on the structure and function of viral regulatory proteins and molecular mechanisms employed in virus replication cycles. *- 16%*	This program forms part of the Biomolecular Research Institute, a joint venture between CSIRO and the Strategic Research Foundation. The percent resources shown do not include the matching funds from the SRF.
To elucidate the structure and function of cell surface receptors for the development of new pharmaceuticals and health control strategies. *- 16%*	Synthesis and evaluation of photoreactive probes to identify the protein(s) involved in triggering glucose-induced insulin secretion in islet cells. Initiation of the analysis of post-translation modifications of the insulin receptor. Large scale production and purification of the insulin receptor hormone-binding domain for crystallization studies. Initiation of molecular studies into the structure and function of the ligand binding and signaling domains of the insulin receptor.
To develop biomaterials with improved biological performance. *- 10%*	Establishment of trials of new collagen-based products for vascular repair and hernia repair. Cloning of key genes for collagen biosynthesis. Establishment of protocols to examine the effects of cell adhesion factors and serum proteins on the persistence of cells on surfaces after initial binding and spreading. Production of prototype materials with coupled biological molecules for device evaluation for GIRD and CRCERT activities. Transfer of technical innovation to commercial collaborators in three GIRD supported projects and involvement in two Cooperative Research Centres.

To improve the control of important animal and plant diseases. *- 3%*	Completion of the evaluation of the capacity of the self-polymerizing expression system to induce enhanced immune responses using peptide and protein constructs in conjunction with our commercial partner. Completion of the evaluation of biodegradable microspheres as vaccine delivery systems with enhanced immune potential in conjunction with Division of Animal Health and supported by the Australian Wool Corporation.
To develop new strategies for the treatment and diagnosis of cardiovascular disease. *- 7%*	Initiation of research on normal growth controls on cells of the blood vessel wall. Determination of feasibility of drug delivery to blood vessel cells via identification of specific cell surface markers. Conclusion of commercial arrangements for funding by Gene Shears Pty Ltd and the CRC for Cardiac Technology and initiation of relevant research.

1992 93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned and appropriation revenues)	$11,351,000
Sponsored Research:	$3,300,000
Total Budget	**$14,651,000**

DIVISION EXTERNAL EARNINGS TARGET

The Division expects that 22% of its annual budget will be spent from external funds in 1992-93.

5.3 DIVISION OF CHEMICALS AND POLYMERS

OBJECTIVE

To develop new technologies to support the growth in Australia of the chemical, polymer., water and wastewater treatment industries which are competitive in domestic and international markets.

STRATEGY

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

INTER-DIVISIONAL COLLABORATION

During 1992-93 the Division expects about 31% of its research and development activities to involve collaborations with CSIRO Division of Applied Physics, Animal Health, Biomolecular Engineering, Manufacturing Technology, Forest Products, Materials Science & Technology, and Wool Technology.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Generate novel biologically active chemicals for evaluation in crop protection. Investigate pre-industrial scale production of fine chemicals to determine optimum conditions for maximising outputs. - *28%* - *MF-1 (see page 18 for code)*	*Scheduled synthesis of over one thousand new compounds for evaluation as environmentally safe insecticides, herbicides and fungicides and selection of several compounds for field trial* *Staged development of process chemistry to synthesize selected compounds for field trial.* New routes to the synthesis of fine chemicals based on the interaction of microwaves with chemicals.
Develop separation membranes for chemical production, catalysis and gas separation processes. Develop physicochemical surface modification techniques. Develop novel surface active chemicals to produce thin films and to give specific end-use effects. Develop novel security devices based on concepts involving photochemical and photophysical principles. - *17%*	Development of integrated membrane reactors to improve processes for chemical synthesis. Development of surface modification techniques in biomedical and chemical application. Completion of surface cleaner development. Development of surfactant aggregates to prepare ordered surfactant or polymer layers for use as particle coatings or in optical-electronic devices. Further development of facility for currency notes.

	Development of new, impact-modified plastics and blends for polymer matrices in composites.
Develop new polymer matrices in carbon fibre composite materials for aircraft. Develop biomaterials for medical implants through polymer synthesis or surface modification. Synthesis of polymers for specific applications using new techniques. - *21%.*	Development of new, impact-modified plastics and blends for polymer matrices in composites. Production of more stable biocompatible polyurethane by polymer synthesis and surface treatment, with the establishment of tests for haemocompatibility/stability. Development of engineered resins to meet specific market needs. Development of Polymer blends based on polystyrene and polyolefins, monomers which polymerise without volume shrinkage.
Develop processes based on the use of magnetic coagulants and adsorbents to treat water, sewage and industrial effluents, plus product recovery from waste streams and sludge treatment. Develop microbial processes to remove nutrients from sewage for inland disposal, and anaerobic fermentation of high strength organic industrial wastes. - *24%* - *EDEA-3*	*Building of full scale plant to evaluate process for treating "sewage concentrate" using magnetite and a study of sludge treatment options.* *Ultra high rate SIROFLOC pilot plant for water supply.* *Adaptation of ion exchange processes to recover heavy metals from industrial wastewaters.* Pilot scale development of processes to treat wool scour and food industry effluents. CSIRO representation on the national association for managing water resources and wastewater disposal.
Generate novel antiviral and pharmacologically active chemicals for ultimate use as clinical drugs. - *10%*	Synthesis of new chemicals based on dideoxy nucleosides, inorganic complexes and organic polyanions for tests with HIV, Hepatitis and related viruses. Development of novel acetylcholine synthesis enhancers for treating Alzheimer's disease. Closer links with biological research centres, especially the Biomolecular Research Institute.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned and appropriation revenues)	$10,854,000
Sponsored Research:	$4,000,000
Total Budget	**$14,854,000**

DIVISION EXTERNAL EARNINGS TARGET

The Division expects that 32% of its total annual budget will be spent from external funds based on estimates as at 30 June 1992, similar to 1991-92.

5.4 DIVISION OF MANUFACTURING TECHNOLOGY

OBJECTIVE

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

STRATEGY

- Conduct research and development in advanced manufacturing technologies by the application of skills in electronic, materials and mechanical engineering and computer science in accordance with CSIRO, Institute of Division priorities.
- Collaborate with the other CSIRO Divisions to ensure complementary resources and skills are exploited in cost effective and efficient research.
- Collaborate with universities and industry across a range of basic, applied and commercial activities by active participation in Co-operative Research Centres.
- Increase the transfer of technologies from the Division's research to industry by establishing business plans for the Division as a whole and for key research programs, setting up specific commercialisation strategies and improving interaction with client companies by moving the technology epicentre toward larger companies.
- Maintain effective links with manufacturing industry by participation in specialist industry centres, such as the Automotive R&D Centre and the Australian Welding Research Centre.

INTER-DIVISIONAL COLLABORATION

During 1992-93 the Division expects to involve 25% of its research and development activities to involve collaborations with CSIRO Divisions of Chemicals and Polymers, Materials Science and Technology, Applied Physics, Mathematics and Statistics, Geomechanics, Radiophysics and Building Construction and Engineering. Nearly 5% of the involvement will be in the area of Plasma Based Waste Destruction.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop an acceptable method treating intractable organic liquid wastes using the technology of electrically generated plasma. - *10%* - *EDEA-5 (see page 18 for code)*	*Determine design and operating parameters for Plascon pilot plant at the commercial partner's site for on-site destruction of chlorinated organics. Determine process parameters for other liquid waste, especially halons.* *Business plan for commercialisation of technology in domestic and international markets.*
Develop new technologies in the areas of assembly automation and laser processing. - *11%*	Completion of the essential modules of the software for Planning for Assembly in collaboration with the Preston Group. Development of a prototype software for surface operations Development of new processes for laser welding of thin steel.

Develop generic elements of an integrated decision support system for production management. - *9%* - *MF-5*	Complete cellular manufacturing software for Boeing and design cellular facility. *Complete scheduling software to meet market specification and draw business plan for commercialisaton.*
Develop sensing (machine vision) and integrated automation modules and systems. - *17%*	Complete laboratory prototype vision system for sewer inspection. Complete vision systems for vehicle inspections and identification with appropriate State Road Authorities.
Develop high pressure and low pressure diecasting processes for non-ferrous metals and alloys. - *25%* - *MI-2* - *MF-3*	Commercialisation and international marketing of diecasting software packages, CASTFLOW and CASTHERM. Commence low pressure die casting process studies. *Technology transfer through Amtec Project and Automotive Research Centre.* *Installation of squeeze casting machine in the Brisbane Laboratory* *Complete 3D solidification software with Boeing and commence studies on micro-structure production* Commence studies on the iron boron alloy system
Develop high-productivity welding processes and consumables, and measurement and control of fume - *14%*	Complete development of cored wire-pulse welding combination for joining of Australian submarine steel. Industrial prototype of narrow gap welding process. Complete procedure development for buried arc GTA welding.
Develop new processes to enhance the properties of engineering surfaces. - *14%*	Determination of new process control parameters for Electronic Plasma Spray Systems for plasma spraying of abradable seals of aerospace components. Complete industrial prototype Electronic Plasma Spray system. Establish feasibility of one-step tube making process. Complete preliminary work identifying critical parameters related to the control of automated plasma cutting process.

1992 93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned and appropriation revenues)	$9,790,000
Sponsored Research:	$4,000,000
Total Budget	**$13,790,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 33% of its total annual budget will be spent from external funds in 1992-93.

5.5 DIVISION OF MATERIALS SCIENCE AND TECHNOLOGY

OBJECTIVE

To assist the growth of internationally competitive Australian manufacturing industry through the development and exploitation of advance, high-value materials and associated technology.

STRATEGY

- To meet the objective the Division will continue to interact with Australian industry in the design and development of:

  - new alloys, ceramics and composite materials,
  - new methods of processing and analysing materials, and
  - new ways of adding value to Australian resources,

  while maintaining an appropriate balance between strategic research, instrumental development and industrial collaboration.

INTER-DIVISIONAL COLLABORATION

During 1992-93 the Division expects about 5% of its research and development activities to involve collaborations with CSIRO Divisions of Horticulture, Food Processing, Applied Physics, Chemicals & Polymers, Manufacturing Technology, Mineral Products and Mineral Processing and Engineering.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To apply fundamental skills in materials and allow structure to the development of improved materials and methods of production for Australian industry; to develop quantitative analytical techniques for the generation of new commercial opportunities for Australian industry. - *17%*	Iron Aluminide alloys evaluated; agreements reached with commercial collaborators for support of titanium aluminide development. Basic instrument for the Australian National Beam-Line Facility at the Photon Factory, Japan constructed and tested. Metal organic chemical vapour deposition evaluated for the production of military specification mercury cadmium telluride epilayers. Quantitative dynamical electron diffraction analysis developed to determine strain, interfacial rigid shifts and superlattice perfection in multilayer crystals. Diamond composite materials field tested by industrial collaborators.

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. - *19%*	Agreement reached with commercial partner on further studies on the fabrication of non-oxide components. Field tests of advanced refractory completed by Vesuvius. Completion of Business Plan for the Refractories Service Centre. Electrostatic precipitator alumina dust evaluated for the production of wear parts.
To develop solid oxide fuel cells for electricity generation. - *10%* - *ERS-5 (see page 18 for code)*	*Efficient sample evaluation and reporting system for micro structural and mechanical testing procedures developed.* *Two 3-watt single cells constructed.*
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. - *25%*	Nuclear Magnetic Resonance studies of hydrocarbon diffusion in porous media under agreement with BHP completed. Sewer sensor prototypes field tested to pre production standards. Feasibility study for laser spectroscopy isotope analysis technique completed. Vacuum system and laser sources for laser cooling of atoms constructed. Prototype imaging spectrometer constructed and tested.
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. - *26%*	Commercial agreement for the development of an ilmenite to TiO_2 pilot-scale process established. Contract for research into selective oxidation catalysis renewed. Carbon fibre properties characterised and optimised. Final report to commercial partner delivered.
Collaborate with the Divisions of Horticulture and Food Processing to produce a suite of techniques to optimise the packaging atmosphere over fresh horticultural produce and to develop environmentally benign packaging. - *3%* - *RM-2*	*Laboratory tests on SO_2 delivery film completed.* *Prototypes of high strength, biodegradable packaging developed.* *Combined function (controlled permeability/condensation control) films developed.* *Commercial version of fail-safe device developed.* Ethylene-scrubbing sachets, controller permeability film and condensation control film in commercial use. Trials of packaging systems for selected crops completed.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned and appropriation revenues)	$11,511,000
Sponsored Research:	$3,400,000
Total Budget	**$14,911,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 27% of its total annual budget will be spent from external funds in 1992-93, based on estimates as at April 1992, down from 32% in 1991-92. The Division has a target of 30% for external funding which it plans to reach by 1993-94.

6. INSTITUTE OF MINERALS ENERGY AND CONSTRUCTION

OBJECTIVE

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

STRATEGY

IMEC research serves industries whose profitability largely relies on world markets and prevailing economic conditions. As a result, factors external to IMEC impact on the Institute's operating environment and funding support base.

Currently, the minerals, energy and construction industries together represent approximately 20% of the national GDP, over 40% of total exports and approximately 60% of total fixed private capital investment. On the world and domestic scenes the industries are expected to face improving economic conditions despite trade protection policies by major trading partners, emerging new trading nations and the environmental factors facing these industries.

IMEC's strategies are to:

- *Ensure that research is directed to the major technical needs of both present and emerging industries.*
- *Play a major contributrary role in the identification and development of new opportunities or industries.*
- *Ensure the Institute has the resources, facilities and reputation nationally and internationally to attract and retain top scientists and bright young graduates.*
- *Underpin future technological innovation by ensuring that sufficient strategic research is undertaken against strategic objectives and with multi-benefit outcomes.*
- *Achieve a research mix such that each Division arrives at a minimum of 34% external earnings and have approximately 30% of research effort directed at strategic research.*
- *Maintain an adequate funding base for existing and emerging priority research areas.*
- *Strengthen synergies between the research efforts of Divisions within IMEC and between IMEC and other research bodies or groups both within and outside CSIRO.*
- *Achieve best management practices and a high level of management capability.*
- *Ensure recognition and support for the Institute from all stakeholder groups, organisational, public, political and industrial.*
- *Ensure that all staff within IMEC understand the Institute's vision, objectives and strategies and their own role helping to achieve them.*
- *Ensure location and physical infrastructure of research sites fully supports and facilitates IMEC research and technological application efforts.*
- *Develop the capacity to anticipate and respond to crucial changes in the political and economic environment which are likely to have a major impact on the Institute.*
- *Develop the capacity to influence and assist in the development of government and CSIRO policy in key areas.*

PLANNED OUTCOMES

- Development and enhancement of strategic alliances with, among others, BHP, BHP Australia Coal Ltd, WMC, GEC-Alstrom, CRA, MIM, Australia's Alumina Producers and the Construction Industry Development Agency.

- Completion of a comprehensive data base of client company structures and activities and use this as a marketing and strategic planning tool.

- Identification of other areas of CSIRO that can contribute to IMEC client industries and provide a lead role in capturing and directing that capability.

- Construction of a funding base which allows at least 30% of the total research portfolio to be strategic research.

- Development of funding priorities with respect to research areas on a five year basis to assist with Divisional planning and budgeting processes.

- Implementation of a refined strategic planning process through the Institute's research programs.

- Establishment of CRC's in exploration technologies (CRC for Australian Mineral Exploration Technologies) and hydrometallurgy (AJ Parker Cooperative Research Centre for Hydrometallurgy).

- Development of CRC's for the third round funding.

- Continuation of our contribution to policy formulation via participation in key government task forces and working groups and ongoing information exchange with key government departments.

- Continuation of Institute redevelopment planning and activities for the establishment of new accommodation at North Ryde, QCAT-Pinjarra Hills, WA Remote Sensing Centre - Floreat Park, Minerals Research Laboratory - Bentley, and extensions to the Clayton and Highett sites.

- Development of uniform costing, charging, and delivery processes for research conducted by IMEC.

- Continuation of monitoring of industry needs in research and technology, and where attractive and feasible establishment of research programs.

- Development of increased interaction with WA industry groups.

- Establishment of a strong relationship with the Australian Coal Association and where possible alignment of IMEC priorities with those of this and other agencies.

INSTITUTE OF MINERALS ENERGY AND CONSTRUCTION

SUMMARY OF RESOURCES 1992-93

(estimates as at 11 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Coal and Energy Technology	98.7	198.5	12832.2	6430.0	19262.2
Mineral and Process Engineering	114.7	191.0	10167.9	6894.0	17061.9
Mineral Products	84.0	152.2	8346.6	3900.0	12246.6
Geomechanics	63.5	112.4	7832.2	5398.0	13230.2
Building, Construction and Engineering	136.3	297.0	18546.4	6784.0	25330.4
Exploration Geoscience	85.3	133.9	9250.8	4738.0	13988.8
Institute Headquarters (including Institute Managed Funds)	4.0	10.7	1347.4		1347.4
Unallocated[b]					6092.8
TOTAL	**587**	**1096**	**74416.3**	**34144.0**	**108560.3**

Note: Columns may not add to totals due to rounding.

[a]Appropriation includes earned appropriation revenue plus ILS (Internal Lease Scheme) allocation and May Statement Funds.

[b]Includes Institute Managed Funds (SIROTECH fees, Furlough-in-Lieu etc.) ILS for North Ryde Redevelopment ($2M).

INSTITUTE OF MINERALS, ENERGY AND CONSTRUCTION

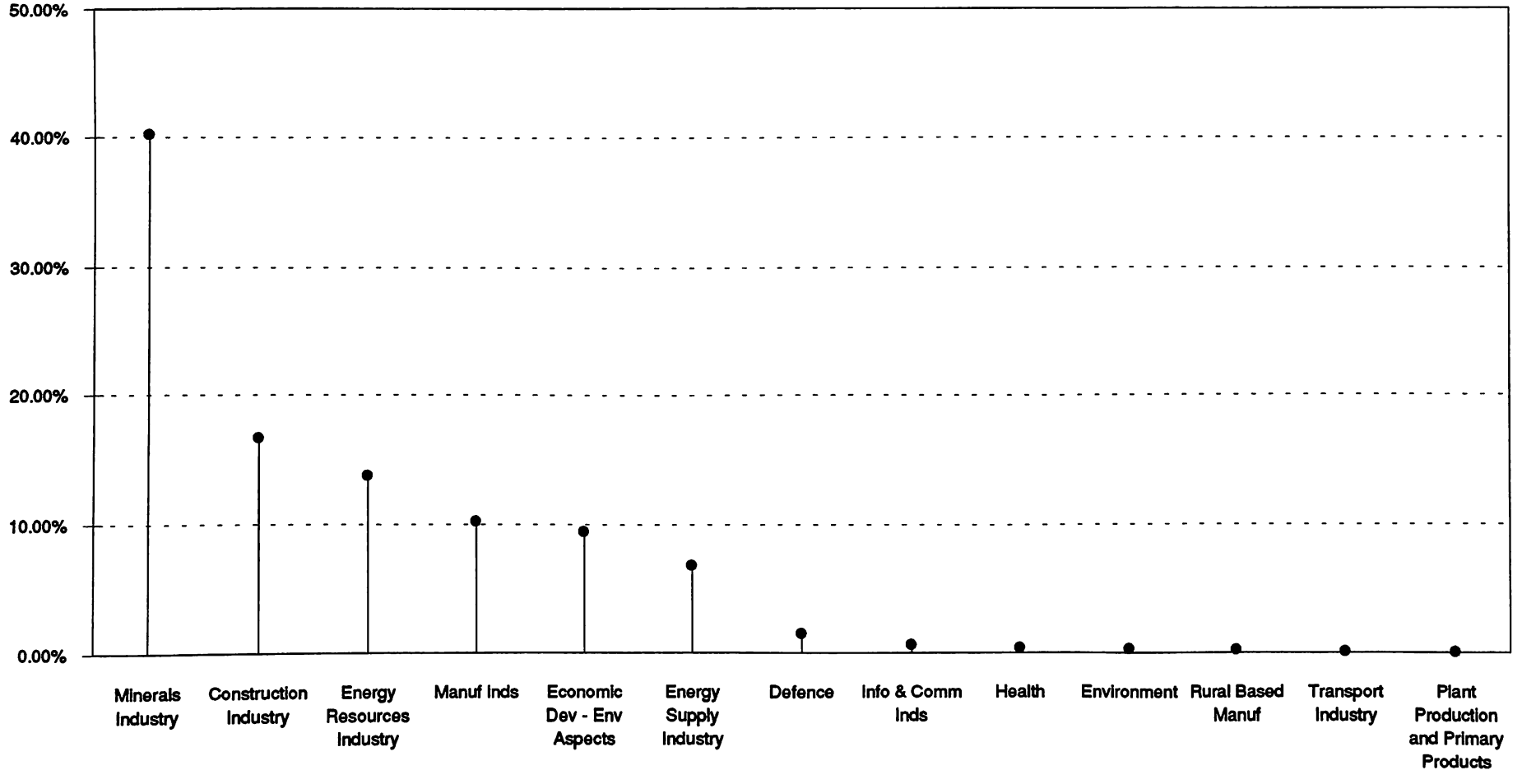
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE 1992/93

(estimates as at 11 May 1992)

RESEARCH PURPOSE	CET	MPE	MP	GEO	BCE	BG	INST. HQ	UNALLOC.[a]	TOTAL
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
RURAL-BASED MANUFACTURING					20.7.7		2.7		210.4
MINERALS INDUSTRY	1,032.3	7,966.8	10,505.5	7,619.2	2,134.0	11,397.4	541.8		41,197.0
ENERGY RESOURCES INDUSTRY	8,545.2	273.4		4,342.0	743.8		185.4		6,945.7
MANUFACTURING INDUSTRIES	1,249.7	6,851.2		830.8	1,231.0	149.3	137.4		10,449.4
TRANSPORT INDUSTRY					89.2		1.2		90.4
INFORMATION & COMMUNICATION					494.3	125.4	8.2		627.7
ECONOMIC DEVELOPMENT-ENVIRONMENTAL ASPECT	4,326.5	965.7		438.2	2,128.6	1,654.0	126.7		9,639.7
ENVIRONMENT						271.3	3.6		9429.4
HEALTH						368.2	4.9		373.1
DEFENCE					1,503.1		20.0		1,523.1
AGRICULTURE FORESTRY AND FISHING						23.2	0.3		23.5
UNALLOCATED[a]								6,092.8	6,092.8
TOTAL	**19,262.2**	**17,061.9**	**12,246.6**	**13,230.2**	**25,330.4**	**13,988.8**	**1,374.4**	**6,092.8**	**108,560.3**

[a] Includes Institute Managed Funds such as Sirotech, ISU, Furlough-in-Lieu. Also includes ILS for North Ryde Redevelopment of $2M.

Distribution of Total Expenditure by Research Purpose, 1992-93



6.1 DIVISION OF BUILDING, CONSTRUCTION AND ENGINEERING

OBJECTIVE

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

STRATEGY

- Develop strong collaborative research ties with the major universities, industry associations, government agencies and private companies serving our industries.
- Establish efficient communication and technology transfer links with the many small companies and individuals that service the industries at a professional and sub-professional level.
- Collaborate with other CSIRO Divisions and external (including international) research agencies to ensure the maximum possible impact from the Division's research investment.

INTER-DIVISIONAL COLLABORATION

None of the Division's programs have lead to Multi-Divisional Programs.

DBCE MDP involvement is in:

- Waste Management with the Division of Chemicals and Polymers and the Division of Watr Resources
- Minesite Rehabilitation with the Division of Soils
- Alumina Hot Gas Cyclone with the Division of Mineral and Process Engineering
- Pipeline Inspection Realtime Analysis Technique with the Division of Manufacturing Technology
- DBCE is taking the lead in the proposed CRC on Urban Studies for Productive Cities which if successful will also involve the Division of Information Technology.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Improve the life cycle performance of materials and components for constructed facilities. - *21%*	Commission a clean air facility and develop procedures to measure volatile organic compounds from building contents at ppb levels in indoor air. Optimisation of a novel surface engineering technique for enhancing adhesion to polymeric materials of low surface energy. Identification of the critical chemical reactions for the hydration of ash-portland cement binders utilising LaTrobe Valley brown coal ash. Determination of the chemical changes in pore solution of concrete responsible for the inhibition of alkali aggregate reactions. Identification of the critical properties of fresh and hardened concrete incorporating high volumes of black coal ash. Development of applications for fire resistant foamed gypsum products with commercial partners.

Improve the commissioning, operation and refurbishment of engineered products, components and services.
- *27%*

Completion of the development and demonstrate the performance of a cooling tank as part of the transfer of Salt Pipe technology with ADI and complete project on further panel development.

Demonstration of the effectiveness of a laboratory prototype of a personal cooling system. Identification of a suitable industrial partner and establish a collaborative R & D project to develop a commercial prototype of the cooling system.

Production of a video showing the three dimensional flows in a slurry pump and construction of a three-dimensional numerical model of the viscous flow in a centrifugal pump impeller. Patent a device to reduce aerodynamic noise in high speed lifts.

Proceed with NATA registration of the hydraulics laboratory and development of a capability for numerical flow modelling of plumbing products.

Extension of the capacity of the Particle Image Velocimetry system to measure gas/solid flows and promote it for use by overseas researchers and development of a strategy for AMIRA sponsored project on a special probe for the simultaneous measurement of gas and particle flows in mineral processing.

Completion of field trials with natural wool insulation and develop a suitable model for incorporation into the building thermal modelling code CHEETAH.

Completion of the low NOx burner analysis for the NSW Dept of Minerals and Energy and submission of the final report. Establishment of the four wave mixing technique and application it to laser diagnostics of low Nox burners.

Improve the lifetime performance of structures in terms of the competing demands of safety, function and cost.
- *15%*
- *IS-1, 2 (see page 18 for code)*

Development of a strategy to research the interaction of wind, rain and hail with buildings using computational fluid mechanics, wind tunnel studies, and field measurements.

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

Completion of the construction of a vibrating table and commencement of experimental development of sloshing dampers for reducing structural vibration.

Development of statistical models of timber structural properties to provide a basis for international harmonisation of timber standards and completion of a collaborative study with industry on in-grade structural properties of radiata pine.

Development of structural standards for metal framed domestic construction, and assist industry in marketing associated building products overseas.

Maintenance of involvement in development of Australian structural standards, and their harmonisation with relevant New Zealand standards as part of CER policy.

Continuation of efforts to establish a CRC on Urban Studies for Productive Cities

Continuation of the Better Cities research effort based on the strong relationships with the Federal and State Governments

Improve planning and management procedures in the building and construction industry.
- 20%

Development of the first stage of an enhanced dynamic land-use transport planning model based on TOPAZ in collaboration with industry partners.

Production of a network version of BCAider, integrating with a CAD system and linking to building product databases.

Commercialisation of ALIGN-3D route optimisation package for road and rail design.

Extension of AI software for sewer inspection system for first stage of commercial prototype.

Development of a prototype database system for the Building Code of Australia as part of regulation reform.

Completion of a study for DHHCS of cost of land development options.

Analysis of business migration, extension of coverage of mobile telecommunications system and assistance of planning of wide band networks for Telecom.

Reduce the risks and costs of life and property losses through fire.
- 17%

Comparison of fire and smoke movement model to simulated experiments in major construction projects in Australia

Completion of nonlinear finite element analysis of masonry structures subjected to fire.

Development of a research program on room fire initiation and growth for inclusion in CRC on Fire Risk Management

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

Achievement of NATA registration for fire testing laboratory.

Completion of a first draft of Standards Australia-CSIRO handbook on bushfire resistant design of housing.

1992-93 RESOURCES SUMMARY

Appropriation Total Allocation (includes earned appropriation revenue)	$18,546,400
Sponsored Research	$6,784,000
Total Budget	**$25,330,400**

DIVISION EXTERNAL EARNINGS TARGET

The Division thus expects that 27.8% of its total budget will be spent from external earnings. This is down from 1991/92 because of a reduction in balance brought forward available for expenditure.

6.2 DIVISION OF COAL AND ENERGY TECHNOLOGY

OBJECTIVE

Through research, development and technology transfer, to work with industry to maximise the efficiency, competitive advantage and environmental acceptability of Australia's coal, energy and related industries.

STRATEGY

- Increase efficiency and economics of the preparation and supply of Australian coals.
- Make more efficient use of Australian coals in electricity production and metallurgical processing.
- Seek technological advantages for Australian industries using coal-related products and processes.
- Increase exploitation of Australian liquid and gaseous fuel resources through production and use of alternative fuels.
- Preserve and enhance the quality of the human and natural environment.
- Develop a balanced portfolio of research projects which attract industry support and also incorporate strategic research.
- Allocate Divisional research resources in support of priority areas: coal preparation, advanced technologies for power generation, gas conversion and new environmental technologies.
- Increase emphasis on marketing of research capabilities and seek further external funding.
- Rationalise Divisional resources to address decrease in Appropriation funding.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Increase the quantity and quality of coal recovered in preparation plants and generate new and improved technologies and products. - *13%* - *ERS-4 (see page 18 for code)*	*Completion of move of wet beneficiating group to Pinjarra Hills, Queensland including re-siting of multi-process, modular preparation plant.* Completion of NERDDC projects on wet and dry beneficiation processes. *Re-establishment and operation of ultraclean coal pilot plant at Maitland site, as part of expansion of AUSCOAL Joint Venture.* Re-direction of effort in coal self-heading studies from coal stockpiles to underground goafs.
Develop and introduce more effective test methods for quality in Australian coals and increase knowledge of coal properties. - *15%*	Completion of NERDDC funding study of the chemistry of hydrogen functionality in coals. Successful industry application of recently developed method of thermomechanical analysis of coals.

Further commercialisation of PMRTA through manufacture and sale of systems in Australia and overseas.

Successful industry application of recently developed method for thermo mechanical analysis of coal..

Successful industry application of methods for determining water-holding capacity of coals.

Installation of NMR facility for microimaging and fluid flow measurement in coals and other porous media.

Refine and develop coal-related products and technologies.
- *10%*

Demonstration to a funding company of the role played by QI particles in binder pitches.

Acquisition of direct aluminium industry funding to proceed technology development for an anode coke replacement from coal.

Development and installation of technical scale facility for research into coke production

Development of technology for the production and refining of 'gram' quantities of fullerine carbons.

Increase the efficiency and economy in power generation, tan metallurgy and related processes, and reduce the output of pollutes, particularly CO_2.
- *12%*
- *ERS-4*

Strengthening of projects targeted at increasing the efficiencies of combustion and gasification processes.

Expansion of efforts in studies related to high temperature gasification processes for advanced power cycles.

Completion of project to eliminate boiler fouling and corrosion by high sodium ashes during combustion of brown coal.

Communication to industry of results supporting use of cleaned coals in power generation.

Increase support of metallurgical industry for research on coal and coke.

Develop improved processes and equipment for the production and utilisation of liquid and gaseous fuels, and petrochemical feedstocks and products, from natural gas, oil shale and coal.
- *26%*

Evaluation of a study to produce synthesis gas as a first stage to converting natural gas to a liquid product

Determination of the technical and economic feasibility of using supercritical extraction techniques to clean soils contaminated with hydrocarbons.

Use of automated multi-sample equipment, developed this year, for measuring methane/coal isotherms for evaluating coals from the MIM/CSIRO Bowen Basin, Coal-bed Methane Project.

Measurement of yield in novel process for hydrogen production and development of model for incorporation into shale oil production processes.

Assess and control the impact of pollutants on fresh and marine water systems.
- *10%*

Management of the toxicants program (part of Port Phillip Bay Environmental Study) including supervision of research contracts.

Commencement of dialysis sampling of pore water to establish the fate of pollutants in sediments and to gain an understanding of how pollutants are moved by plants and animals (part of Coastal Zone Program).

Application of algal bioassays to assess the toxicity of treated pulp-mill effluents (part of National Pulp Mill Research Program).

Assessment of the efficacy of wetlands to remove contaminants from mine drainage (part of Mine Rehabilitation program).

Development of laboratory-scale equipment for removal of metal and metal organic complexes from industrial waste-waters.

Develop methodologies for more effective management of air pollution.
- *14%*

Incorporation of novel photochemical smog, chemistry into existing windfield models in collaboration with the Division of Atmospheric Research.

Measurement and prediction of SO_2 concentration and deposition from power station and smelter plumes.

Assessment of the efficiency of removal of flyash, SO_x and NO_x from both conventional and advanced power cycles using pulsed energisation.

Evaluation of Australian thermal coals with respect to trace elements partitioning during preparation and combustion.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenue)	$12,832,200
Sponsored Research	$6,784,000
Total Budget	**$19,262,200**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 35% of its total budget will be spent from external funds in 1992-93, based on estimates at 1.2.92 This level will be maintained for the next three years.

6.3 DIVISION OF EXPLORATION GEOSCIENCE

OBJECTIVE

To provide exploration companies with new or improved means to explore which enhance the competitive position of Australia's exploration industry.

STRATEGY

- Develop inter disciplinary teams from a strong discipline oriented research base with a focussed approach on industry problems to support the development of new and improved concepts and techniques for exploration.

- Conduct inter disciplinary research aimed at understanding the physical and chemical processes responsible for the concentration of ores and hydrocarbon accumulation; and of weathering, element dispersion and secondary enrichment.

- Develop geophysical, geochemical and remote sensing techniques to improve effectiveness in the location of ore deposits and hydrocarbons, for example the development of non-invasive, environmentally benign, efficient and cost- effective techniques for application in Australia's complex weathered environment.

- Transfer the exploration technology and the research products to the mineral, oil and gas exploration industries, thereby assisting it to improve Australia's resource base.

INTER-DIVISIONAL COLLABORATION

The Division is responsible for management of the GIRD project on development of an airborne EM instrument for salinity mapping which is conducted in collaboration with the Division of Water REsources. Other inter-divisional collaborative activities include:

Tropical Remote Sensing Unit (Townsville) and Remote Sensing project in Perth with Division of Soils, Imaging Spectrometer project through COSSA; 3D visualisation with the Divisions of Information Technology and Geomechanics; vegetation monitoring via remote sensing with the Division of Water Resources; coalbed methane and tight reservoir studies with the Division of Geomechanics as part of the Australian Petroleum Cooperative Research Centre; iron ore work with the Division of Mineral and Process Engineering; and stable/radiogenic isotope work in the Mine Site Rehabilitation Program.

SPECIFIC OBJECTIVES
- *Percent of Total Resources*
- *CSIRO Strategic Plan*

Develop new and improved exploration methods based on detailed studies of ore deposits and their environments and on the physical and chemical processes that control ore formation.
- *30% (see page 18 for code)*

PLANNED OUTCOMES
(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)

Establishment of the characteristics of nickel deposits in komatiite terrains, based on an understanding of the stratigraphic evolution of ultramafic sequences and the genesis of associated magmatic nickel ore deposits within Greenstone belts of the Yilgarn Block.

Establishment of the physical and chemical vectors which identify ore bodies associated with hydrothermal processes.

Improvement of the industry's knowledge of the iron ore types known broadly as "detrital" and their genesis. Provision of an industrial classification of the channel iron ore deposits.

Characterisation of major and trace element geochemistry and isotope geochemistry of the Mt Read volcanics as a basis for mineral exploration in the Mt Read region of Tasmania.

Development of a collaborative research plan to transfer the detailed knowledge of the mineralogy and geochemistry of a modern ore-forming environment for application to exploration for VMS deposits in ancient terrains preserved in continental Australia.

Establish new or improved methods for mineral exploration suited to a range of important Australian weathered environments by integrating regolith studies with exploration geochemistry and geophysics.
- 16%

Development of strategies for mapping and classification of regolith landform units with which primary and secondary gold deposits are associated. This includes the development of a classification scheme for regolith materials and the preparation of an Australian atlas of rock weathering.

Establishment of patterns of secondary dispersion of gold associated elements and investigation of processes for the dissolution, transport and precipitation of gold during weathering.

Introduction of a range of geophysical methods, including palaeomagnetic dating techniques, to investigate geological relationships in weathered terrains and to delineate subsurface regolith stratigraphy.

Demonstration and transfer to industry of techniques for classifying and mapping regolith materials to aid selection of geochemical sampling media.

Demonstration and transfer to industry of the value of knowledge of the processes of weathering, geochemical dispersion and regolith formation in interpretation and assessment of geochemical exploration data.

Continuation of research into the application of multi-isotope analyses of groundwater as a key to the location of buried mineralisation.

Develop geochemical, mineralogical, geophysical and remote sensing techniques and instrumentation to aid mineral exploration with emphasis on location of concealed deposits.
- 34%

Examination of potential of sulfur isotope measurements of surficial material in order to indicate the presence of buried deposits.

Establishment of a database of lead isotope "fingerprints" of gold and base metal mineralisation in the Lachlan Fold Belt and New England Orogon for use in exploration.

Characterisation of trace element patterns in indicator and resistate minerals for application to diamond exploration and for the location of sulfide orebodies. The techniques will be extended to the analysis of soil gas as a new exploration tool in Australia.

Construction and testing of an airborne electromagnetic system capable of measuring extremely short time transient signals for mapping sub-surface conductivity variations.

Development of a new generation of noise reduction methods for TEM systems.

Development of advanced multi-dimensional transient electromagnetic modelling software, in collaboration with the mining industry.

Improved understanding of the relationship between observed petrological variation and rock magnetic properties for use in the interpretation of magnetic surveys. Field testing of an advanced vector magnetometer system to enable the in situ measurement of remanent magnetism and magnetic susceptibility.

Development of a new generation of magnetics modelling software allowing for non-inductive magnetic responses and complex interactions between magnetic bodies.

Commencement of work to define the nature of regolith conductivity structures.

Improvement of interpretation of airborne gamma ray data by detailed comparison of aircraft, field-based and laboratory-based gamma ray spectra.

Improved techniques for using remotely-sensed data for geological mapping, structure mapping and mineral mapping, including: evaluation of airborne spectroradiometers in mineral mapping; definition of the extent to which subtle variations in mineralogy can be determined by field spectrometers (as an indication of proximity to mineralisation); and the continued development and flight-testing of an airborne CO_2 laser system capable of making multi-spectral reflectance measurements of the earth in the 10 μm emissivity window.

Continued development of image processing techniques for multi-spectral ultra-high resolution remotely sensed data to enable detection of minerals in the presence of up to 50% vegetation cover and their application to operational remote sensing techniques for gold exploration in North Queensland and Western Australia.

Collaboration with the WA State Government in developing applications of NOAA-AVHRR data for routine monitoring and management of vegetation at continental scale.

Demonstration and transfer to industry of hydrogeochemical methods for the location of mineral sedimentary environments in areas of extensive cover.

Demonstration of the practical use of drill core orientation using palaeomagnetism.

Demonstration of the use of ferruginous and calcareous regolith materials in exploration for gold.

Develop for application new techniques to evaluate thermal, chemical, temporal, petrophysical and source rock petrological aspects of the generation, migration and accumulation of petroleum in Australian basins. *- 16%*

Establishment of relationships between organic matter types, source rock geochemistry, and palaeodepositional sedimentary environments. Development of hydrologic models for the identification of oil source rocks and the processes that control petroleum generation and migration in a range of sedimentary basins.

Development of novel techniques based on the application of isotope geochemistry to fluid history analysis for a detailed understanding of oil and gas genesis and prospectivity potential in on-shore and off-shore sedimentary environments

Extension of expertise in organic petrography of coal types as a basis for developing a new method for measuring coal permeability in relation to methane drainage.

Development of alternative methods for the measurement of vitrinite reflectance, fluorescence and other maturity parameters based on Raman spectra. Investigation of the origin of fluorescence in coal macerals using TEM and organic geochemical methods.

Assessment of the fluorescence method for determining thermal maturity of kerogens in North West Shelf sedimentary rocks (for the Australian Petroleum Industries Research Association).

Workshops for industrial collaborators to demonstrate the use of isotopic and fluid inclusion studies to establish timing of generation and migration of hydrocarbons (fluid history analysis).

Apply Techniques developed for minerals and oil exploration to a range of environmental problems. *- 4%*

Completion of first stage of study of biokinetics of lead in human pregnancy.

Initiation of a multi-disciplinary, multi-divisional project to study the uptake, storage, release and excretion of lead in man using ^{206}Pb

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenue)	$9,250,800
Sponsored Research	$4,378,000
Total Budget	**$13,988,800**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 38% of its total annual budget will be spent from external funds in 1992-93 based on estimates at 24 April 1992.

6.4 DIVISION OF GEOMECHANICS

OBJECTIVE

To increase the efficiency, productivity, safety and international competitiveness of the Australian mining and hydrocarbon extraction industries.

STRATEGY

- Establish closer working relations with the extractive minerals and energy industries to ensure that the Division's research priorities are aligned with the industries needs.
- Undertake research aimed at the strategic issues facing the mineral and energy industries through well planned and targeted research programs with measurable outcomes.
- Increase the transfer of technology to industry through the development of commercialisation strategies and through the maintenance of strong links with industry.
- Undertake research in the Oil and Gas Engineering Program through the Australian Petroleum Cooperative Research Centre.
- *Increase the interaction between CSIRO Divisions undertaking research into minerals extraction and processing by the operation of the Queensland Centre for Advanced Technologies (QCAT) and the Cooperative Research Centre for Mining Technology and Equipment.*
  - Strategic Plan Progress: MI.2

INTER-DIVISIONAL COLLABORATION

Collaboration with the CSIRO Mine Site Rehabilitation Research Group. This will represent approximately 3% of the Division's total research activities.

Collaboration with the Division of Exploration Geoscience through the establishment of the Cooperative Research Centre for Australia's Petroleum Industry, will represent approximately 20% of the total research.

The Cooperative Research Centre for Mining Technology and Equipment involves collaboration with the Division of Mineral Processing and Engineering and the Division of Manufacturing Technology. This will represent approximately 12% of the total research activities of the Division.

Collaboration with the Division of Coal and Energy Technology and the Division of Information Technology represents 5% of Divisional research activities.

SPECIFIC OBJECTIVES *- Percent of Total Resources* *- CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To improve the efficiency, productivity and safety in Australian coal mines. *- 27%* *- ERS-3 (see page 18 for code)*	Predictive models for distribution of geological structures in all coalfields within the Sydney Basin and parts of the Bowen Basin. Feasibility of applying acoustic emission to monitor high stress and deformation around coal mine operations and mine subsidence. New mine equipment monitoring techniques for the maintenance and safety of coal cutting equipment and draglines.

Integrated monitoring system and analysis of rock mass stress and machine/rock interaction around longwall mining systems.

Experimental construction of a regional geotechnical database for planning applications.

Demonstration and development of a business plan for the NUMBAT mine emergency survey vehicle and achieve acceptance of the vehicle in Australian mine rescue practices.

Support of commercial development of roof stress monitoring and associated instruments with demonstration trials and product support.

Demonstration and bureau application of mine design computer program packages developed by CSIRO for coal mining. This includes the development of industry utilisation of super computer facilities within the Advanced Computer Laboratory.

Application of lineament and structural analyses to prediction of mining conditions.

Develop new geomechanics systems and technologies to maximise the economic recovery of minerals and metal ores from mining operations in Australia (Metalliferous Mining).
- *40%*
- *MI-5*

Conduct laboratory and field verification experiments of systems for in situ artificial cementation. Conduct field trials of new CSIRO in situ cementation systems and establish connections with commercial developers for applications to local and overseas markets.

Conduct laboratory and field studies on the performance of corrosion resistant reinforcement systems.

Evaluation of nonlinear dynamics underlying rock constitutive behaviour.

Evaluation of joint mass characteristics and resulting fragment size distributions from blasting through crushing and processing to find the size requirements

Evaluation of joint mass characteristics and resulting fragment size distributions from blasting through crushing and processing to find the size requirements

Review research in damage mechanics and apply methodology used in the gradient plasticity model to brittle behaviour of rocks especially relevant to rock stability and comminution processes.

Continuation of support for pre and post processing software developed for stress analysis codes and continue site specific application of BEFE stability analysis code.

Conduct field trials of SIROSIZE and SIROJOINT prototype image analysis technology to demonstrate their performance and to follow up with commercial versions for routine use in Australian mining operations.

Conduct field trials of new CSIRO designed "Swellex" rock reinforcement systems and follow-up with a business plan for commercial production of the unit for local and international markets involving Atlas-Copco and BHP.

Through a collaborative arrangement with AMIRA, the rock reinforcement group will provide training and instructional material for rock support and reinforcement in underground and open pit mines

Undertake continued demonstration and application of numerical modelling of ore body formation with selected mining operations.

Through a joint venture agreement, develop Fractal Graphics as a commercial aim to build and sell an integrated geographical/geological, information/modelling system for mineral exploration, mine design and planning, extraction and rehabilitation.

Conclusion of commercialisation arrangements for in-situ mineral analysis systems (borehole logging) and expansion of the application to meet ore body delineation requirements.

Design of a prototype CSIRO radar antenna (in conjunction with the Division of Applied Physics) for use in engineering applications.

Design of a prototype CSIRO radar antenna (in conjunction with the Division of Applied Physics) for use in engineering applications.

Development of wave form analysis software for immediate interpretation and instantaneous display of radar images

Commercialisation of the ground penetrating radar under a Memorandum of Understanding the BHP Engineering for engineering applications.

To contribute to the performance of Australia's oil and gas production industry by addressing the following strategic issues:

- **development of a coalbed methane production industry,**
- **the stability of deviated and horizontal wellbores,**
- **the stimulation of tight reservoirs.**

- *27%*
- *ERS-1, 2*

Determination of representative relative permeability curves for Australian coals and investigate the factors controlling multi-phase (gas/water) flow in coal.

Completion of the development of reservoir stimulation code SIMED and undertake comparative trials against other codes. Application of SIMED to trial problems to establish bench marks.

Completion of laboratory and theoretical studies of the "cavity completion" technique for stimulation of methane production from coal.

Completion of the development of multi-phase well testing tool and conduct proving trials and public demonstrations.

Evaluation of laboratory and field studies to elaborate on the parameters controlling hydraulic fracture stimulation treatments in coal seams.

Development of methods for targeting preferred geological environments for coalbed methane development in the Sydney and Bowen basins. Establishment of integrated demonstrations of coalbed methane technology for Australian conditions.

Resolution of the in-situ stress environment in the Northwest Shelf/Timor Sea region, particularly the orientations and magnitudes of the horizontal stresses. Continue developing strongly interactive research between CSIRO and leading industry operations in the NW Shelf-Timor Sea region.

Final development and commissioning of Australia's only high pressure triaxial cell which will enable the mechanical properties of reservoir shales to be measured under reservoir conditions.

Conduct of suites of strength-deformation tests on shales, with associated index tests, to develop a stress-strain-pore pressure response model for shales.

Development of a PC based stability sensitivity model which can be used as a design aid to minimise instability risks as a function of well deviation and azimuth.

As part of the APCRC's tight oil research, development of the technology and capacity for making in situ measures of the reservoir properties, and for characterising tight and heterogeneous reservoirs.

Completion of commercialisation of CSIRO well testing and hydraulic fracturing capabilities.

Research progress into tight oil demands strong interaction with industry operators and participation in the research by these operators.

Development of analytical techniques for determining in situ stress from mini-frac (hydraulic fracture) data obtained from bore holes not coincident with a principal stress direction. Demonstration and application of mini-frac for in situ stress management

Interpretation of in situ stress conditions from mini-frac data obtained under conditions of high in situ stress ratio.

To develop geomechanics systems appropriate for minimisation of environmental degradation and the facilitation of economically acceptable and socially responsible rehabilitation of mine sites.
- *6%*
- *EDEA-7*

Evaluation of enhanced natural rehabilitation processes for mine waste in contrast to artificially re-constructed landforms.

Publication of a manual on analytical procedures for establishing safe, long term, slope angles for open pit walls.

Experimental verification and field testing of new environmentally sensitive and cost effective process for in situ cementation of weak an porous rocks and soils so as to prevent movement of toxic mine waste fluids and provide permanent erosion protection.

Establishment of a business plan for the in situ cementation project as applied to waste management and the commencement of discussions with the firms in the mining/environment industry in relation to commercialisation.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenue)	$7,832,200
Sponsored Research	$5,398,000
Total Budget	**$13,230,200**

DIVISIONAL EXTERNAL EARNINGS TARGET

Based on estimates as at 30 June 1992 the Division expects that 45% of its total annual budget will be spent from external funds in 1992-93.

6.5 DIVISION OF MINERAL AND PROCESS ENGINEERING

OBJECTIVE

To increase the international competitiveness and environmental performance of the Australian mineral and energy industries.

STRATEGY

- Develop and apply skills in engineering and science, through theoretical, experimental and applications studies in collaboration with industry, to the stages of processing and beneficiation that offer the most cost effective returns or means of improvement for industry.
- Emphasise professional management and teamwork, champion service and excellence, ensure staff involvement in external affairs, and encourage a stimulating working environment.
- Concentrate effort on further value-adding to Australia's mineral output, especially in alumina production, aluminium production, and ferrous and non-ferrous metal production.
- Redeploy Divisional resources to expand activities in the Mine and Process Waste Management IMEC Program.
- Collaborate with Research Groups offering expertise in core technologies pertinent to mineral processing, especially with the CSIRO Divisions of Mineral Products, Geomechanics, Exploration Geoscience, Building Construction and Engineering, Material Science and Technology, Coal and Energy Technology, Soils, and Mathematics and Statistics.

INTER-DIVISIONAL COLLABORATION

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

- Iron Ore Processing Program (10% of total Division Resources) in collaboration with the Divisions of Exploration Geoscience, Mathematics and Statistics, and Soils.

The Division is also involved in the following programs managed by other Divisions:

- Alumina Processing (Mineral Products)
- Magnesium Metal Production (Mineral Products)

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop new and improved mineral beneficiation and primary processing methods to add value to Australia's mineral resources. - *16%* - *MI-2 (see page 18 for codes)*	Completion of industrial trials aimed at improving selectivity of nickel flotation. *Establishment of a comminution laboratory at Pinjarra Hills and transfer of staff from Clayton. Commencement of intensive collaboration with the Division of Geomechanics and the Cooperative Research Centre for Mining Equipment and Technology.*

Improve existing high temperature mineral processing systems and develop new processes for secondary processing of mineral products. - *50%* - *MI-3 ,4*	*Upgrade of the SIROSMELT research facility at Clayton .* *Agreed level of CSIRO funding and staffing of the GK Williams Cooperative Research Centre for Extractive Mettallury.* *Determination of the feasibility of producing anhydrous magnesium chloride.*
Develop on-line analysis instrumentation for improved control in the minerals, coal and petroleum industries and develop new control strategies for these industries. - *16%*	Completion of the program of public affairs associated with the award of the Australia Prize to scientists within the Division. Completion of patenting and testing of a method for determining particle size in alumina precipitators. Demonstration that HF emissions from aluminium smelter pot lines can be measured using lasers.
Develop improved methods of process waste management for mineral processing operations that are environmentally sound and cost effective. - *8%* - *MI-2*	*Establishment of a research team of six at Pinjarra Hills* Establishment of the Australian Centre for Process Systems and the CAPENET Computer Network for delivery of technology to the process industries. Commissioning of a QEM*SEM machine and provision of after-sales service to the purchaser. Development of a business plan for QEM*SEM sales.
To improve the competitive position of the Australian iron ore industry through technological advances in beneficiation, process modelling, sintering, instrumentation, quality and process control. - *10%*	Establishment of the DMPE Comminution and Physical Separations Project at Pinjarra Hills to develop stronger linkages with JKMRC. Identification of productive pre-competitive research areas. Development of a whole plant model of iron ore dry processing operations.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenue)	$10,167,000
Sponsored Research	$6,894,000
Total Budget	**$17,061,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division's external earnings target for 1992-93 is 33% of annual budget. The Division expects to exceed this figure.

6.6 DIVISION OF MINERAL PRODUCTS

OBJECTIVE

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

STRATEGY

- Maintain a world class research skills base in key chemical and mineral sciences relevant to the current and emerging needs of the minerals industry.
- Through external funding arrangements, ensure that clients need the outcomes of the Division's research and are committed to their application.
- Build on the Division's competitive strength through enhancing its reputation for successful applied research.
- Select and undertake projects that can lead to new mineral resource-based enterprises or to improved efficiency, productivity and competitiveness of existing enterprises.
- Commercialise successful projects through collaborative development arrangements with industry.

INTER-DIVISIONAL COLLABORATION

The Division is responsible for co-ordinating the following inter-Divisional Programs:

- Alumina Production (22% of total Divisional resources) in collaboration with the Divisions of Mineral and Process Engineering and Building, Construction and Engineering.
- Heavy Mineral Processing (18% of total Divisional resources) in collaboration with the Division of Mineral and Process Engineering.
- Magnesite Processing (27% of total Divisional resources) in collaboration with the Division of Mineral and Process Engineering.
- Energy Storage (14% of total Divisional resources) in collaboration with the Division of Mineral and Process Engineering and Building, Construction and Engineering.
- Aluminium Production (11% of total Divisional resources) in collaboration with the Divisions of Coal and Energy Technology, Mineral and Process Engineering and Materials Science and Technology.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Improve the productivity, product quality and product range of Australian alumina refineries (Alumina Production). - *22% (see page 18 for codes)*	Establishment of a major external funding base for a new project on alumina precipitation, through involvement in the A.J. Parker CRC for Hydrometallurgy. Technical-scale assessment of a new process for ameliorating the red mud residue from the Bayer process.

Improve productivity in the processing of Australia mineral sands, allow value-added products to meet changing market specifications, and enhance prospects of further local downstream processing. - *18%*	Development of a new process route to treat high-magnesia ilmenites. Commercial implementation of a novel process to remove impurities from mineral sand concentrates and products.
Develop processes, products and product applications that will ensure maximum value to Australia of the unique Kunwarara magnesite deposit. - *27%* - *MI-1*	*Development of methods for producing anhydrous magnesium chloride feedstock for magnesium metal production.* *Completion of the construction of laboratory-scale electrolysis equipment to assess feedstocks for magnesium metal smelting processes.* Demonstration of the effectiveness of caustic magnesia in treatment of industrial wastes. Completion of a mini-pilot plant for producing flame-retardant grade magnesium hydroxide for applications in polypropylene.
Improve storage batteries to meet society's future needs for cleaner electricity supplies, portable power and road transport. - *14%*	Commercial implementation of an advanced plate-curing process for increasing the efficiency of lead/acid battery production. Field demonstration of the suitability of gelled-electrolyte battery technology (i.e.: no water loss) for remote-area power supply applications.
Support development of aluminium smelting, technology that will increase the proportion of Australian raw materials processed locally, improve smelter productivity and reduce greenhouse and other environmental impacts of the aluminium industry. - *11%*	Establishment of the protocol and apparatus to assess inert anodes for aluminium smelting and evaluation of candidate materials developed by the Division of Materials Science and Technology. Quantification of intrinsic effects of both composition and temperature on current efficiency in aluminium smelting, using a novel laboratory technique.
Develop and improve processing strategies for treating the increasing proportion of refractory ores that will occur in feedstocks for production of gold and other precious metals. - *8%*	Definition of strategic research needs of the gold industry that could attract funding through AMIRA and be addressed through the A.J. Parker CRC for Hydrometallurgy. Assessment of oxidising agents used to pretreat sulfidic gold ores.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation (includes earned appropriation revenue)	$8,346,600
Sponsored Research	$3,900,000
Total Budget	**$12,246,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 35% of its annual budget will be spent from external funds in 1992-93.

7. INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING

OBJECTIVE

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

STRATEGY

- *Allocate research resources in accordance with CSIRO and Institute research priorities, guided by the advice of the CSIRO Agricultural Sector Advisory Committee and Divisional Advisory committees, and the needs of our customers.*

- *Undertake retrospective and prospective cost-benefit evaluations of major research projects particularly those which are planned or under review.*

- *Seek collaboration with other CSIRO Institutes and research organisations in the definition of research opportunities and, if productive, in the conduct of the research itself.*

- *Maintain a balanced portfolio of research programs and skills including longer term strategic research largely supported by appropriation funds and short term applied research expected to be supported heavily by external fund sources where the benefits are of a private, marketable type.*

- *Ensure programs are adequately resourced for their objectives and that excellent relationships are maintained with rural research and development corporations, commercial firms and public bodies competitively funding research.*

- *Manage research through devolution of line responsibilities, a commitment to objectives and milestones, and the measurement and rewarding of performance against these.*

- *Implement CSIRO's recently adopted policy on agricultural extension through co-operation with State Departments of Agriculture, agribusiness firms and private agricultural consultants.*

- *Co-operate with public health and educational authorities and private firms to achieve adoption of Institute research results on human nutrition.*

- *Achieve rapid commercialisation of patentable research results with the assistance of Sirotech and by choosing the best form of business arrangement for each piece of technology.*

PLANNED OUTCOMES

- Development of plans for the relocation of McMaster Laboratory and its integration with the Prospect site.
- Continued development of the skills of Divisional Business Managers and Program/Project leaders in collaboration with Sirotech to improve commercialisation of the Institute's intellectual property.
- Formulation of Business Plans for all Divisions to complement their Strategic Plans.
- An increased proportion of external funding for short-term applied research for direct industry benefit, and reservation of a higher proportion of appropriation funds for longer-term strategic; and public good, research.
- Maintained or increased coverage in rural media and popular press.
- Plans for co-ordinated presence at major rural displays.
- Publication of ten retrospective cost-benefit studies of Institute research projects.
- Implementation of cost benefit evaluation on all full research funding applications to the Meat, Pig and Dairy Research and Development Corporations and some applied research applications to the Wool R&D Corporation.
- Submission of four high quality proposals for the third round of Co-operative Research Centres.
- Establishment of the Co-operative Research Centres in Molecular Engineering and Technology and Industrial Plant Biopolymers.
- Completion of the Review of the Division of Food Processing including the determination of the future directions and locations of CSIRO's research for the food industry.
- Development of several major inter-Divisional research programs and refocussing of existing programs within the parameters of the CSIRO research priorities process, and its policy on Multi-Divisional Programs.

INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING

SUMMARY OF RESOURCES, 1992-93

(estimates as at 11 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Animal Production	99	243	15614.7	5000	20614.7
Animal Health	95	209	9584.2	6000	15584.2
Australian Animal Health Laboratory[b*]	43	191	11541.9	1500	13041.9
Biometrics	7	8	511.6		511.6
Food Processing	120	247	14053.8	8600	22653.8
Human Nutrition	48	107	5416.4	2614.3	8030.7
Tropical Animal Production	55	146	8020.9	2653	10673.9
Wool Technology	140	378	13469.7	19401	32870.7
Institute Headquarters	3	16	1823.7		1823.7
Unallocated[c]			2407.1		2407.1
Total	**610**	**1545**	**82444.0**	**45768.3**	**128212.3**

Note : Columns may not add to totals due to rounding.

a Approximation includes earned appropriation revenue plus ILS (Internal Lease Scheme) allocation and May Statement Funds.

b Half of appropriation annual is provided by DPIE.

c This category included Institute funds managed on behalf of Divisions such as Sirotech fees, Information Services Branch funding and safety officers.

INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING

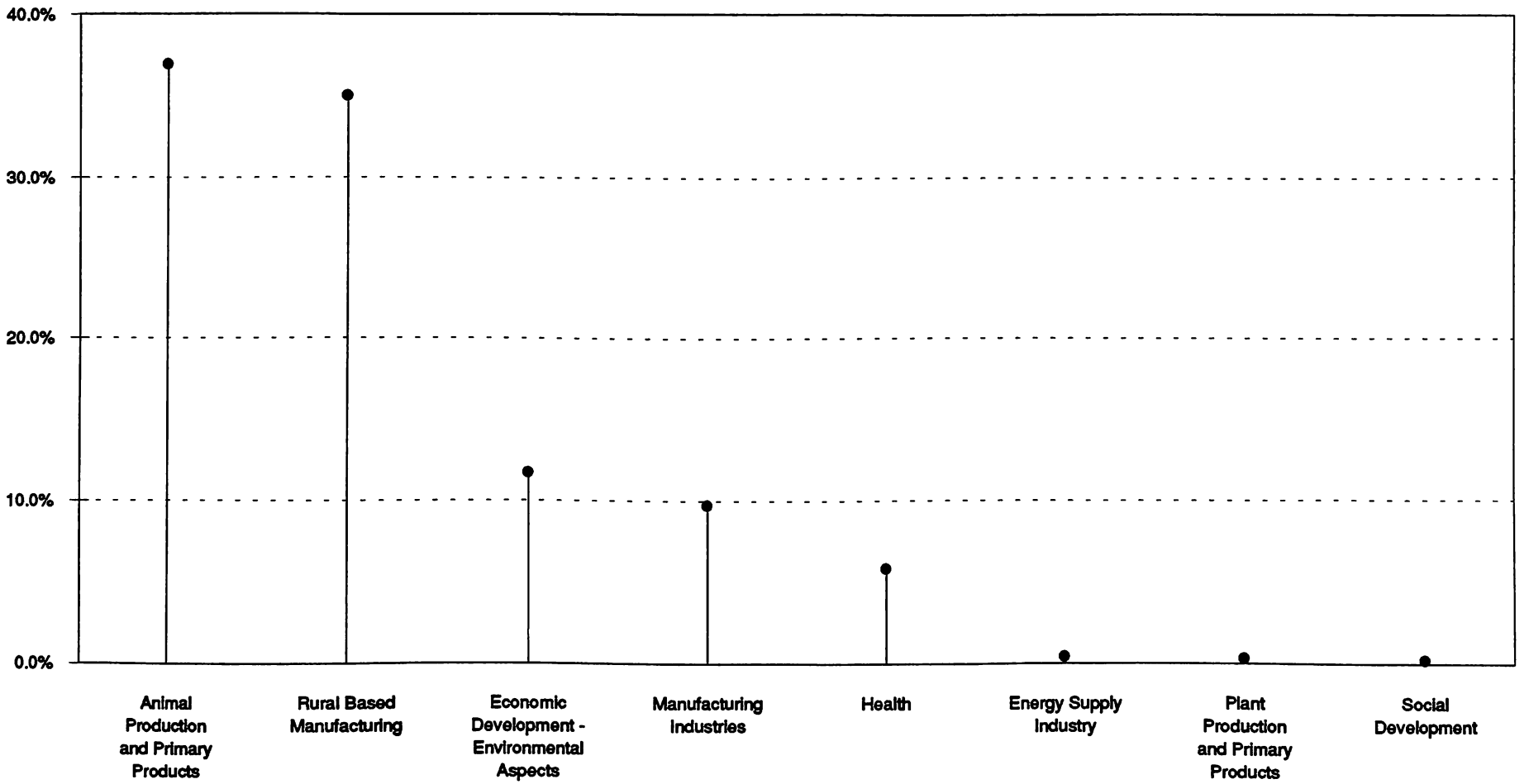
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE

(estimates as at 11 May 1992)

RESEARCH PURPOSE	AP	AH	AAHL	B	FP	HN	TAP	WT	INSTITUTE HEADQTRS	UNALLCTD	TOTAL
PLANT PRODUCTION & PRIMARY PRODUCTS					371.5				5.5	7.2	384.2
ANIMAL PRODUCTION & PRIMARY PRODUCTS	14018.0	5174.0	11620.3	238.7	4989.4		6777.9	2966.9	673.5	888.9	47347.6
RURAL BASED MANUFACTURING	329.8	109.0		272.9	16772.7	1445.5		24429.0	637.8	841.8	44838.5
ENERGY SUPPLY INDUSTRY					520.2				7.7	10.1	538.0
MANUFACTURING INDUSTRIES	412.3	6592.1	1147.7			1124.4	2775.2		177.3	234.0	12463.0
ECONOMIC DEVELOPMENT-ENVIRONMENTAL ASPECTS	5854.6	3007.8	65.2				85.4	5474.8	213.2	281.3	14982.3
HEALTH		701.3				5460.8	1035.4		105.9	139.7	7443.1
SOCIAL DEVELOPMENT AND COMMUNITY SERVICES			208.7						3.1	4.0	215.8
TOTAL	20614.7	15584.2	13041.9	511.6	22653.8	8030.7	10673.9	32870.7	1824.0	2407.0	128212.5

Note: Columns may not add totals due to rounding.

Distribution of Total Expenditure by Research Purpose, 1992-93



7.1 DIVISION OF ANIMAL HEALTH

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

- 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.

INTER-DIVISIONAL COLLABORATION

The Division is responsible for the management of the Vaccine Technologies Program (6% percent of Divisional Resources) in collaboration with the Divisions of Animal Production (2%), Biomolecular Engineering (5%) and Tropical Animal Production (2%).

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop new or improved vaccines and diagnostic tests to control or eradicate the economically important bacterial diseases of farm livestock. - *18%* - *MF-5, AP-4 (see page18 for codes)*	*Completion of field evaluation of a fleece rot/flystrike vaccine and studies on the effect of cytokines in the skin of sheep* genetically *resistant or susceptible to fleece rot/flystrike.* *Formulation of a 7-valent recombinant pili vaccine for pinkeye in cattle and achievement of commercial levels of expression of a Dichelobacter nodusus (footrot in sheep) protease gene in an appropriate host.* Completion of field trials of the gamma interferon assay for diagnosis of bovine tuberculosis in New Zealand and Ireland *Finalisation of commercial agreements for vaccines against footrot, salmonella, staphylococcal mastitis and CLA, and for cytokines.* *Provision of planning inputs for two CRC proposals for round three, and a multi-divisional program on more effective vaccines.*

Develop sustainable control strategies for internal parasites of sheep and cattle.
- *20%*
- *MF-5, AP-3, 4*

Assembly of forty hypervariable DNA probes for genomic analysis of nematode resistance in sheep, and construction of a preliminary linkage map on twenty of these probes.

Completion of the evaluation of recombinant nematode antigens for vaccination of sheep.

Evaluation of the efficacy of some novel anthelmintic formulations in sheep and cattle and completion of field evaluation of optimum application time for controlled intraruminal release of anthelmintics in the winter rainfall zones.

Identification of the linkage groups containing ivermectin resistant gene in *Haemonchus* and cloning of the ivermectin resistance gene from *C. elegans*.

Completion of a survey of indigenous nematophagous fungi in sheep faeces from high rainfall regions of NSW and identification of the principal constraints to survival of fungal elements during transit through the gastrointestinal tract of sheep.

Establishment of the larval development assay and completion of evaluation of the nematode diagnostic DNA kit with Departments of Agriculture and commercial partner.

Develop methods for diagnosis, treatment and prevention of poisoning diseases of livestock caused by natural environmental plant and microbial toxins and reduce their contamination of food.
- *7%*
- *MF-5*

Completion of field trials of lupinosis vaccine formulations in Western Australia and Victoria and the survey of phomopsin content of Australian lupin seed.

Completion of pen trials to test the efficacy of an Annual Ryegrass Toxicity (ARGT) vaccine in sheep and of toxin binding agents as an antidote to ARGT.

Finalisation of an agreement for the lupinosis vaccine with a commercial partner.

Develop new or improved vaccines and diagnostic tests to control or eradicate economically important diseases of poultry.
- *9%*
- *MF-5*

Evaluation of attenuated wild type Infectious Laryngotracheitis (ILTV) vaccine in chickens

Construction of viral vector vaccines and evaluate two of these in chickens.

Identification and cloning of two chicken cytokine genes.

Evaluation of poultry diagnostic tests with a commercial partner

Finalisation of continued funding for the avian viral vectors project.

Develop and maintain diagnostic services for exotic diseases of livestock and diseases of fish and to provide laboratory diagnostic support, training and expert advice in exotic animal diseases to government agencies.
- *17%*

Establishment of diagnostic tests for an extended range of exotic avian pathogens for scrapie/BSE and for porcine reproductive and respiratory syndrome and validation of *in vitro* diagnostic procedures for major exotic fish pathogens.

Finalisation of the six-year collaborative research project on Foot-and-Mouth disease in Thailand.

Completion of a major project of development of exotic disease training and awareness videos and support material.

Development of a new collaborative project on Foot-and-Mouth disease diagnosis with the Pirbright Laboratory, England.

Devise and assess new techniques for the identification and characterisation of pathogens that cause specified exotic diseases of livestock.
- *13%*

Establishment of improved systems for the expression of genetically engineered proteins; Semliki forest virus when this system becomes available, Phageor "coliclonal" antibody technology and fermentation technology for Prokaryotic and Eukaryotic expression systems.

Development of new diagnostic tests for key diseases, yeast expressed VP7 for African horse sickness and Epizootic haemorrhagic disease, PCR for African swine fever, recombinant gp53 and 55 for Pestivirus.

Development of an ELISA test for Rabbit Haemorrhagic Disease virus and completion of the pathogenesis studies

Transfer of PCR based diagnostic techniques to the Berrimah Agricultural Research Centre, Northern Territory.

Develop new vaccines and diagnostic tests for selected exotic viral diseases of livestock and poultry.
- *16%*
- *MF-5*

Characterisation of the immune response of sheep to the VP7 protein of bluetongue virus following vaccination with live virus, a vaccinia virus recombinant containing the VP7 gene and purified yeast-expressed VP7.

Development of freeze substitution for immunocytochemistry and assess the potential of computer-aided electron microscopy to investigate the three dimensional structure of viruses.

Production of sheep adenovirus recombinants and use of them to deliver vaccine antigens

Development of a collaborative project with the USDA laboratory in Laramie, Wyoming to examine the interaction of bluetongue virus with its insect vector

Transfer of technology and training for rapid virus detection by electron microscopy and the bluetongue competition ELISA to the Berrimah Agricultural Research Centre and the University of Northern Territory

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues and a DPIE contribution to AAHL of $5,400,000)	$21,126,100
Sponsored Research:	$7,500,000
Total Budget	**$28,626,100**

DIVISIONAL EXTERNAL EARNING TARGET

The Division expects that 47% of its total annual budget, will be spent from external funds in 1992/93 based on estimates as at 16 April 1992.

Australian Animal Health Laboratory Budget	
CSIRO Appropriation Total Allocation[a]:	$5,978,4000
DPIE Appropriation Total Allocation[b]:	$5,563,500
Sponsored Research:	$1,500,000
Total Budget:	**$13,041,900**

[a]Figure includes May Statement Funding and Appropriation revenue estimate.

[b]AAHL, Australia's high-security exotic disease preparedness facility, receives a matching contribution of $5,400,000 from the Department of Primary Industries and Energy.

7.2 DIVISION OF ANIMAL PRODUCTION

OBJECTIVE

To deliver products, processes and information to our customers through creative science and innovative technology. Our customers are wool and meat producers and processors, agribusiness and the scientific community.

STRATEGY

- Conduct research and development in the Australian livestock industries, directing our activities particularly towards improving product quality and diversity, ensuring sustainability of agricultural systems and increasing the efficiency of animal production.

- Collaborate with other Divisions within the Institute of Animal Production and Processing in particular and with other research providers to ensure complementary resources and skills are exploited to ensure cost-effective and efficient research.

INTER-DIVISIONAL COLLABORATION

The Division is a participant in the following inter-Divisional Programs:

- *Land and Water Care Program* (2% of total Divisional resources) in collaboration with the Divisions of Plant Industry, Soils, Tropical Crops & Pastures, Water Resources, and Wildlife and Ecology.

- *Fibre Utilisation Program* (7%of total Divisional resources) in collaboration with the Divisions of Tropical Animal Production and Tropical Crops and Pastures.

- *Vaccine Technology Program* (2% of total Divisional resources) in collaboration with the Divisions of Animal Health, Biomolecular Engineering and Tropical Animal Production.

- *Wool Quality Program* (1.5% of total Divisional resources) in collaboration with the Division of Wool Technology (Not an MDP).

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To increase wool quality, production efficiency and profitability in the Australian wool industry through superior breeding strategies and enhanced genetic technologies. - *32%* - *AP-1, 3 (see page 18 for codes)*	*Obtaining of preliminary estimates from historical data of comparative genetic parameters for wool production and wool quality traits in fine and medium wool Merinos across several environments.* *Establishment of flocks of fine wool sheep in traditional medium-wool growing areas to elucidate environmental constraints to production.*

Development of a database incorporating wool sale-by-description information to aid in the formulation of Merino breeding objectives.

Development of the analytical software and associated database to allow the estimation of Merino sire breeding values and their publication in a National Register.

Completion of the first stage sampling of medium wool Merino stud flocks in NSW to reveal the incidence of genetically determined wool faults.

Measurement of genetic adaptation of nematode parasites bred for 30 generations in sheep hosts selected for increased or decreased parasite resistance.

Evaluation of selection procedures to allow parasite resistance to be incorporated into Merino breeding programs.

Comparison of resistance mechanisms in three different lines of Merino sheep bred for increased resistance to internal parasites.

Refinement of a supplementary feeding strategy to substantially reduce lamb mortality in prime lamb flocks.

Achievement of a rate of transgenesis of between 0.15 and 1% (i.e. between 1 and 15 transgenic lambs from 1500 born).

Establishment of *in vitro* maturation and *in vitro* fertilization as routine methodologies for sheep oocytes and, if superior to existing standard operating procedures to incorporate them into revised standard operating procedures for producing transgenic sheep.

Transfer to mice of a gene encoding information for a tobacco chitinase and measurement of its expression in various tissues.

Continuation of the validation of anti-sense ribozyme RNA molecules as inhibitors of gene activity in transgenic animals.

Identification of transgenic lambs born from embryos microinjected with the gene MTCEK1 encoding the cysteine biosynthetic pathway and measure gene expression and wool growth.

Measurement in mice of the phenotypic effect of the gene MTAceAB1 encoding the glyoxylate cycle.

Testing by experiment of the predictions of the reaction-diffusion mechanism of follicle initiation and regulation.

Isolation and commencement of characterisation of a mitotic inhibitor isolated from cultures of wool follicle dermal papilla cells.

Preparation and characterisation a sheep genomic DNA library cloned in yeast artificial chromosome (YAC) vectors.

To enhance the product quality and productivity of the Australian meat industries. - *9%* - *AP-5*	Construction of a prototype commercial manufacturing plant to produce protected nutrients for controlling quality and yield of ruminant products. *Confirmation that the incidence of dark-cutting meat can be prevented with a catecholamines-specific antibody to offset the effect of pre-mortem stress.* Initiation of identification of causes of low reproductive performance in two commercial meat chicken lines.
Improve the quality of wool in seasonally fluctuating environments. - *8%*	Determination of the responsiveness of follicles and fibre growth from sheep with high and low staple strength to identify the effects of changing nutritional environments upon staple strength. Testing of limiting amino acids for wool growth in pregnant ewes under field conditions to compare animal house and field responses. Determination of the value of anabolic hormones under semi-commercial conditions for increasing staple strength to establish the base for commercialisation.
Develop methods for measuring and analysing change in productive temperate pastures. - *6%* - *EDEA-6*	*Development of a suitable processing system to analyse Landsat data and to quantify change in botanical composition of two typical native grassland communities.* *Continuation of field trials to assess the ecotoxicity of Ivermectin on the biological community of grazed temperate pastures.*
Devise management techniques and innovations to enhance stability and resistance in productive temperate pastures - *5%* - *EDEA-6*	*Commencement of field trials to test techniques to increase the efficiency of nutrients, fungicide and insecticide seed coating treatments and to evaluate seed fertiliser placements.* *With NSW Agriculture, evaluation of the effectiveness of pasture growth status maps for fertiliser management advice.*
Controlled release technologies to benefit the grazing industry - *3%* - *EDEA-6*	Development of an *in vitro* tester to predict release rates of devices and establish criteria to develop springless devices.
Improve the mineral status of grazing animals. - *8%* - *EDEA-6*	*Determination of whether glutathione level in blood is a valid predictor of sulphur status.* *Development of statistical techniques developed to enable data bases to be combined for multivariate analysis.*
Develop decision support software systems to enhance the profitability of animal production enterprises. - *8%*	Continuation of development of AUSPIG for international release by BP Nutrition. Development of specifications for the AUSBEEF simulation model and decision support software and to begin negotiations with DSL over commercialisation of AUSBEEF.

Testing of whether IGF1 and FGF have an effect on the growth and development of ovarian follicles and if either will stimulate or inhibit hormone secretion from the follicle.

Development of a cell culture system for thecal cells and to test the action of insulin, IGF and TGFa on their viability, morphology and endocrine function.

Testing of the action of insulin, IGF, FGF and TGFa on the viability, morphology and endocrine function of cultured granulosa cells.

Develop vaccines to control reproduction and thereby enhance enterprise profitability.
- *8%*
- *AP-5*

Determination of whether nutrients and metabolic hormones influence ovulation rate through an effect on the growth and development of ovarian follicles and whether they stimulate or inhibit hormone secretion from follicles.

Conclusion of an agreement with Vetoquinol to market Fecundin in France.

Supply pre-tested immunological reagents to Bioquest Limited for marketing by the company as indicated in an agreement between CSIRO and Bioquest Limited.

Conclusion of negotiations with a commercial partner for the marketing of Multivac in Australia.

Completion of development of a vaccine formulation that increases prolificacy in gilts and establishment of commercial links for the marketing of this vaccine.

Completion of development of a vaccine formulation that increases prolificacy in cattle and establishment of commercial links for the marketing of this vaccine.

Continue development of a vaccine formulation that increases fertility and wool growth in young Merino ewes and if successful seeking a commercial collaborator for marketing.

Modify the microbial population of the rumen to improve the digestion of low-quality forage to enhance the productivity of animal production.
- *7%*
- *AP-2*

Isolation and testing of new strains of anaerobic fungi that have a high capacity to degrade fibre.

Determination of the effect on voluntary feed intake and digestibility of inoculating the rumen with a strain of anaerobic fungus that has a high capacity to degrade fibre.

Development of molecular techniques to identify and measure anaerobic fungi in the rumen.

Determination of the numbers of methanogenic, acetogenic and sulphate-reducing bacteria in the rumen.

Determination of the growth rate and amino acid composition of components of the rumen microbial population that differ in cell size.

Measurement of net protein synthesis by bacteria, protozoa and anaerobic fungi when concentrates are added to a hay diet.

Development of specifications for a simulation model to predict for the supply and distribution of nutrients for growth, wool growth and reproduction of sheep in a seasonally fluctuating environment.

Improve wool quality through better husbandry technology.
- 6%

Provision of support for the commercialisation of biological wool harvesting by completion of the development of a net-based fleece retention and removal system and seek a commercial partner.

Completion of development of non-surgical mulesing and seek a commercial partner.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues)	$15,614,700
Sponsored Research:	$5,000,000
Total Budget:	**$20,614,700**

DIVISIONAL EXTERNAL EARNINGS TARGET3

The Division expects that 28% of its annual budget will be spent from external funds in 1992-93, based on estimates as at 18 May.

7.3 DIVISION OF FOOD PROCESSING

OBJECTIVE

To facilitate the export of high-value and value-added foods from Australia and to ensure safety and nutritional quality of food supplied to the consumer.

STRATEGY

The acquisition of knowledge of the chemical, physical, biological and psychophysical attributes of foods and food components as they affect processing operations; the development of food processing and preservation technologies; definition of the requirements for retention of wholesomeness and safety of foods; transfer of information and technology to industry, especially for the facilitation of exports, and to the consumer.

INTER-DIVISION COLLABORATION

The Division is responsible for the management of the following inter-Divisional program:

- *Applications of Molecular Thin Films: Sensing and Separation Technologies* (5% of total Division resources) in collaboration with the Divisions of Applied Physics and Biomolecular Engineering.

The Division is collaborating with the Divisions of:

- Materials Science and Technology and Horticulture in *Active Packaging for Horticultural Produce* (2% of total Division resources).
- Applied Physics, Chemicals and Polymers and Plant Industry in *SAW/ELISA Biosensors* (2% of total Division resources).
- Human Nutrition in the applications of Whey Protein Fractions.

SPECIFIC OBJECTIVES - *Percentage of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop improved microbial starter cultures, obtain better control of microbial spoilage, determine relationship between probiotic bacteria, diet and health, and devise systems for enzymic and microbial conversion of milk components to more valuable products - *5%*	Provision of genetically-modified starter bacteria with improved bacteriophage resistance and cheese making characteristics provided for commercial trials. Development of genetic systems in *pediococci* for increased bacteriocin production developed. Mapping of genome of *lactococci* and their bacteriophage. Laboratory production of prototype functional foods from lactose in cheese whey. Review of the effects of probiotic bacteria on human and animal health and development of an appropriate research strategy to provide a basis for dietary intervention to maximise beneficial effects.

	Provision of new methods for extending shelf life of dairy products provided to industry
	Publication of new guidelines for better sanitation in cheese factories.
Develop new or improved technologies for manufacture of high-value milk protein isolates. - *6%*	Finalisation of patent specification covering manufacture of gelled food products from whey protein finalised.
	Evaluation of gelled food products technology evaluated in at least one food system.
	Completion of the assessment of physical, chemical and functional properties of micellar whole casein powders.
	Improvement of efficiency of pilot-scale process for manufacturing ß-casein from milk.
	Finalisation of patent specification for extraction of minor whey proteins using membrane separation technology.
	Optimisation and finalisation of operational parameters for pilot-scale manufacture of minor whey proteins.
	Preliminary assessment of efficacy of dietary whey protein for cancer prevention in an animal model (in conjunction with Division of Human Nutrition).
Develop new or improved technologies for manufacture of a wider range of cheeses and dairy-based powders. - *5%*	Completion of development of ultrafiltration-based processes for manufacture of two new varieties of mould-ripened cheese.
	Development of an on-farm strategy for reducing variation in functionality of milk for cheese making (in collaboration with Victorian Department of Food and Agriculture)
	Provision for technical support for APV-SiroCurd cheese making technology in USA and Australia through establishment of a support agreement.
	Study to be completed of effects of fat/protein ratio on rheology of fermented retentates.
	Development of testable hypotheses for production of improved flavour in low-fat Cheddar-type cheese.
	Negotiation of a licensing agreement for commercial manufacture of heat-stable milk powders.
	Completion of development of pilot-scale production of fast-gelling milk powder.
	Completion of strategic study of factors affecting foaming properties of milk powders.

Maintain international competitiveness of the Australian meat processing industry by improving the efficiency of industry operations with emphasis on the efficiency of converting livestock to meat. - *13%* - *RM-3 (see page 18 for codes)*	*Completion of testing of prototype hide workup mechanism.* *Completion of design of integrated system for hide workup.* *Construction and testing of prototype rib deboning machine.* *Construction and testing of prototype rear leg restraint and severance devices.* *Achievement of first stage of automatic removal of pelvic bone.* *Writing of generic algorithms for the shape of primal cuts.* *Determination of feasibility of using vision sensing for beef offal separation determined for selected organs in addition to livers.*
Improve the quality, especially for export, of Australian beef, sheep meat and pork. - *11%*	Completion of feeding experiments to determine kinetics of disappearance of fat colour following change from grass to grain feeding. Development of probe for carotene 15-15' dioxygenase developed. Determination of relationships between plasma and tissue concentrations of carotenoids. Completion of evaluation of characteristics (fat hardness, tenderness, meat colour, rate of discolouration) for meat for the Japanese market. Determination of optimal procedures for meat for the Japanese market. Determination of survey of pork quality in major Australian abattoirs. Determination of causes of pork quality defects determined and solutions.
Devise new processes for adding value to meats and for better exploiting meat and its components. - *8%*	Modification of pilot-plant operations and product characteristics modified to reflect market requirements for Isolated Muscle Protein. Correlation of collagen crosslink concentration with efficiency of hide conditioning in gelatine and sausage casing production. Determination of effect of chemical and physical treatments on isolated crosslinks and collagen. Determination of the storage life of consumer portions of lamb, beef and pork using CO_2 technology and definition of factors limiting storage life. Commencement of commercial trials of new packaging technology.
Develop novel food processing and packaging technologies, and improved transport of foods. - *15%* - *RM-2*	Establishment of research program in extrusion technology. Definition of procedures for predicting fluid flow processes in the Spinning Cone Column. Demonstration of the feasibility of treating liquids, which contain suspended solids, by the novel contactor and solution of problems of scaling the pilot contactor to commercial size.

Preparation of fractions from eggs and lupin seeds with functional properties for use as food components prepared using the novel contactor.

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

Completion of studies of temperature distribution in containers of chilled meat and commissioning of the CSIRO air flow measuring apparatus.

Determine mechanisms of flavour perception and its role in food acceptance, identify natural food flavours and off-flavours/taints in foods, and develop sensors for use in food processing, environmental and biomedical applications
- *16%*
- *RM-1*

Identification of more of the mechanisms of taste and smell underlying food acceptance.

Completion of Japan Project on cross cultural sensory evaluation.

Planning of expansion into Chinese Asia, Korea and South-East Asia.

Expansion of services in sensory evaluation to the Australian Food Industry.

Evaluation of natural fruit juice concentrates prepared by Spinning Cone Column technology.

Identification of sources of natural flavours in crustaceans.

Evaluation of taint barrier food contact materials for the safe packaging of non-hermetically sealed foods.

Expansion of the contract research service of the National Centre for Advanced Microanalysis of food to include chemical contaminants derived from food contact materials.

Evaluation of electrode fabrication facility with an output capability of one thousand biosensor electrodes.

Establishment of the CRC for Molecular Engineering and Technology: Sensing and Diagnostics at fully operational level.

Determine the microbiological safety of foods, prevent microbial spoilage of foods, devise means to lower serum cholesterol in humans, and develop plant cell culture technology to produce food components
- *13%*

Full commercialisation of cholesterol removal from egg using ß-cyclodextrin.

Establishment within CRC for Industrial Plant Biopolymers of plant cell lines producing commercially attractive yields of polysaccharides having useful functional properties. Scale up fermentation of these cell lines to 100 litres.

Commencement of research on sensors for pathogenic bacteria in foods and prediction of the behaviour of pathogenic microorganisms in foods.

Establishment of Dairy Industry Quality Centre.

Completion of survey of major spoilage and toxigenic fungi and the occurrence of significant mycotoxins in commodities in Indonesia and the Philippines. Completion of basic study of factors affecting *Aspergillus flavus* invasion and aflatoxin production in peanuts in Thailand.

Establishment of methodology for the enumeration of *Escherichia coli* 0157:H7 and incidence in retail mince meat.

Transfer technology to the food industry and consumers.
- *8%*

Continuation of the national facility for technology and information transfer and advice for the meat processing industry.

Use of two-way information flows to maintain industry/consumer relevance of the R&D program.

Conduct at least 2 specialist technical training courses for industry at representative national locations.

Publication of a minimum of 12 technical reports relevant to current industry problems.

Preparation of minimum of three training videos for the meat industry.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues	$14,053,800
Sponsored Research:	$8,600,000
Total Budget:	**$22,653,800**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 34% of its total annual budget will be spent from external funds in 1992-93.

7.4 DIVISION OF HUMAN NUTRITION

OBJECTIVES

To improve human well-being and community health and reduce the incidence of diet-related disease in Australia by nutritional and other means including influencing the production and consumption of the appropriate foods.

STRATEGY

- Conduct research to develop an understanding of those nutrition-related disorders that account for the greatest morbidity and mortality within the Australian community.
- Encourage and actively collaborate with food and health care industries to produce and evaluate foods with optimal nutritional characteristics, and other therapeutic agents.
- Develop techniques for improving nutritional knowledge and behaviour in the community and transmit that information to community health agencies and to food industry.
- Maintain a strategic approach to integrating and improving links with the food and pharmaceutical industries to develop business plans for newly identified opportunities.

INTER-DIVISIONAL COLLABORATION

The Division will collaborate with the Division of Plant Industry in the project: "High-Value Oilseed Products for Food Use", and with the Division of Food Processing in the application of whey protein fractions.

SPECIFIC OBJECTIVES
- *Percent of Total Resources*
- *CSIRO Strategic Plan*

To develop diets and assist industry to develop foods with altered fat and fibre composition that will reduce the national risk of cardiovascular disease.
- *20%*
- *RM-5, IS-4 (see page 18 for codes)*

PLANNED OUTCOMES
(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)

Establish research projects on new nutrition based opportunities for the food industry, (a) fibre-rich breads; (b) low saturated fat commercial margarines; (c) fibre-rich cereal products; (d) almonds; (e) eggs.

Analyses of polysaccharides in new foods and assessment of their potential for health.

Assessment of chemical structure, and physical and biological properties of Australian acacia gum exudates.

Identification of biological factors (including central obesity, genetic traits and gender) which influence response to dietary fats and cholesterol.

Definition of (a) the role of the HMG CoA Reductase Inhibitors in lowering lipids in specific patient groups; (b) the effect of pure dihomo-gamma-linolenic acid on plasma lipids and blood pressure.

Provision of advice and assistance above industries and health services to adopt successful outcomes of above R&D.

Obtaining 30% of research costs from external funds.

To reduce the occurrence of cancer in the Australian people through appropriate nutritional interventions. - *19%* - *IS-4*	*Evaluation of the effectiveness of natural antioxidants in protecting skin cells against UV-induced macromolecular damage and carcinogenesis.* *Identification of potential carcinogens in meats prepared in various ways.* *Identification of pesticides and other chemical residues in foods that have carcinogenic potential and definition of their mutagenicity in rodents.* *Evaluation of various sources of fibre on chemically-induced experimental colon and breast cancer in rodents.* Informing of sponsoring companies, meat industry and health services of outcomes of above R&D. Obtaining 36% of research costs from external funds
To promote the well-being of Australian people and assist food industry through development of targeted nutrition intervention and food policy strategies. - *15%* - *RM-5, IS-4*	Completion of database of dietary intakes and psychosocial determinants of food choice in 2000 elderly, and of the eating habits among low socio-economic groups. *Interventions through newly developed educational tools, to overcome barriers to change.* *Establishment of a Food Policy Research Unit to examine opportunities for networking with external organisations, and assisting retailers and food companies to implement nutrition strategies.* *Definition of the value of natural antioxidants on genetic damage and lipid oxidation.* Provide sponsoring food companies with database information and health services with other outcomes. Obtaining 28% of research costs from external funds
To utilise nutritional means to augment or replace drugs in the management of high blood pressure and cardiac disorders. - *27%* - *IS-4*	Initiation of a new Program "Nutritional Pharmacology" through closure of two programs and redeployment of staff. Development with food and pharmaceutical industries of strategies to combine nutrients and drugs to lower blood pressure. Evaluation of novel antioxidants and lipid emulsions to prevent cardiac arrhythmias. Confirmation of the value of a novel biological marker which identifies genetic hypertension. Evaluation of specific fatty acids of commercial interest that protect heart muscle during ischaemia. Informing sponsoring companies of outcome of research. Pursuit of filing of two patents Securing of 18% of research costs to be met from external funds

To establish a rational approach to the design and commercialization of new growth factors to treat wounds, gut disease and polytrauma; to support the growth of cells in culture; and to stimulate growth of lean animals for agriculture.
- 19%

Characterization of growth factors isolated from milk products (whey) which promote cell growth and wound healing.

Manufacture of novel growth factors by recombinant technology. Commercialization of products through CSIRO part-owned company, GroPep Pty. Ltd.

Expansion of strategic research into growth factors through the CRC on Tissue Growth and Repair (36% equity by CSIRO).

Inform sponsoring RIRFs, CRC partners and GroPep Pty. Ltd. of outcomes of R&D.

Securing of 68% of research costs from external funds.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues	$5,416,400
Sponsored Research:	$2,614,300
Total Budget:	**$8,030,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 33% of its total annual budget will be spent from external funds in 1992-93.

7.5 DIVISION OF TROPICAL ANIMAL PRODUCTION

OBJECTIVE

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

STRATEGY

- Undertake research to:
  - provide livestock producers with technologies for rapid genetic improvement of livestock to meet the needs of producers, processors, and consumers;
  - develop better control measures for important diseases and parasites ;
  - provide technologies which allow the animal to make the best use of the production environment throughout the year;
  - improve the quality and marketability of animal products for Australian and overseas markets.

- Ensure that the appropriate technologies derived from the Division's research are developed into marketable products, all technologies are incorporated into sustainable management systems, and in collaboration with the extension agencies, promoted to the livestock industries.

- Obtain a portfolio of funds necessary to sustain effective and appropriate research and utilise good planning practices to provide a basis for the allocation of resources which optimises the national benefits of the Division's research within the framework provided by CSIRO and the Institute.

INTERDIVISIONAL COLLABORATION

The Division is a participant in the following inter-Divisional Programs: *Fibre Utilisation Program* (8% of total Divisional resources) in collaboration with the Divisions of Animal Production and Tropical Crops and Pastures. *Vaccine Technology Program* (3% of total Divisional resources) in collaboration with the Divisions of Animal Production and Biomolecular Engineering.

SPECIFIC OBJECTIVES *- Percent of Total Resources* *- CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Produce effective sub-unit vaccines against ephemeral fever and other arboviruses. *- 1%*	Evaluation, in a limited pen trial, of a recombinant form of at least one BEF viral glycoprotein for protective ability against bovine ephemeral fever, with a view to possible commercialisation at a later date.
Quantify the distribution and competence of possible vectors of viruses of importance in the cattle and sheep industries. *- 3%*	Completion of the species analysis of collections made in WRDC Project CT13, the distribution of vectors of arboviruses affecting sheep. Subject to approval of an external funding proposal, the establishment of suitable sites and times for collection in southern Australia of *Culicoides victoriae*, in preparation for vector competence studies with bluetongue viruses. Examination of the effect of ivermectin treatment of sheep on the survival of *C. brevitarsis* fed on those sheep.

Produce non-living vaccines against ticks and maintain chemical control of ticks.
- *12%*
- *AP-4 (see page 18 for codes)*

Completion of the purification of protective antigens from tick larvae and generation of sufficient sequence information for gene isolation to be carried out.

Further characterisation of adult tick antigens with the aim of clarifying whether material previously characterised contains additional protective components.

Performance of pen trials with new recombinant antigens as they become available from Biotechnology Australia, and the performance of trials of recombinant antigens singly or in combination under field conditions.

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

Produce non-living vaccines against the tick fever organisms, *Babesia spp.* and *Anaplasma marginale*.
- *13%*
- *AP-4*

Evaluation, in a pen trial, of 4 new compound adjuvants with recombinant Babesia bovis antigens for their ability to induce more reproducible levels of protection. Development of an IgG isotype assay for use as a cross check on protection.

Evaluation of baculovirus expressed 12D3 B. bovis antigen for protection in cattle in combination with different antigens and with different adjuvants, by October 1992, followed by the evaluation of the triple antigen Babesia vaccine under tick challenge conditions in a field involving 120 adult cattle at the Amberley Field Station. This trial is to be completed by April 1993.

Evaluation of the protective capability, using pen trials, of recombinant antigens derived from a library prepared from a protective protein fraction of Anaplasma.

Sub-fractionation of a protective lipid-enriched fraction of Anaplasma and testing of components for their protective effect in pen trials.

Further development of the diagnostic ELISA assay for *Anaplasma* to increase its accuracy to greater than 95% with less than 5% false positives and no false negatives.

Produce a vaccine against the larvae of the sheep blowfly.
- *6%*
- *AP-4*

Commencement of cloning, sequencing and expression of a protective protein from Lucilia cuprina. Purification of two additional protective antigens extracted from sheep blowfly larvae.

Establishment of the mechanism of action of the larval growth retardation activity in sheep vaccinated with a protective protein from Lucilia cuprina.

Produce a vaccine against the adult buffalo fly.
- *7%*

Continuation of the search for efficacious antigens, including peritrophic membrane antigens, using biochemical techniques.

Isolation of any proteins in the buffalo fly which are homologous to at least two known protective antigens in blowflies and cattle ticks, using biochemical and genetic engineering techniques.

Investigation of the digestion and fate of cattle antibodies taken up by buffalo fly.

Develop advanced selection technology for beef cattle to improve product quality and the efficiency with which it is produced.
- *5%*

Technology transfer of results of the consequences of selection research through the Beef Genetic Improvement program and producer Demonstration Sites.

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

Calculation and reporting of the effects of varying levels of management on the relative performance of the selection lines in terms of growth and parasites.

Re-evaluation of industry selection programs, e.g. Breedplan, using estimates of genetic parameters based on the full 10 years data from the Belmont selection programs.

External support to be obtained ($000 K per year for 5 years) for the evaluation of the utility of selection of parent lines in cross breeding programs for growth and meat quality.

Develop molecular genetic techniques for improved livestock breeding.
- *9%*
- *AP-2, 3*

Isolation of 50 new (total 100) bovine microsatellite markers. The mapping of 100 new markers leading to construction of a bovine linkage map with 180 markers.

Regional (physical) localisation of 5 new genes or markers. Development of a robust procedure for the micro-dissection of bovine chromosomes and the construction of regional libraries.

Isolation and precise localisation of highly informative markers for the polled gene in cattle. Testing of 30 new markers for linkage to the Booroola fertility gene in sheep.

Initiation of meat quality marker study by genotyping the first Charbray family for 25 markers. Completion of breeding of the second and third Charbray families for the meat quality marker project.

Finalisation of commercialisation of diagnostic test for Pompe's disease.

Exploit the phenomenon of hybrid vigour to produce cattle more suited to the tropics and subtropics than those currently available.
- *7%*

Collection of one year's data on reproductive rates of first-cross highly tick resistant Herefords on Brahmans, compared to F_nBX and Brahmans, in different environments. Production of extra tick resistant animals by back crossing resistant dams to their sire, and evaluation of the tick resistance of these calves. Evaluation of the 3-way cross involving tick resistant Herefords over Brahmans and BX.

Production of an additional 70 purebred Boran and Tuli by embryo transfer and natural mating. Initial comparison of growth of Boran and Tuli crossbreeds with that of existing breed and the production of an additional 300 Boran and Tuli crossbreeds for evaluation purposes at Belmont.

Develop technologies to increase calving rate of female cattle, to suppress fertility of male and female cattle, and to regulate the onset of puberty in male and female cattle.
- *7%*
- *AP-5*

Continuation of studies aimed at identifying a single dose, dry-phase implant for endocrine vaccines in cattle, including the potential of vectors for antigen delivery.

Investigation of schedules of prepubertal steroid immunisation with respect to increasing reproductive characteristics of both male and female cattle.

Initiation of studies on sperm preservation and encapsulation with a view to developing technologies for prolonging the survival and fertilizing capacity of sperm after artificial insemination.

Initiation of studies on *in utero* masculinisation of female cattle for use in terminal crossbreeding systems.

Manipulate metabolic processes to attenuate weight loss in cattle resulting from poor dry-season pastures.
- *16%*
- *AP-5*

Identification of receptor α2 receptor subclass(es) responsible for the metabolic rate-lowering action of guanfacin by blocking the action of guanfacin with selective inhibitors. Evaluation of any possible adverse effects of chronic treatment with α_2 agonists in cattle with respect to effects on feed intake; reaction time; heart rate and/or behavioural response. Development of an effective protein-linked guanfacin antigen.

Isolation of purified receptor (initially β_2) sufficient for immunological studies. Testing of possible anti-clenbuterol anti-idiotypic antibodies (in collaboration with the Division of Animal Production) for efficacy in muscle. Determination of the relative importance of β_2 and β_2 adrenoceptors in controlling muscle growth in rodents.

Evaluation of the ability of toxins from plants of the *Pimelea* species to induce antibodies in cattle as preliminary to developing a protective vaccine against *Pimelea* poisoning.

Completion of studies of the action of IGF-1 in undernourished cattle (in collaboration with the Division of Human Nutrition).

Improve nutrition of northern cattle and sheep by increasing energy and protein digestion through dietary and microbial manipulations.
- *8%*
- *PP-2*

Assessment of esterases and etherases from rumen and non-rumen microbial sources in facilitating depolymerisation of lignin model compounds and forage lignin. Development of assay techniques for esterases and application to detection of enzymes in situ.

Initiation of development of DNA probes for tracking population numbers and dynamics of rumen microbes. Commencement of studies on dynamics of defined cellulolytic rumen microbes, in relation to movement of plant material and microbial protein from the rumen.

Completion of investigations of effects of early weaning and supplementary feeding on reproduction rates in northern cattle and of the evaluation of *Acacia nilotica* as an animal feed.

Generalise and extend existing vaccine technologies and develop new methods of control, prevention and detection of parasitic diseases.
- *6%*
- *AP-4, MF-5*

Demonstration of effective inhibition of BEF virus replication in cell culture, using ribozymes directed at BEF virus mRNA. Investigation of delivery of minizymes (produced by Division of Biomolecular Engineering) to BEF virus infected cells in culture and in infected cattle.

Construction of a rabies virus-like particle (VLP) in insect cells by using baculovirus expression vectors. Demonstration of the expression of a foreign indicator gene in mammalian cells using rabies VLPs.

Characterisation of the proteins of the rhoptry organelle of haemoprotozoa as source of protective antigens. Development of a functional assay for at least one protective antigen of Babesia and use of that assay to make an assessment of the significance of that antigen in other species.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues	$8,020,900
Sponsored Research:	$2,653,000
Total Budget:	**$10,673,900**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 30% of its total budget from external sources for 1992-93.

7.6 DIVISION OF WOOL TECHNOLOGY

OBJECTIVE

To increase worldwide demand for Australian wool, wool products, hides, skins and leather.

STRATEGY

- Develop innovative 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 practical, promote their adoption in Australia.

INTER-DIVISIONAL COLLABORATION

Environmentally and economically acceptable methods of disposing sludges from wool scour effluent treatment in collaboration with Division of Chemicals and Polymers. (1% of Division's resources)

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop technology and other knowledge aimed at increasing consumer demand for products made from Australian wool. - *46%*	Upgrading of FAST users manual with incorporation of a chapter on garment manufacture. Specification of the required measurements for the prediction of knitted fabric performance during making -up. Development of a durable stain repellent finish for wool apparel and upholstery. Introduction of V-groove spinning to the industry via trade fairs and/or industrial development trials. Demonstration of the commercial viability of the new differential dyeing technique. Elucidation of the influence of fibre surface energy on wear comfort. Completion of assessment of the relative importance of mean fibre diameter distribution on the perception of prickle in knitted fabrics and initiation of similar studies on woven fabrics.
Improve the efficiency of conversion of raw wool to end products. - *32%* - *RM-4, EDEA-3* *(see page 18 for codes)*	*Commercial agreement for introduction to industry of an environmentally acceptable process for shrink resisting wool sliver.* *Licence for the manufacture and sale of the new dyeing auxiliary (Sirolan LTA) outside Australia and New Zealand.* *Transfer the new low temperature dyeing technology to wool processors in Australia and New Zealand.*

	Completion of commercial agreement to transfer antisetting agent technology to industry. Determination of the effectiveness of hydrocyclones for replacing the settling tanks in the scouring process. Completion of fundamental study of dirt redeposition on wool fibres during scouring.
Develop techniques to completely specify raw and semiprocessed wool so as to facilitate the marketing of wool (Sale by Description and the prediction of processing performance). *- 13%*	Commercialisation of an instrument for the measurement of the mean and distribution of fibre diameter. Evaluation with trade collaborators of prototype instrumentation and metrology for wool style and formulation of a joint strategy for development of appropriate commercial procedures
Develop new or improved processes for handling, marketing, preservation and conversion of hides and skins into leather products. *- 7%*	Implement within the Australian industry a sub 24 hour procedure for converting raw hides to wet-blue leather with significantly reduced effluent. Completion of a commercial evaluation of a wool pulling machine.
Develop new or improved textile filter media, filtration processes and related instrumentation for the benefit of Australian industries. *- 2%*	Improve control strategy for pulse-jet filter management in power station applications.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues	$13,469,700
Sponsored Research:	$19,401,000
Total Budget:	**$32,870,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 45% of its total budget from external sources for 1992-93.

7.7 BIOMETRICS UNIT

OBJECTIVE

To provide statistical expertise for CSIRO's agricultural, biological and environmental Divisions. (All Divisions in the Institutes of Animal Production and Processing, Natural Resources and Environment, and Plant Production and Processing).

STRATEGY

- Collaborate in Divisional research projects.
- Provide a high quality consulting service.
- Train Divisional staff in basic statistical methods and in the use of statistical computer packages.
- Carry out biometrical research relevant to Divisional programs.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Collaborate in Divisional research projects and provide a high quality statistical consulting service. - *75%*	Location of staff in each Division as required for consulting. Writing of material for publication and/or consulting reports.
Train Division staff in basic statistical methods and in the use of statistical computer packages. - *10%*	Presentation of short courses including: Introduction to Genstat 5, Regression Modelling, Design and Analysis of Experiments. Introduction to Basic Statistics and Minitab. Training of staff via one-to-one consultations.
Carry out biometrical research relevant to Divisional programs. - *15%*	Continuation of projects on Statistics for Food Science and Statistics for Animal Science. Commercial provision of new applications software.

1992-93 RESOURCES SUMMARY

Appropriation Total Allocation: (includes earned appropriation revenues	$511,600
Total Budget:	**$511,600**

8. INSTITUTE OF PLANT PRODUCTION AND PROCESSING

OBJECTIVE

To benefit Australia's plant-based industries through research that improves Australia's international competitiveness and market access and maintains the resource base.

STRATEGY

The Institute's key strategies are to

- *Give priority to research that will enhance the prospects of rural industries either with current or potential comparative advantage with particular emphasis on Asian markets.*
- *Apply modern biology to the improvement of plant production and primary products.*
- *Apply modern science and technology to developing the highest quality products for specific markets.*
- *Restructure CSIRO temperate and mediterranean pasture research in alignment with other research institutions with a view to forming strategic alliances. Increased support from industry will be sought.*
- *Maintain emphasis on field crops and seek increased industry involvement particularly for research related to product competitiveness. Emphasise sustainability of production through conservation of the resource base.*
- *Seek increased industry support for horticultural research. Emphasise application of biotechnology to production and post-harvest problems including transport, disinfestation and contaminant minimisation.*
- *Increase industry support for forestry. Selective emphasis on increasing the volume and quality of the feedstock resource base to take advantage of possibilities to increase exports and reduce imports. Assist industry to adapt to the changing forest resource.*
- *Increase effort on wood products, especially through increased industry support.*
- *Research for processed food products to be selective with a focus on product quality and differentiation and greater industry involvement.*
- *Redeploy experienced staff and form multi•skill teams with other CSIRO Institutes to strengthen research programs on the sustainability of agricultural production. Some redeployment of Appropriation funds to encourage increased external funding.*
- *Increase effort directed towards better understanding of native flora, fauna and ecosystems, and towards conservation of biodiversity.*
- *Promote the Australian National Herbarium, the Australian National Insect Collection, plant genetic resource centres and other biological collections as important national resources for the conservation of biological diversity.*
- *Undertake more systematic appraisal of research proposals and evaluate regularly the benefits accruing from research.*

The main businesses served by the Institute are those concerned with wheat, coarse grains, grain legumes, oilseeds, sugar, cotton, timber and horticultural crops, including new crops in these categories. The work on pastures and insect pests serves the wool, beef and sheep meat industries.

PLANNED OUTCOMES

- Evaluate the potential contribution of soil biology as a focus for future research of the Institute including the re-establishment of an effective research capacity in plant nematology.

- Evaluate the future role for CSIRO research in the dryland farming systems based on pasture/grain production in SE Australia, taking account of the findings of the 1989 review of mediterranean agricultural research.

- Implement CSIRO priority decisions concerning proposals developed for rural land management, biological diversity, reducing reliance on pesticides; and genetically modified organisms for agriculture, industry and medicine.

- Develop effectiveness and efficiency indicators especially for R&D performed for external clients, that reflect the benefits of the research and ensures that such funding is compatible with CSIRO's longer-term strategic research.

- Develop and implement the Institute's response to the recommendations from the performance evaluation of the Division of Plant Industry.

- Conduct market research on decision support systems, using GRAZPLAN as a model, to evaluate them as a means of achieving technology transfer.

- Develop a database of farmer productivity groups to provide access to prime target audience for technology transfer activities.

- Develop Divisional human resources plans to encompass the current and following triennium (1994-97) and consistent with strategic directions of the Divisions.

- Implement procedures for full program and project costing developed by Institute working party.

- Examine the feasibility of sharing administrative and research support services at Glen Osmond, SA and Black Mountain, ACT.

- Initiate arrangements to evaluate during 1993-94 the performance of the Division of Entomology.

- Develop guidelines for annual assessment of projects that provide for evaluation of progress against research and technology transfer objectives, the level of investment, the quality of scientific practice, and staff management.

INSTITUTE OF PLANT PRODUCTION AND PROCESSING

SUMMARY OF RESOURCES 1992/93

(Estimates at 25 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Entomology	117.9	317.9	14965.5	9044.2	24009.7
Forest Products	57.0	106.0	7295.7	1758.0	9053.7
Forestry	81.0	173.0	10207.4	2032.4	12239.8
Horticulture	48.0	97.9	6197.9	1930.8	8128.7
Plant Industry	186.6	463.1	24768.5	9349.0	34117.5
Soils	84.0	177.5	11080.4	2891.1	13971.5
Tropical Crops and Pastures	69.0	147.0	13122.4	3251.8	16374.2
Biometrics Unit	4.0	2.0	531.8	14.2	546.0
Institute Office	2.0	10.1	945.1		945.1
Other Institute[b]			4857.1		4857.1
TOTAL	**650**	**1496**	**93971.8**	**30271.5**	**124243.3**

Note: Columns may not add to totals due to rounding.

[a]Appropriation includes earned appropriation revenue plus ILS (Internal Lease Scheme) allocation and May Statement Funds.

[b]Includes $0.650m administered on behalf of all Institutes (CABI) and $4.129m administered on behalf of Divisions (CABI).

INSTITUTE OF PLANT PRODUCTION AND PROCESSING

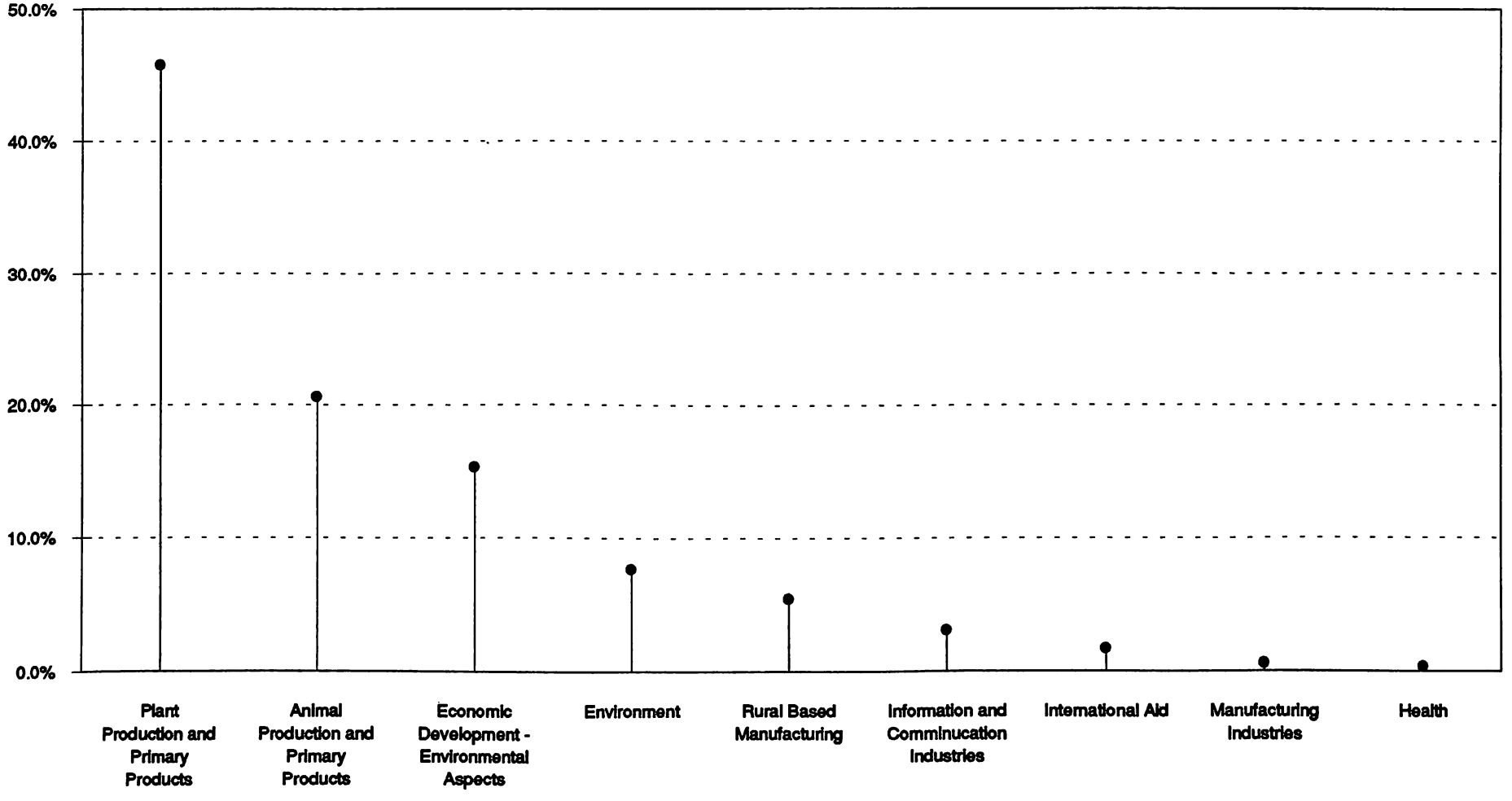
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE 1992/93

(estimates as at 11 May 1992)

RESEARCH PURPOSE	ENTOMOLOGY	FOREST PRODUCTS	FORESTRY	HORT	PLANT INDUSTRY	SOILS	TROPICAL CROPS & PASTURES	TOTAL
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
PLANT PRODUCTION & PRIMARY PRODUCTS	10956.0	1221.3	8397.2	7461.3	19163.8	3666.2	5867.0	56732.8
ANIMAL PROCUCTION & PRIMARY PRODUCTS	6325.6				8305.5	1398.8	9490.8	25520.7
RURAL-BASED MANUFACTURING	177.1	5419.4	348.3		791.0			6735.8
MANUFACTURING INDUSTRY	202.4					471.2		673.6
INFORMATION & COMMUNICATION	1113.3				1222.5	1398.8		3734.5
ECONOMIC DEVELOPMENT-ENVIRONMENTAL ASPECT	2682.1	2900.5	1960.6	1105.1	2265.1	6728.8	1380.5	19022.7
ENVIRONMENT	3668.9		709.4		3991.0	1060.1		9429.4
HEALTH	177.1				215.7			392.8
INTERNATIONAL AID			1483.4				517.7	2001.1
TOTAL	25302.5	9541.2	12898.9	8566.4	35954.6	14723.8	17255.9	124243.4

Note: Columns may not add to totals due to rounding.
Institute Office funds are included in above figures.

Distribution of Total Expenditure by Research Purpose, 1992-93



8.1 DIVISION OF ENTOMOLOGY

OBJECTIVE

To devise ways of controlling insect and other pests of crops, crop products, livestock and man, and to understand the role and impact of insects in the environment.

STRATEGY

- The Division exploits its uniquely wide range of scientific skills in biological, chemical, physical and mathematical disciplines in three main fields of endeavour: pest control, use of beneficial organisms and study and conservation of the natural environment.
- It seeks to improve existing pest control practices, to develop novel techniques that lessen reliance on chemical methods and to provide rational integrated combinations of these systems.
- In each case, it 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 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.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plans*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Study the ecology and behaviour of major pests attacking field and horticultural crops, and in the case of termites, timber and building materials. Develop effective management strategies against them that increase productivity and minimise the need for broad spectrum insecticides, thereby reducing environmental problems and residues. - *14%* - *PP-3 (see page 18 for codes)*	Commence a program on the biological control of breadfruit mealybug in the Pacific. Complete studies on the ecological genetics of endosulfan resistance in *Helicoverpa armigera.* Complete the development of the HEAPS simulation model for heliothis and continue with its validation and application to management problems in cotton. Complete the studies on the impact of leucaena psyllid on leucaena crops in eastern Australia. *Commence studies on the heat-dosage response relationships of codling moth and light brown apple moth to elevated temperatures in fresh fruit.*

Find and assess potential biological control agents for important introduced and native weeds in Australia. Subsequently to release, establish and evaluate selected control agents. Integrate biological and other methods of weed control in order to improve the level of overall control in agricultural and conservation areas.
- *21%*
- *PP-3*

Development of strategies for biological control of weeds of agricultural importance including skeleton weed, Patterson's curse, common heliotrope, nodding thistle, slender thistle, scotch and related thistles, St John's wort, horehound, sida and caltrop.

Develop strategies for biological control of weeds of conservation importance including mimosa, bitou bush, bridal creeper, scotch broom and certain aquatic weeds.

Complete the new Montpellier laboratory and pursue possibilities for increasing its versatility as a European research base.

Continue to pursue collaborative projects to establish biological control of certain weeds in developing countries.

Develop well-based, efficient pest and commodity management strategies for stored grain and similar products.
- *16%*
- *PP-3*

Pursue development of alternative fumigation technologies that do not rely on methyl bromide or phosphine to provide tools for resistance management and as replacements in the event of loss of either major fumigant through resistance development or regulatory action.

Commence studies on mechanical techniques for disinfestation of stored grain with a view to developing a cheap and rapid residue-free process capable of replacing methyl bromide fumigation.

Complete studies on the biology, distribution and control of *Trogoderma variabile*, a recently-introduced and important stored product pest.

Complete development and commercialise techniques and apparatus of generation of phosphine fumigant external to the grain storage structure.

Develop environmentally sound technologies for pest control as adjuncts or alternatives chemical pesticides, especially by means of entomogenous nematodes, and the fungus *Metarhizium anisopliae*.
- *8%*
- *PP-3*

On ACIAR funds and in collaboration with Chinese scientists, evaluate new strains and new application methods for nematodes to control *Carposina* in China.

Determine what is the optimal biochemical composition of *S. carpocapsae* for long term storage at 5 and 23C.

Study the behavioural factors influencing the efficacy of Metarhizium in control of termites and evaluate different formulations based on carriers, strains and synergists.

Continue negotiations with potential partners with the aim of entering into a commercial agreement on a mycoinsecticide for termites.

Document, describe and improve the understanding of Australia's insect and mite fauna with special emphasis on those groups that are of economic, social or scientific or social/environmental importance.
- *11%*

Complete CD-ROM-based, interactive, expert identification system to the *Coleoptera* (beetle) larvae of the world.

Complete and publish computerised checklist of all names ever associated with the Australian fauna of *Lepidoptera*, summarising knowledge of their taxonomy, nomenclature and classification.

Complete entering of all records of *Isoptera* (termites) into ANIC Database.

Complete account on *Coleoptera* for the period 1986-1989 from the Wog Wog habitat fragmentation experiment.

Commence entomological component of the Cape York Peninsula Land Use Strategy (CYPLUS).

Undertake strategic and applied research into the molecular biology of insect development, reproduction and pathology. Conduct research into the development and exploitation of gene transfer technologies in insects, along with their associated bacteria and viruses so as to develop new ways of controlling insect pests with minimal environmental disruption.
- *15%*
- *PP-3*

Generate recombinant baculoviruses containing toxin-encoding genes and test their efficacy, develop a recombinant HeEPV and assess parameters affecting its production and stability.

Clone dipteran esterase genes involved in OP resistance, purify juvenile hormone esterase and obtain peptide sequence data, and clone and sequence the genome of a small RNA virus and then subclone the capsid genes into an expression vector for evaluation of their anti-feedant effect.

Conduct field evaluation of the monoclonal antibody identification kit for distinguishing between heliothis pests of cotton.

Commence characterisation of the factors underlying resistance to Bt toxins in heliothis.

Assess feasibility of biological control options and varieties of sub-clover (resistant) to red-legged earthmite.

Develop strategies for the eradication or control of insects and related invertebrates affecting humans, livestock and pastures, that are either in Australia or threaten to enter the country. These management approaches will minimise the use of pesticides through the implementation of ecologically sustainable practices.
- *15%*
- *PP-3*

Develop a facility in Malaysia capable of mass rearing Screw worm fly in order to test procedures for sterile insect control of this pest.

Complete a management model to minimise insecticide usage in controlling flystrike in sheep and validate the model against field data.

Continue studies on the distribution, population dynamics, seasonal variation of dominant species of earthworms in soils used for cereal cropping and pastures in south eastern Australia and the effects of earthworms on soil structure, fertility and plant production.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$14,965,500
Sponsored Research:	$9,044,200
Total Budget:	**$24,009,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 38% of its total budget from external sources.

8.2 DIVISION OF FOREST PRODUCTS

OBJECTIVE

The Division's objective is to benefit Australia by increasing the quality and value of forest products.

STRATEGY

The Division works closely with forest-based industries and the Division of Forestry in conducting research to develop:

- Increased profitability through efficient use of wood resources and technologies for new products and processes.
- Environmentally improved practices and processes.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To improve the efficiency and value to the community of the Australian timber and wood based products industry. - *50%* - *RM-6 (see page 18 for codes)*	Develop a fundamental understanding of collapse in young, relatively fast-grown hardwoods. Assist hardwood utilisation by developing improved sawing patterns and drying schedules. Complete a CSIRO/USDA world-wide database of commercial timbers for publication in two volumes, for broad reference use by the timber trade, and allied industries. Develop strategies with our commercial customers for termite control in buildings, including extending the commercialisation of non-chemical barriers. *Increase the utilisation of plantation softwoods by improving durability and stability in service, by studying sawing and drying in terms of value added product development, and by continuing to market our continuous high temperature drying technology.* Provide expert assessment of potential biocides to assist the industry in developing environmentally acceptable wood preservatives and preservative systems. Produce a suite of advisory leaflets on control of decay, wood borers, and termites in dwelling.
To improve the profitability of the Australian industry using wood as a fibre source with technology which is environmentally acceptable, and enhance knowledge of wood as a raw material as an aid to decision-making for the forestry, pulp and paper, and reconstituted wood industries. - *50%*	Develop composite products with potential for commercialisation for the building, horticultural and animal health industries based on recycled newsprint as a means of reducing community waste. Advance the formulation of faster curing, phenol/formaldehyde resins for medium density fibreboard (MDF), laminated veneer lumber (LVL) and plywood production to the stage of commercial acceptance

Further develop the scanning microdensitometry equipment so that eucalypt wood can be measured.

Determine the effect of alkali and sulfide profiles on the efficacy of extending delignification in the pulping of eucalypt woods beyond the current end point without detrimental effect on pulp strength.

Propose a modified technology for rayon manufacture based on the current invention but avoiding the use of environmentally questionable solvents.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$7,295,700
Sponsored Research:	$1,758,000
Total Budget:	**$9,053,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 19% of its total budget from external sources.

8.3 DIVISION OF FORESTRY

OBJECTIVE

To increase economic benefit to Australia by improving the productivity and management of the nation's forests on an ecologically sustainable basis.

STRATEGY

- Develop advanced methods of tree breeding for improving economically important characteristics.
- Improve silvicultural and operational systems for increased and sustained productivity .
- Determine the effect of growing conditions on wood properties which influence the quality of end products.
- Improve methods for protecting forest resources from fire and to minimise losses from pests and diseases.
- Evaluate and select trees for wood production and for the amelioration of land degradation.
- Improve communication and cooperation with forest industry and develop where appropriate, commercial opportunities which arise from research.

SPECIFIC OBJECTIVES *- Percent of Total Resources* *- CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To explore, sample, characterise, evaluate conserve and distribute 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%*	Development of a decision support system to assist landcare planners and advisors in the selection of tree species for planting in areas affected by dryland salinity. Preparation of an annotated bibliography for *Casuarina equisetifolia.* Evaluation of genetic variation in the *Eucalyptus urophylla/pellita* complex using isozyme, morphological and leaf oil characteristics for use in plantings in the lowland, humid tropics. Preparation of information for the major review of the current AIADAB-funded "Seeds of Australian Trees" project and development of a replacement project proposal.
Determining options for the management of native forests on an ecologically sustainable basis for wood production. *- 17%* *- ENV-3 (see page 18 for codes)*	A final report covering the collaborative studies between the Division and the Victorian Department of Conservation and the Environment (DCE) on tree nutrition, stem defect and coppice biology. Establishment of field trials to measure response to fertilisation of: • Young natural regeneration. • Thinned and unthinned 25 year-old regrowth. • Young plantations of *E. sieberi, E. baxteri* and *E. globulus.* Establish the importance of minor damage incurred by *E. sieberi* during mechanical thinning. Trials will be established to determine the longer term consequences of such damage as causes of wood degrade in standing trees.

Complete research and development of the "National Bushfire Model". PC-based software will be made available as "on line" fire suppression DSS, and as a training module.

Develop fire behaviour models and prescribed burning guidelines to minimise crown and bole damage to young regrowth E. sieberi (the major commercial species in coastal eucalypt forest of the SE of Australia).

Improving methods for optimising the quantity and quality of wood from radiata pine plantations on a sustainable basis by an increased understanding of genetic diversity within the species and the effects of soil, environment and stand management on productivity.
- *27%*
- *EDEA-3*

Establish data sets for initial linkage analyses for high density RFLP linkage maps in *Pinus radiata* and *Eucalyptus nitens*. Develop assay procedures for RAPD markers in pines and eucalypts.

Conduct preliminary thermo-mechanical pulping trials on a commercial scale to determine the combination of wood density and fibre length that is most economical in the consumption of energy.

Estimate genetic correlations and genetic gain in mature stemwood of *P. radiata* consequent upon selection for NESTUR, a stem growth index in seedlings.

Complete instrumentation and a full growing season's monitoring of components of the water and nutrient cycles and tree growth in effluent plantations at Wagga. Commence water and nutrient model development as well as preparation of preliminary plantation management guidelines.

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%*

Develop a model to assess available water capacities of soils and their potential for meeting evaporative demand in managed plantations in order to obtain best fit of species to site.

Develop a mechanistic model which predicts total production and stem height, diameter and volume growth in response to radiation and temperature. Test the model using data from *E. nitens* and *E. globulus* experiments at Esperance.

Develop a project on very early selection of eucalypts (seedling stage) and determine if techniques that have been applied successfully in *Pinus radiata* are useful in eucalypts.

Submit a final report to Bunnings Treefarms on the results of mycorrhizal research in WA over the last five years and provide proposals for new directions the work could take in the light of recent results.

1992-93 RESOURCES SUMMARY

Appropriation Total Allocation: (includes earned appropriation revenues)	$10,207,400
Sponsored Research:	$2,032,400
Total Budget:	**$12,239,800**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 17% of its total budget from external sources.

8.4 DIVISION OF HORTICULTURE

OBJECTIVE

Improve crop quality, efficiency and sustainability of horticultural production on-farm, and improve product specification and post harvest handling off-farm for Australian crops of the temperate, subtropical and tropical zones.

STRATEGY

Emphasis is placed on developing new techniques for the selection and breeding of improved horticultural crops, understanding the complex interaction between plant performance and the environment, understanding the factors limiting the shelf-life of horticultural products, and developing improved post-harvest handling techniques.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop superior new varieties of grapevines, citrus and other horticultural crops and better crop management systems to enhance productivity and quality. - *35%*	Evaluate hybrid and F2 segregating populations generated from promising melon genotypes. Conduct semi-commercial trials with controlled atmospheres for dried fruit disinfestation. Assess affects of GA and calcium sprays on incidence of albedo breakdown in oranges. Conclusion of work on overcoming problems associated with breaking winter dormancy in pistachios. Review pistachio program and formulate Division's future research role for this crop. Obtain potato tuber polyphenol oxidase genes. Obtain genes specific to nucellar embryogenesis. Distribute new varieties e.g. Marroo Seedless and Sunset mandarin through licensed agents, and crop management information through industry newsletters, seminars, field days etc.
Develop novel methods to detect and control viral agents in horticultural species - *12%*	Complete the first round of testing of transgenic tobacco for resistance to TLCV. Obtain a full length DNA clone of the viral agent causing the highest yield losses in leaf roll infected vines.

Establish gene transformation technologies and reliable, objective methods of variety identification. - *11%*	Identify new transformation/infection and regeneration strategies to apply to the production of transgenic grapevines. Establish the limits to objective clonal identification of grapevines and review future research directions. Identify potential commercial partners for DNA fingerprinting technology.
Ensure consistent cropping of selected subtropical and tropical fruit crops by development of improved management techniques and varieties - *11%*	Assessment of growth, yield & nut characteristics of 1988 cashew hybrids and kernel recovery for 1989 hybrids that are fruiting. Development of experimental systems to study physiology and flowering responses to water stress of regular and erratic bearing mango cultivars. Understand the floral induction process in lychee aimed at improving flowering. Commercial treatment of mango for flower induction in NT.
Identify environmental and plant factors limiting productivity of horticultural crops. - *7%*	Determine benefits of CO_2 enrichment to the early growth of variegated ornamentals. Investigate possible role for abscisic acid in controlling vine vigour under conditions of heterogeneous rootzone hydration.
Identify factors controlling ripening, senescence and post-harvest disorders of horticultural crops to enable development of improved post harvest storage procedures. - *17%* - *RM-2 (see page 18 for codes)*	*Develop new generation of techniques for use in active packaging systems.* Evaluate roles of ethylene and cytokinins in floral senescence in broccoli. Extend studies of the influence of heat treatment on fruit quality and disease tolerance in oranges from coastal fruit to export-quality inland fruit. In avocados study the importance of time post harvest to the efficacy of modified atmospheres as a means of extending storage life. *Carry out further commercial scale trials on advanced packaging systems; demonstrate pilot scale HiHume system to potential commercial partners.*
Modify the ripening characteristics of commercial fruits by the introduction of chimaeric genes with promoters responsive to environmental signals. - *7%*	Extend sequence information on the endopolygalacturonase beta-subunit. Seek to isolate and sequence a peach fruit endopolygalacturonase cDNA. Technology transfer - Conclude contract arrangements with commercial partners.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$6,197,900
Sponsored Research:	$1,930,800
Total Budget:	**$8,128,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 24% of its total budget from external sources.

8.5 DIVISION OF PLANT INDUSTRY

OBJECTIVE

The Division's objectives are to carry out modern biological research for the benefit of Australian agriculture, native vegetation management, and food processing industries.

STRATEGY

- conduct research in a broad range of basic and applied plant sciences;
- use postdoctoral fellowship and visiting scientist programs to enhance the skills base;
- develop the next generation of plant scientists, especially those skilled in modern biological research incorporating molecular biology techniques;
- partner Universities and industry in Cooperative Research Centres; and
- establish joint ventures and collaborations to transfer results for industry and community benefit.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To determine the molecular basis of photosynthesis and its role in plant productivity. - *8%*	Determination of the basis of the inhibition of photosynthesis by supplementary UV-B radiation and high light at the molecular level, and the mechanisms of recovery from these environmental stresses. Determination of the extent to which CO_2 released in the bundle sheath cells of C_4 plants leaks back to mesophyll cells. Identification of the DNA elements that regulate the expression of the genes for pyruvate, P_i dikinase and NADP malic enzymes. Examination of the effect of transforming C_4 plants with antisense constructs on photosynthesis and plant performance.
To determine the molecular basis of the interaction between environmental factors, hormones and plant growth and development. - *5%*	Definition of the role of TAACAAA as a generalised GARE, and investigation of its interaction with proteins. Transformation of pea plants with dehydrin constructs suitable for testing the role of dehydrins in desiccation tolerance. Development of an NPA receptor assay for *Arabidopsis* capable of detecting differences in the receptor recognition characteristics. Characterisation of GAs associated with leaf elongation and α amylase induction in barley seedlings. Determination of whether florigenic activity can be detected in phloem exudates of induced *Lolium*, using the isolated apex in organ culture as an assay system.

To develop novel disease resistance mechanisms for crop and pasture species.
- *7%*

Field trailing of transgenic potato plants infected with potato leaf roll virus.

Initiation of legume transformation with DNA constructs derived from the subterranean clover stunt virus (SCSV) genome.

Isolation of host and rust specified genes and their promoters that are specifically involved in rust disease in flax.

Accession of yeast and bacterial systems for *in vivo* testing of ribozymes and development of selection systems for new ribozymes.

To use molecular biology to manipulate plant genes.
- *11%*
- *PP-3 (see page 18 for codes)*

Characterisation of the putative DNA methyl transferase gene in *Arabidopsis*.

Cloning and sequencing of a *Eucalyptus* gene homologous to the *Arabidopsis* leafy floral gene.

Generation of mutations in the M rust resistance gene in flax using the M linked Ac.

Field testing of transgenic cotton plants expressing 2,4-D resistance and determination of true field resistance levels.

Sequencing of giant taro protease inhibitor cDNAs, identification of full length clones and expression in transgenic tobacco to determine if they have effective insecticide activity.

Transfer of novel genetic marker genes into wheat cells and tissues by microprojectile bombardment.

To use a variety of novel techniques to identify genes conferring useful traits and to introduce these genes into important crop and pasture species.
- *8%*
- *PP-4*

Completion of the purification of leucocyanidin reductase and partial amino acid sequencing for the design of DNA probes that will assist in isolating the cDNA for the enzyme.

Transformation of the Australian pasture legumes, sub clover and lucerne, with gene constructs encoding the sulfur-rich protein, SFA-8.

Construction of genes encoding proteins with potential anti-viral activity in lucerne and sub clover.

Transformation of plant cells in culture with artificial chromosomes containing large segments of rye DNA that include the secalin genes.

To improve temperate Australian pastures.
- *11%*

Screening of 126 sub clover accessions from mixed grass-clover stands in the mediterranean region for tolerance to allelopathic extracts from phalaris stubble.

Evaluation of *Medicago laciniata* as a pasture legume for the outer wheat lands and for semi-arid pastoral lands.

Completion of study to determine the accuracy of leaf wax measurements for quantifying the composition of the herbage eaten by sheep grazing mixed pastures.

Commencement of evaluation of five potential acid soil tolerant cultivars of phalaris at three sites in Victoria, and of one drought tolerant cultivar for the marginal phalaris areas at three sites in New South Wales.

To diversify and to improve the adaptation of field-crops in southern Australia.
- *11%*

Determination of whether the poor growth of plants whose roots are restricted to large biopores arises from an inability to extract water fast enough.

Quantification of the sensitivity of whole plant respiration to temperature during growth, and its relationship to the short-term sensitivity to temperature during measurement and to global warming.

Production of cotton and flax plants transformed with stearoyl-ACP desaturase gene in the sense and antisense orientation, and screening of flax cDNA libraries to isolate the linoleoyl-PC desaturase gene(s).

Determination of the commercial potential of a wheat with the tin (tiller-inhibiting) gene in southern Australia.

To increase crop production and to improve the management of water and nitrogen use by cereals, legumes and pastures in the mediterranean climatic regions of Australia.
- *5%*

Determination of the water use of a range of cereal, legume and oilseed crops on yellow duplex soils.

Determination of the influence of drying different proportions of the root environment of lupin on photosynthesis and growth.

Quantification of the rates of uptake of nitrate by wheat roots in respect to age of root and nitrogen status of the plant.

Determination of the potential productivity and water use of pastures at sites with varying rainfall.

To develop economically viable and ecologically sustainable systems of cotton production for Australia.
- *6%*
- *PP-3*

Development of a workable strategy for marketing and support of decision support packages.

Completion of IBM version of entomoLOGIC for release at 1992 Cotton Conference.

Further development of high yielding replacement for Siokra L22, and various lines with combinations of HPR characters.

Completion of testing of soil water and soil nitrogen models in OZCOT.

Determination of the effect of several `key' insecticides on mite outbreaks.

To devise economically efficient and environmentally sustainable systems of crop and soil management.
- *11%*
- *PP-5*

Completion of a contribution to an advisory publication on sustainable tillage, stubble management and crop sequences, based on the Land and Water Care project.

Evaluation of microorganisms involved in crop residue degradation and their potential for development as inoculants for improved management of crop residues.

Maximisation of the contribution of temperate grain legumes towards the productivity of sustainable cropping systems, and increasing the efficiency of nitrogen fertiliser use for cotton and rice by the use of urease and nitrification inhibitors.

To provide a basis for biological conservation, management and use of the Australian flora and vegetation. - *10%*	Completion of population and nationwide survey of flax rust (*Melampsora lini*) isolates using RFLP markers. Release of commercial quantities of seed of Hume Wallaby Grass (*Danthonia richardsonii)* for landscaping purposes. Submission and publication of the 'Handbook of Economic Plants in Australia'. Completion of evolutionary and phylogenetic studies of *Portulaca* in Australia, resulting in `Flora of Australia' treatment and taxonomic revision.
To improve the market value of Australia's grain harvest and cereal products. - *6%* - *PP-3*	Gaining an understanding of the conditions required for renaturation of glutenin subunits in dough systems and using this knowledge to test specific subunits. Identification of sources of genes for genetic modification of starch structure in cereal grains. *Completion of technology transfer of test kits for a full range of six grain pesticides to a commercial partner and to the local cereal industry.* Development of near infrared technology to permit on-the-spot analysis of barley quality for malting, feed and food uses.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$24,768,500
Sponsored Research:	$9,349,000
Total Budget:	**$34,117,500**

DIVISIONAL EXTERNAL EARNINGS TARGET FOR 1992-93

The Division expects to receive 27% of its total budget from external sources.

8.6 DIVISION OF SOILS

OBJECTIVE

To benefit Australia through research and technology transfer which contributes to the sustainable and profitable management of our soil and land resources.

STRATEGY

- Develop profitable and sustainable systems of soil and land management.
- Maintain, enhance and promote knowledge about soils to benefit Australia.
- Identify and anticipate soil issues of national importance.
- Promote education, training and application of soil science.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* (Italicised test indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)
Improve the productivity of crops, pastures and forests and to facilitate revegetation and rehabilitation of degraded soils by developing ecologically sustainable methods and strategies that reduce losses from root diseases, enhance beneficial associations between plant roots and soil organisms and conserve the biodiversity of soil organisms. - *22%*	Recommendations for the timing and extent of grass removal from pastures necessary to protect the following cereal crop from take-all. Management recommendations for optimising earthworm populations in cropping systems of southern Australia. Initiation of a project to identify microbial activities and soil microorganisms that may be useful as bioindicators of soil health and crop productivity. Establishment of trials to examine nutritional limitations to tree seedling establishment on three major forest soils in northern Queensland. Definition of the effect of herbicide residues on cereal root diseases in wheat.
To develop methods for identifying and managing nutrient deficiencies and toxicities in soils which contribute to optimal and sustainable production systems for the production of high quality crops and pastures. - *12%*	Development of a model to predict grain quality in advance of harvest for marketing agencies by identification of the importance of soil type, management practices, variety, applied N and seasonal variations in rainfall and temperature on the quality and nutritional status of wheat and barley grown in SA and Victoria. Further work on potting media, specifically • pH effects on Cu and Zn availability from sewage sludge; • long term supply of manganese; • effectiveness of wetting agents. Evaluate the ecological sustainability of pasture management strategies in savannah woodland through measurements of • biomass of mound-building termites; • N-cycling through mound-building termites; • effects of grazing management on soil biomass.

Investigation of the growth of *'Legionella longbeachii'*, the organism responsible for Legionella disease, in potting mixes and other plant substrates.

Test the effectiveness of selected enzymes as indicators of soil biological activity and land degradation.

To provide methods to measure predict and manage the impact of urban, mining, industrial and agricultural land use on soils and landscapes and to rehabilitate disturbed or contaminated land.
- *21%*
- *EDEA-7 (see page 18 for codes)*

Investigations of waste rock dump stability and erosion potential, and engineered landform evolution at several mine sites including Hammersley Iron, Oaky Creek Coal Mine and Curragh Coal Mine.

Continuation of field trials to investigate the establishment of self-sustaining ecosystems on waste rock dumps at minesites in the wet and dry tropics.

Formulation and implementation of an Operating Plan for the newly formed multi-divisional Minesite Rehabilitation Program.

Development of methods for controlling cadmium content of wheat by trace element additions, careful choice of rotations, selection of appropriate cultivars, and by improving soil and foliar analysis criteria as predictors of grain cadmium content.

Completion of evaluation of the effect of cultivar, fertiliser type and trace element addition on cadmium uptake by potatoes.

To protect Australia's soil resource from physical degradation and thereby maintain and enhance agricultural productivity by developing methods to describe and manage the physical condition of soil.
- *18%*
- *PP-5*

Completion and transfer of results of a study on the effects of tillage and traffic at various moisture contents on cotton soils.

Provision of information to enable land managers to manage surface cover and roughness to minimise erosion and increase water infiltration.

Completion and distribution of publications from the Land and Water Care project on soil degradation in relation to commodity production in the south-eastern wheatbelt.

Investigation of the use of photo-oxidation for identifying physically protected soil organic matter and explore opportunities to develop the method as a test for soil degradation.

To improve land management by developing methods and testing based on knowledge of the properties mineralogy behaviour and distribution of Australia's soils and to disseminate this knowledge through databases.
- *27%*

Testing of the new Australian Soil Classification Scheme using existing data and encourage its adoption and use through the Australian Collaborative Land Evaluation Program.

Sampling, monitoring and revision of the classification of Australian wetland soils and the development of a geographic information system for soil sediment and morphostratigraphic data for the coastal zone.

Identification of soil properties and processes responsible for damage to optical fibre networks in expansive soils and recommendation of ameliorative strategies in collaboration with Telecom.

Investigation of the potential of digital terrain and radiometric data for soil property mapping.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$11,080,400
Sponsored Research:	$2,891,100
Total Budget:	**$13,971,500**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 21% of its total budget from external sources.

8.7 DIVISION OF TROPICAL CROPS AND PASTURES

OBJECTIVE

To benefit the nation through research for the livestock and crop industries of northern Australia.

STRATEGY

- Develop strong linkages with influential members of the grains, beef and sugar industries to facilitate problem definition, technology transfer and funding.
- Assemble multi-disciplinary project teams to address industry and strategic research problems, including involvement with other CSIRO Divisions and other agencies such as State and Territory Departments and Universities.
- Establish an appropriate portfolio of funds and commercial enterprises to support effective and appropriate research.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop new legumes and grasses to increase the efficiency of cattle and sheep production in northern Australia. - *24%*	Establish a collaborative research program on the efficiency of phosphorus use by plants with NZ and CSIRO counterparts. Develop a prototype model for persistence of tropical pasture legumes as a potential aid to selection of new species/cultivars, using *Wynn cassia* (a known persistent legume) as a test plant. Introduce a collection of grasses and legumes from the Kruger National Park in South Africa and commence evaluation to assess their suitability for regeneration of degraded land.
Provide the northern Australian pastoral industries with pasture and animal management systems for economic sustainability. - *26%*	Appoint new scientist(s) to the Davies Laboratory to lead and participate in new research on the structure and functioning of tropical woodlands. Develop technology to measure grazing behaviour within complex landscapes (using satellite tracking systems and still-video imagery). Review "Grazing tolerant tropical grasses" project (AM57) by December 1992. Publish information on run-off and soil loss responses to pasture management at Cardigan, Q.
Breed more productive, higher quality and more disease resistant tropical field crops and develop better management practices. - *25%* - *PP-1 (see page 18 for codes)*	*Initiate a new project on sugar accumulation, including an International workshop to develop collaboration within Australia and with research agencies in USA.* Release new soybean (1), mungbean (2) and cowpea (2) cultivars for commercial development. Complete publication of kenaf research and development.

Develop and evaluate economically sustainable agricultural production systems for tropical and sub-tropical environments. - *15%*	Define the role of the QDPI/CSIRO Agricultural Production Systems Research unit in policy formulation for subtropical croplands in a series of workshops which include members of State policy maker groups. Plan the appropriate R&D capacity and required recruitment and collaborative arrangements to enable the scaling-up and aggregation of outcomes of research projects on agricultural production systems. Conclude the ACIAR funded Kenya project and publish most papers and Symposium Proceedings.
Improve plant and animal production using molecular genetics. - *10%*	Assess transgenic tobacco used as a test plant carrying genes for reduced expression of lignification preparatory to transferring the genes to a commercially relevant grass.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$13,122,400
Sponsored Research:	$3,251,800
Total Budget:	**$16,374,200**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects to receive 20% of its total budget from external sources.

9. INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT

OBJECTIVE

Provide the scientific knowledge required for the effective management and conservation of Australia's natural resources and environment, particularly in relation to the conservation and protection of natural heritage and sustainable use by dependent industries.

STRATEGY

- *Application of the CSIRO methodology to assist in setting research priorities.*
- *Consultation with stakeholders including the INRE, CSIRO Agricultural and Divisional Advisory Committees to target the research and to help ensure its uptake.*
- *Shift the balance in research effort on rural production to an enhanced effort on the ecologically sustainable aspects of rural production.*
- *More focused attention on urban environmental issues particularly in relation to urban air quality and urban water and wastewater infrastructure.*
- *Continuation and initiation of major multi-Divisional programs in an attempt to provide holistic solutions to large complex issues - climate change, coastal zone, land and water care, waste emissions, conservation of biodiversity, algal blooms.*
- *Maintain close liaison with federal government departments and organisations and increase liaison with state and local government agencies.*
- *Continue to seek specific government support for environmental research and greater industry support for fisheries research.*
- *Operation of the INRE Project Office to market and coordinate multi-Divisional skills especially in marine science.*
- *In support of these strategies, the Institute will:*
- *Promote and reward excellence in science and management.*
- *Assess and evaluate rigorously the benefits of current and proposed research.*
- *Market its skills and promote its worth to governments.*
- *Ensure the effective operation of the Institute and Divisional Advisory Committees.*

PLANNED OUTCOMES

- Setting of future research directions for the Divisions of Atmospheric Research and Water Resources as part of the regular review cycle.
- Development of Institute's strategic management plan for 1992-1997.
- Publication of the results of six retrospective benefit-cost analyses and initiation of prospective evaluations on two major Institute research areas.
- Integration of COSSA into the INRE operations.
- Development of an integrated financial and human resource management projection system.
- Renewal and enhancement of external funding for climate change science and impact research and the establishment of a forestry R&D corporation by Government to cover both production and conservation issues in forestry.
- Devolution of the INRE postgraduate project award scheme and the CSIRO/Universities Collaborative Scheme to Divisions with the establishment of Division specific programs for interaction with Universities.
- Effective and efficient operation and establishment of multi-Divisional programs.
- Improved collaboration with State agencies.
- Implementation of the $12 million Port Phillip Bay Environmental Study including contribution to the launch of the study.
- Improved communication within the Institute.
- Effective communication/marketing plans for the CSIRO Coastal Zone and Land and Water Care Programs.
- Maintenance of high quality briefing to the Minister, other politicians, senior Departmental staff, and CSIRO management on environmental issues of national importance; increased briefings at all levels of government on developments in environment research.
- Contribution to ensuring increased sales and subscriptions for ECOS.
- Announce first major outcomes of National Pulp Mills Research Program.
- High public profile for CSIRO during World Environment Week.

INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT

SUMMARY OF RESOURCES, 1992-93

(estimates as at 11 May 1992)

Division	Prof Staff	Total Staff	Approp Total[a]	Sponsored Research Funds	Total Funds
	[EFT units]	[EFT units]	($'000)	($'000)	($'000)
Atmospheric Research	89	150	7159.3	3850	11009.3
Fisheries	92	160	12209	4800	17009.6
Oceanography	50	97	5938.4	2000	7938.4
Water Resources	128	269	15435.7	4050	19485.7
Wildlife & Ecology	108	260	16179.9	4250	20429.9
Environmental Mechanics	16	33	2493.7	705	3198.7
Biometrics Unit	6	7	527.7		527.7
National Facility - ORV Franklin	5	9	4301.6		4301.6
Institute Headquarters	6	11	782.7		782.7
Floreat Park Site Service	2	18	272.4		272.4
COSSA	5	14	2737.7	455	3192.7
Total	**507**	**1028**	**6838.7**	**20110**	**88148.7**

Note: Columns may not add to totals due to rounding.

[a]Appropriation includes earned appropriation revenue plus ILS (Internal Lease Scheme) and May Statement Funds.

INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT

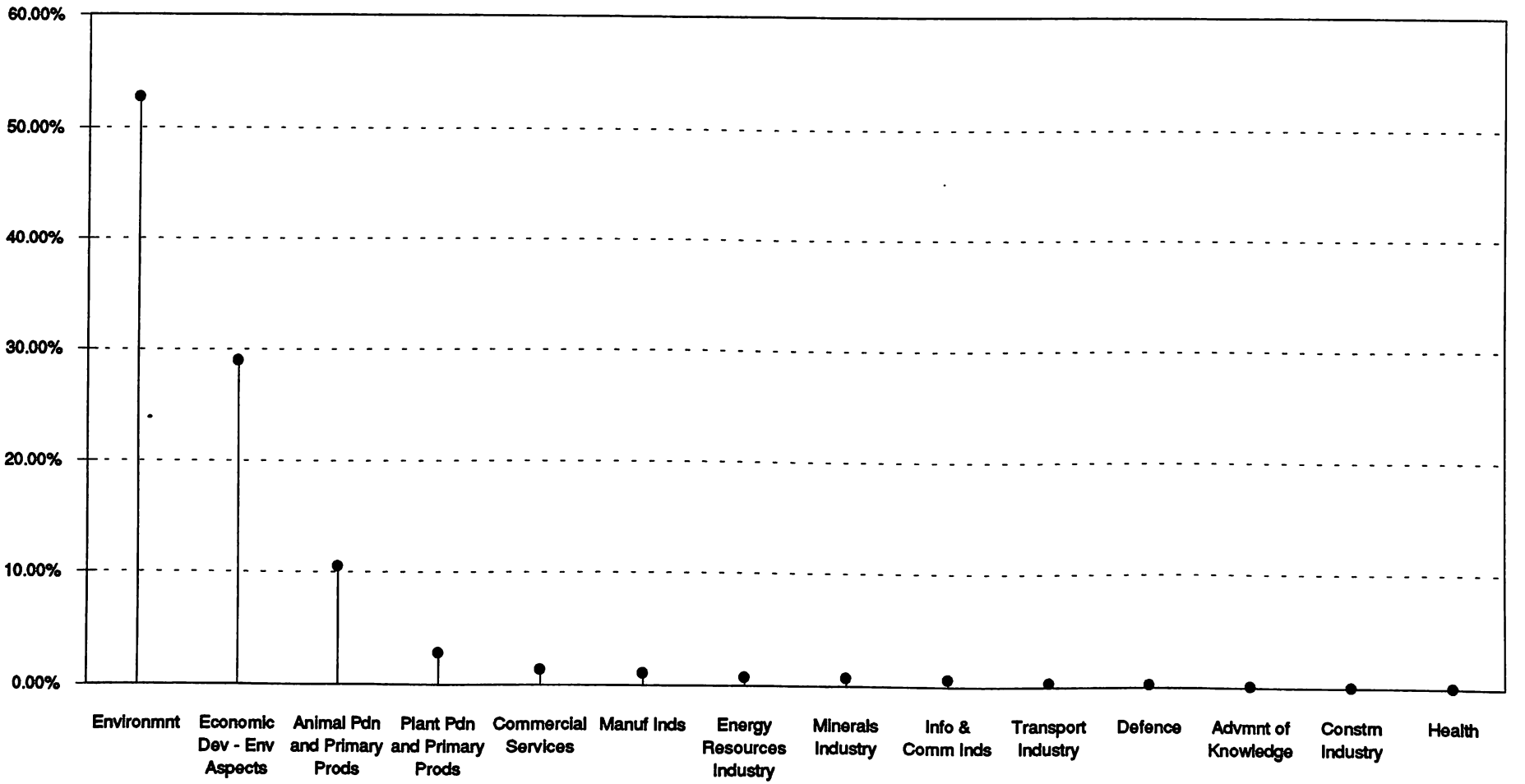
DISTRIBUTION OF RESOURCES BY RESEARCH PURPOSE

(estimates as at 11 May 1992)

RESEARCH PURPOSE	ATMOSPHERIC RESEARCH	FISHERIES	OCEANOGRAPHY	WATER RESOURCES	WILDLIFE & ECOLOGY	ENVIRONMENTAL MECHANICS	BIOMETRIC S UNIT	NATIONAL FACILITY ORV FRANKLIN	INSTITUTE HEADQUARTERS	FLOREAT PARK SITE SERVICES	COSSA	TOTAL
	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)	($"000))	($'000)
DEFENCE	0.0	153.1	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.5	31.9	187.1
PLANT PRODUCTION & PRIMARY PRODUCTS	880.7	0.0	0.0	584.6	0.0	300.7	237.5	0.0	21.9	7.6	255.4	2,288.4
ANIMAL PRODUCTION & PRIMARY PRODUCTS	880.7	7,688.3	436.6	0.0	0.0	0.0	0.0	0.0	81.4	28.3	0.0	9,115.3
MINERAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	1.9	606.6	614.0
ENERGY	0.0	0.0	674.8	0.0	0.0	0.0	0.0	0.0	5.5	1.9	0.0	682.2
MANUFACTURING	0.0	0.0	516.0	272.8	0.0	137.5	0.0	0.0	8.6	3.0	63.9	1,001.8
CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.9	31.9
TRANSPORT	0.0	0.0	277.8	0.0	0.0	0.0	0.0	0.0	2.3	0.0	31.9	312..8
INFORMATION & COMM SERVICES	0.0	0.0	0.0	0.0	510.7	0.0	0.0	0.0	4.7	1.6	31.9	548.9
COMMERCIAL SERVICES	440.4	0.0	0.0	662.5	0.0	0.0	0.0	0.0	10.2	3.5	0.0	1,116.6
ECONOMIC DEVELOPMENT ENVIRONMENTAL ASPECTS	1,541.3	2,364.3	635.1	12,763.1	6,639.7	921.2	52.8	0.0	225.4	78.5	830.1	26,051.6
ENVIRONMENT	7,266.2	6,803.8	5,398.1	5,202.7	12,666.5	1,839.3	211.1	4,301.6	409.4	142.5	1,245.1	45,486.4
HEALTH	0.0	0.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0	0.0	0.0	26.4
ADVANCEMENT OF KNOWLEDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3	63.9	65.0
CAT 150 000	0.0	0.0	0.0	0.0	612.9	0.0	0.0	0.0	5.5	1.9	0.0	620.3
TOTAL	11,009.3	17,009.6	7,938.4	19,485.7	20,429.9	3,198.7	527.7	4,301.6	782.7	272.4	3,192.7	88,148.7

Note: Columns may not add to totals due to rounding.

Distribution of Total Expenditure by Research Purpose, 1992-93



9.1 DIVISION OF ATMOSPHERIC RESEARCH

OBJECTIVE

To improve understanding and to solve significant practical problems concerning the physics, dynamics and chemistry of the atmosphere of the Australian region, and of the globe insofar as it affects the Australian region.

To provide the best possible advice on problems and issues involving the atmosphere.

STRATEGY

Research is focused on three types of problem:

- those which are fundamental stumbling blocks to the forecasting of weather, climate and atmospheric pollution;
- those practical problems which are relevant to community concerns; and
- those which bear importantly on primary and secondary industry.

Much of this research is focused on a series of applied problems; studied in collaboration with operational agencies wherever possible. A core strategic program is maintained in a number of areas so as to preserve an ability to re-focus on new problems as they arise. In addition, commercial exploitation of techniques and instrumentation derived from this research is pursued in joint developments with manufacturing industry. A coordinated plan for atmospheric research in CSIRO and the Bureau of Meteorology will be implemented.

INTER-DIVISIONAL COLLABORATION

The Division coordinates the CSIRO Climate Change Program (48% of Divisional resources) in collaboration with the Divisions of Oceanography, Fisheries, Water Resources, Wildlife and Ecology, Environmental Mechanics and Plant Industry.

It also collaborates with the Divisions of Coal and Energy Technology, Environmental Mechanics and Building, Construction and Engineering in an emerging air quality program.

SPECIFIC OBJECTIVES - *Percent Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Investigate the past, present and future sources, sinks and budgets of trace gases and aerosols in the global atmosphere in order to provide the basis for an assessment of future trends and likely climate impact, as well as to provide the information needed to gauge the efficacy of remedial action. - *15%* - *ENV-1 (see page 18 for codes)*	*A new laboratory for trace gas analyses of the isotopic composition of present-day CO_2 and the automated sampling for a range of other trace gases from a global sampling network what is now operational. Analysis of the historical changes (past 350 years) of air extracted from Antarctic ice cores will continue.*

Global and national budgets for chlorofluorocarbons and methane in relation to both the greenhouse and the ozone depletion issues will be examined, as will the role of background sulfur, nitrogen and aerosol compounds in climate. Field studies examine the exchange of trace gases by specific ecosystems.

Scientific support for the Australian Baseline Air Pollution Station is ongoing.

Development of state-of-the-art computer models of global climate, and simulation of greenhouse-induced climate change using such models.
- *20%*
- *ENV-1*

Continued development of 4-level and 9-level general circulation models, the development of a limited area nested model and the development of a coupled ocean atmosphere model.

New climate change simulations to provide further results for evaluation of model performance as well as use in impact studies.

Assess regional extent and impact of future climate change caused by changing atmospheric composition.
- *13%*

Development and application of new methodologies for analysis of climate change data. Third report to WA, NT and NSW and the fourth report to Victoria. Assessment of national-scale issues such as the behaviour of the monsoon tropical cyclones and the long-term role of ENSO.

Develop a testable computer climate model for assessing the forecasting of drought, and investigate the precipitation mechanisms of frontal and severe storm systems, with specific applications to catchment hydrology and precipitation enhancement.
- *11%*
- *ENV-2*

Drought research relies heavily on understanding the behaviour of the Pacific Ocean, and is now being expanded to include sea surface temperature anomalies in other oceans.

"Proof of concept" experiments with a drought forecasting scheme will continue, and are now being applied in forward looking mode. New projections for 1992/93 will be carried out.

A five year consultancy in cloud seeding over Gippsland for Melbourne Water will be completed. Analysis of field data will now be carried out.

A new method of providing precipitation estimates based on computer modelling studies of precipitation from severe storms is now being targeted for specific catchment.

Examine regional air quality problems and develop a framework for the general understanding of the factors contributing to such problems; develop models for flow in the lower atmosphere for the explanation and accurate prediction of phenomena such as pollutant dispersion and bushfire behaviour.
- *18%*

Extension of research in the Latrobe Valley on sources of chemical constituents which contribute to visibility and air quality (smog) problems in the Latrobe Valley to the Melbourne region.

Strategic research and specific consultancies on sea-breeze and terrain effects on the atmospheric flow near existing or planned power-station sites will continue with application to current problems in Victoria, New South Wales and Western Australia.

Commencement of a new field study of rainwater acidity in NSW, the implementation of an Asian Program of Acidification Research and new consultations on air quality for Malaysia.

Commencement of new project to include reactive chemistry in air quality models.

Completion of analysis of field data for testing theoretical models of transport and dispersion of pollutants in the lower atmosphere gathered during a NERDDP-funded observational study of the Tarong Power Station plume.

Laboratory studies aimed specifically at the problem of how buoyant chimney plumes interact with the connective boundary layer complement this work, using a new CSIRO designed facility (now fully operational).

Develop innovative remote sensing instruments and methods apply these methods to increasing efficiencies and reducing costs in the Australian environmental, agricultural and industrial sectors and to reducing uncertainties in weather forecasting and climate change models.
- 20%

New models and methods of analysis to improve commercial and research products from the Division's remote sensing facility.

First year of a two year feasibility study of the prototype satellite-borne atmospheric pressure sensor supported by the Australian Space Office, and in collaboration with VIPAC Ltd.

Field and satellite studies of land surface temperatures applied to frost risk in wheat in Western Victoria will be carried out.

Following the 1991 launch of the ATSR on the ERS-1 satellite a validation study of SST measurements is now in progress.

The satellite acquisition data system is being used for surface vegetation and cloud climatology studies to improve climate models.

Upgrade of lidar system following successful field testing of lidar techniques for industrial plume spread monitoring is now in its third year. Preliminary observations using the past completed view system are being carried out.

Public communication, advice to Federal and State Governments and lobbying for external funding.
- 3%

Continued role in informing the policy-makers and the general public of major environmental issues (greenhouse effect ozone depletion, regional air-quality issues, drought).

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues)	$ 7,159,300
Sponsored Research:	$3,850,000
Total Budget:	**$11,009,300**

DIVISIONAL EXTERNAL EARNING TARGET

The Division expects that 35% of it's total annual budget will be spent from external funds in 1992-93 based on estimates as at 16 April 1992 up from 32% in 1991-92. The Division has a target of 30%.

9.2 DIVISION OF FISHERIES

OBJECTIVE

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

STRATEGY

- As Australia's largest marine living resources research group, the Division operates throughout Australian waters and adjacent seas, and participates in international research where this is relevant to Australia's needs. The Division undertakes strategic and tactical research in support of the mariculture and fishing industries to assist them to achieve and maintain their economic competitiveness and the sustainable development of their resource base.

- The Division also undertakes research to assist with the assessment and management of the impacts on the marine environment of climate change, economic development, and resource exploitation. The Division works with industry, government agencies and other scientific institutions to identify research problems, facilitate research, communicate the results of its work, and develop commercial opportunities to maximise the benefits to Australia of this research.

INTER-DIVISIONAL COLLABORATION

The Division plans collaborative research with the Divisions of Atmospheric Research and Oceanography in the Climate Change Program; and with the Centre for Environmental Mechanics, Divisions of Soils, Water Resources, Coal and Energy Technology, and Oceanography in the Coastal Zone Program; and with other Divisions, including Tropical Crops and Pastures, Chemicals and Polymers, Animal Production, Entomology, Wildlife and Ecology and Forestry and Biometrics Unit and COSSA, at the individual project level.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To determine the ecological principles needed for managing Australia's tropical fishery resources for ecological and economic sustainability, and to assist government and industry to apply these principles. - *22%*	Describe and determine the role of coastal nursery habitats in determining the long-term productivity of tropical prawn populations. Survey and inventory of coastal resources of northern Australia (from the Torres Straits to Broome) on which the productivity of the Northern Prawn Fishery depends. Develop biological tagging techniques and determine natural chemical fingerprints /tracers for tropical penaeid prawns. Identify and quantify factors that determine interannual variability of recruitment in the Northern Prawn Fishery. Provide information for Great Barrier Reef Marine Park managers on the effects of prawn trawling in the Far Northern Section of the reef.

Provide annual fisheries biomass estimates for resource managers of new tropical fisheries management areas and of existing tropical demersal fisheries on the continental shelf.

Compare the catch rates of commercial species and the effects on benthic structure of newly developed environmentally friendly fishing gear and standard gear.

Monitor and provide rock lobster stock assessments in the Torres Straits area for resource managers.

Assess impacts on tropical fisheries of human activities in the coastal zones.

Complete existing externally funded and contract research for the program's clients.

Continue effective communication between CSIRO and tropical resource managers, commercial and recreational industries and other researchers at the Northern Prawn Fishery and other workshops.

To determine the ecological principles needed for managing Australia's temperate and deepwater fishery resources for ecological & economic sustainability, and to assist government and industry to apply these principles.
- *25%*

Complete the acoustic and egg production evaluation of the abundance of Orange Roughy stocks off eastern Australia.

Develop and apply acoustic and egg production techniques for estimating stock abundance in oreo dory and blue grenadier fisheries.

Provide the research results to resource managers to assist in the determination of fishing quotas in the South East Trawl Fishery.

Continue close contact between CSIRO and resource managers, and industry liaison with commercial fishing and recreational peak fishing industry bodies.

Complete evaluation of use of otolith microchemistry as a tool for reconstructing the reproductive life histories of finfish.

Continue faunal delineation, taxonomic and genetics studies on commercially important fisheries groups.

Participate in stock assessment for resource managers of Southern Shark, South East Trawl and the North West slope fisheries.

Complete research on effects of fishing on scallop stocks.

Complete existing externally funded and contract research for the program's clients.

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.
- *16%*
- *AP-6*

Provide stock assessment advice for resource managers in the Southern Bluefin Tuna Fishery.

Continue collaborative research, and catch monitoring and biological sampling surveys of southern bluefin tuna with Japanese, Indonesian and Australian industry, resource managers and research agencies.

Review existing and develop new methods of risk analysis for stock assessment in pelagic fisheries and continue development of the cross divisional project.

Complete joint CSIRO - South Pacific Commission yellowfin tuna tagging operations in Coral Sea and complete pilot study on yellowfin tuna stock discrimination within the Australian Fishing Zone and the broader Western Pacific region.

Initiate field and model investigation of longline fishing fleet dynamics and the movement of southern bluefin tuna in relation to the environment.

Complete externally funded and contract research for the program's clients; and continue the pelagic fisheries resources management and industry liaison project.

To develop the scientific and technological basis necessary to expand and improve the performance of the mariculture industry.
- *8%*

Complete existing externally funded and contracted research for the program's clients and continue the mariculture industry liaison service .

Continue research into improved microalgal diets for the mariculture industry.

Continue research on maturation and cryopreservation techniques for prawn eggs and larvae.

To determine the ecological principles needed to manage the impact of economic development on the marine environment, and to assist government and industry to apply these principles
- *21%*
- *EDEA-2*
- *EDEA-4*
- *ENV-1*

Develop two new research projects directed at key ecological processes indicating the early onset of eutrophication in marine coastal waters and the assessment of the impacts of economic development in the marine environment by December 1992.

Establish a functional mesocosm tank system for the new coastal impact assessment project, to allow rigorous and cost-effective testing of marine environmental impacts by June 1993.

Complete in situ field observations of primary production and carbon fluxes at strategic locations in the Western Equatorial Pacific and the Southern Oceans by December 1993.

Develop an algorithm for phytoplankton pigment and primary production estimates and software for ocean colour remote sensing by satellites (including SEAWIFS) by July 1993.

Assess the feasibility of using a multispectral scanner for detecting individual species and mapping vegetated habitats in shallow coastal waters by December 1992.

Develop and test a spectroradiometer for collecting optics data for ground truthing for algorithm development by July 1993.

Develop appropriate field sampling methods for investigating the relationships between coastal sewage discharges and the ecological impacts of nutrients by July 1993.

Complete the final contract report for the Department of Defence on three years of baseline data, and an operational database and a recommended monitoring program for Jervis Bay to be delivered by September 1992.

To provide an effective and efficient research support infrastructure for all aspects of Divisional management; and research support facilities at all sites to meet Divisional objectives and obligations.
- *7%*

Establish Research Support (including the Office of the Chief) as a full program with identified projects in the Division. This program will be subject to the same program performance reviews, financial processes and resources planning as the five Research programs

Develop and apply a financial and business plan, the strategic blueprint for all the Division's financial and business activities.

Develop and implement a Human Resources Plan, to address present and future staffing needs in the Division and support the personal performance evaluation and merit reward system; as well as to identify and evaluate the present and future skills needs of the Division and provide a strategic framework for recruitment and staff development.

Continue implementation of Occupational Health and Safety Plan, putting CSIRO policy into practice at all the Division's work places (including ships at sea) and ensuring staff consultation to determine the best work place practices.

Implement an annual review of the Divisional Communication Plan and Strategy to identify the perceptions of the Division's clients and collaborators; and develop a framework for external and internal communication activities by July 1993.

1992 RESOURCES SUMMARY	
Appropriation Total Allocation: (incl. earned appropriation revenues)	$12,209,000
Sponsored Research:	$4,800,000
Total Budget:	**$17,009,000**

DIVISION EXTERNAL EARNING TARGET

The Division expects that 31% of its total annual budget will be spent from external funds in 1992-93 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 April 1992, down from 37% in 1991 - 92. The Division has a target of 35% for external funding, by 1995-96.

9.3 DIVISION OF OCEANOGRAPHY

OBJECTIVE

To provide a scientific basis for the efficient conduct of national activity relating to the Australian regional oceans, including resources, environmental management, technology and the prediction of climate.

STRATEGY

- Select and conduct theoretical, modelling and field oceanographic studies of the physics and chemistry of subjects of specific relevance to the use of marine resources, the management of the marine environment and the influence of regional oceans upon Australian and global climate variability and change.
- Obtain multiplier value to divisional research by maintaining and strengthening working links with internationally coordinated oceanographic research and satellite remote sensing programs.
- Provide direct research service and scientific advice to federal, state and industrial bodies on issues of environmental management and industrial development.
- Develop marine instrumentation and software and where possible promote its exploitation commercially in collaboration with industry.
- Develop links with other scientific agencies and universities particularly through special purpose and collaborative grants, and Cooperative Research Centres.
- Obtain external funding to enhance the scale and cost effectiveness of divisional effort on vectored marine research.
- Operate the RV Franklin and maintain its capability as a state-of-the-art National Facility for the benefit of Australian oceanography and for the Division's programs.
- Transfer information through scientific publications, specialist and popular reports, seminars, public lectures and responsible interaction with the media.

INTER-DIVISIONAL COLLABORATION

The Division is a major collaborator (40% of Divisional resources) in the Climate Change program and in the Coastal Zone Program.

SPECIFIC OBJECTIVES - *Percent Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Describe and quantify thermodynamic and chemical processes in the oceans for incorporation into predictive models of climate variability in the Australian region (El Nino Southern Oscillation related effects in particular) and "greenhouse" induced climate change. - *40%* - *ENV-1,2*	*The first accurate calorimetry test of the net heat flux into the ocean by measurement of heat and freshwater fluxes at the air-sea interface and in the upper thermocline in the TOGA-COARE experiment.* Completion of a study of the seasonal variation of the major currents in the tropical Indian and Pacific Ocean. Completion of a trans-Pacific ocean section with USA collaborators and maintenance of the current meter array measuring the transport of the East Australian Current. Collection of XBT and sea level data from the ocean observing networks in the tropical oceans and in the Tasman Sea. Elucidation of the mechanism of Antarctic Intermediate Water formation. *The first quantitative assessments of the representation of heat transport processes in a global ocean circulation model.* Assessment of the accuracy of a box inverse model using simulated Southern Ocean data obtained from the Fine Resolution Antarctic Model. Documentation of the algorithm for calculating the new density variable, neutral density, and its installation in leading oceanographic laboratories around the world. *Evaluation of the relative roles of warming and freshening in the subduction region south of Australia based on a comparison of hydrographic data from 1967 and 1990 in the Tasman Sea.* Tests of a number of possible formulations of inverse techniques using suitable numerical data from a three-dimensional oceanic advection diffusion tracer problem *Establishment of a centre for the coordination of a Southern Hemisphere acoustic network for monitoring global ocean warming.* *An evaluation of the factors controlling the carbon cycle in the western Equatorial Pacific.* *Determination of the seasonal variability in the fluxes of carbon dioxide in the Southern Ocean.*
To support and improve the efficiency of offshore resource activities in Australian regional oceans. - *20%* - *EDEA-4*	*A calibrated three-dimensional hydronamic model of Bass Strait applicable to the prediction of near-shore transport and dispersion of pulp mill effluents.* *An analysis of hydrodynamic, hydrographic and chemical data relevant to the establishment of pulp mills discharging effluent into Bass Strait.*

An operational prediction scheme for surface currents in SE Australian waters.

Completion of an air-sea interaction field program using CSIRO's research aircraft to establish the wind drag over the ocean surface.

Completion of a field program on the North-West Shelf to determine characteristics of high speed currents which are required for offshore platform and pipeline design.

Completion of chemical analysis of fatty acids, was esters and pigments in orange Roughy and other fish species, and consulting with industry on development of marine oil-derived products.

Description of the physical processes determining the migration of tropical prawn larvae and south-eastern scallop larvae.

Determination of the effect of freeze drying on the extraction of lipids from marine organisms including molluscs.

A suite of new chemical markets for marine micro algae for use by the petroleum exploration industry.

Undertake directed research, to provide impartial advice to Government and industry on the physics and chemistry of the marine and estuarine environment.
- *26%*
- *EDEA-4*

A compilation of physical and chemical data from the Derwent Estuary study (CSIRO Coastal Zone Program).

A prototype hydrodynamic and water quality model of an estuarine system (CSIRO Coastal Zone Program).

An assessment of amounts and types of organic compounds from paper mill effluent in the upper Derwent Estuary.

An evaluation of Bathurst Harbour as a baseline environment for coastal pollution studies.

A chemical survey of the Sydney coastal environment following commissioning of Sydney's deep water sewerage outfalls.

Analysis of physical and chemical data collected in Bass Strait to explain the distribution and transport of chemicals found there.

Description, based on modelling and measurement, of the dispersion of jarosite dumped in the ocean by Pasiminco-EZ.

Management advice to the Port Phillip Bay Environmental Study for the Melbourne Water Corporation.

Description of the influence of the East Australian Current on the circulation and water quality of Jervis Bay.

Promote the development, marine application and transfer to Australian industry of relevant technology such as satellite remote sensing, instrumentation, computer software, chemical techniques and marine hardware. - *14%*

Construction of the Tasmanian Earth Resources Satellite Station, a high bit-rate satellite reception facility in Hobart in conjunction with the University of Tasmania, CSIRO OSSA, Australian Space Office and other organisations.

Supply of Australia-wide satellite derived sea surface temperature and vegetation index products to a range of government and private users.

Assessment of the ability of satellite-borne synthetic aperture radar (SAR) on L&C bands to map major oceanographic currents.

Provision of first class facilities to the oceanographic community using *RV Franklin* and its data processing group, and the installation of a new computer system aboard *Franklin.*

Fabrication of a solid-state pH electrode and testing it in the laboratory in conjunction with TITRON INSTRUMENTS Pty Ltd.

Completion of a prototype of a commercial, automated conductivity/temperature bridge, for the measurement of the conductivity and salinity of seawater.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$5,938,400
Sponsored Research:	$2,000,000
Total Budget:	**$7,938,400**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 26% of its total annual budget will be spent from external funds in 1992-93 based on estimates as at 31 March 1992, down from 28% in 1991-92.

9.4 RV *FRANKLIN* (A NATIONAL FACILITY)

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.

OPERATIONAL 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.*

PLANNED OUTCOMES

CSIRO, in the financial year 1992-93, will use 131 days or 64.5% of the available ship time for the period. (Of this, Division of Oceanography usage will be 111 days). CSIRO research cruises are as follows:

FR	5/92	16/6-3/7/92	Australian contribution to the international JGOFS experiment, quantifying the carbon cycle in equatorial waters.
FR	6/92	14/7-4/8/92	International cooperative study researching currents in the Vitiaz Strait and equatorial dynamics.
FR	7/92	19/9-6/10/92	Australian contribution to the international WOCE experiment - transport and dynamics in the Tasman and Coral Seas
FR	10/92	19/11-8/12/92	Australian contribution to the international COARE mixed layer heat budget experiment.
FR	1/93	7/1-8/2/93	Australian contribution to the international TOGA COARE heat flux experiment.
FR	5/93	4/6-23/6/93	Submarine hydrothermal vents in the Manus Basin.

Total budget:	**$4,301,600**

9.5 DIVISION OF WATER RESOURCES

OBJECTIVE

To develop ways to use and manage Australia's most precious resource and to provide timely, scientific solutions to managing water and wastes to public agencies and the private sector.

Of particular importance is the maintenance of the quality and quantity of urban , rural and industrial water supplies at acceptable cost. The interactions of water resources with land, vegetation and ecological systems are also a major research focus.

STRATEGY

- Research the processes involved in the interactions between the atmosphere, plants, land and water.
- Translate these findings into practical techniques which will assist agencies to better manage natural resources to meet community, industry and environmental needs.
- Continue to participate in the debate on sustainable development of Australia's natural resources.
- Via collaborative links with our industry, we will increase technology transfer, and enhance our opportunities to commercialise our research.

INTER-DIVISIONAL COLLABORATION

- Via the multi-Divisional Land and Water Care Program, the Division has strong collaborative links with staff in the Divisions of Soils, Wildlife & Ecology, and the Centre for Environmental Mechanics.
- We continue to contribute to the Climate Change Program with the Division of Atmospheric Research.
- We anticipate that enhanced collaborative links will be developed with the Division of Fisheries and the Centre for Environmental Mechanics, associated with the Algal Research Program.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To analyse the processes in the land phase of the hydrological cycle in order to predict the consequences for water resources management of land use decisions. - *17%* - *EDEA-6 (see page 18 for codes)*	Determine the response of groundwater systems to variations in recharge and discharge and apply this to resource management. *Develop a suite of process-based models to describe the interactions between rainfall, vegetation and landscape, at scales applicable to the land care concerns of landholders. The integration of our models will provide guidance for the management of land degradation and water quality.* Develop technologies in remote sensing and instruments in order to define the relationships between water distribution, vegetation and land.

Develop opportunities for commercial distribution of our research tools and products, particularly computer software programs and specialised instrumentation through establishing joint venture programs.

Maintain current level of external funding support. Increased effort to be directed to the marketing of products with commercial potential.

Identify sources and the fate of nutrients, salts and sediment reaching water supplied, and predict the impact of climate change on water resources.
- *17%*
- *EDEA-2*
- *ENV-1*

Assess the impact of plausible climate change on specific water resources.

Develop the use of stable and unstable isotope techniques and soil magnetics to trace water and sediment movement in the landscape.

Determine the sources of nutrients responsible for water eutrophication, algal blooms, degradation of water quality in the Murray-Darling Basin and, in particular, explicit tracing techniques for phosphorus.

Assess the impact of wastewater disposal in salt lakes, subsurface brine pools and the potential for commercial production of salts, presently imported, from such sources.

Maintain strong collaboration with authorities responsible for water catchment management by working with them in their planning and operational activities to ensure the use of our methods and results are adopted by these authorities.

Maintain the current level of external support, but ensure that some of this money is used to further develop new tools such as tracers.

To predict the behaviour of contaminants and salts in the environment, for better managing our water resources.
- *28%*
- *EDEA-2*
- *EDEA-3*
- *EDEA-6*
- *EDEA-7*

Determine the long-term impact of leakages of petroleum fuels on groundwater quality in studies on the Swan Coastal Plain aquifer in WA.

Demonstrate the potential use of in-situ bioremediation for clean-up of industrially contaminated sites (with BHP and the Microbiological Research Unit and Canberra University), focusing particularly on petroleum hydrocarbons.

Identify the main factors controlling the movement of nutrients within groundwater and surface water and identify factors affecting in-stream algal growth, in studies focusing on the Swan River Estuary in WA.

Demonstrate the feasibility of reducing salinity within the Kent River catchment, using land-use strategies based on scientific understanding of catchment processes, taking account also of socioeconomic implications. This work will be carried out in collaboration with State agencies in WA.

Provide assessments, with State agencies, of strategies to reduce salinisation from groundwater discharge on the edge of the Murray Basin in the upper SE of South Australia.

Assess, with industry support, the extent of replenishment of saline groundwater which is used for process water in goldmine operations, Kalgoorlie region in WA.

Develop models for regional assessment of the vulnerability to pollution, and provide more focused management models for better disposal of wastes from rural industries at local scale, using data from existing field areas in NSW, Queensland, South Australia and Western Australia.

The Program continues to foster collaborative links with both public and private partners. All projects directly involve industry and effective transfer mechanisms are established so that benefits from research can be easily taken up.

Total funding has increased steadily since 1989/90 with levels of external support at approximately 40% of total budget. We expect to maintain this level of external support, develop further overseas projects particularly in SE Asia, and keep international project work at around 10-15% of Program activity.

Develop evaluate and apply decision support systems and other techniques of institutional, social, economic and environmental analysis to water resources problems.

- *10%*
- *EDEA-2*
- *EDEA-3*
- *EDEA-6*
- *IS-2*
- *IS-5*

Develop a generic version of the CMSS (catchment management support system).

Modify the ARX spatial inferencing system for land management, developed for the Puckapunyal Army Base, for possible installation at other sites. Develop generic capabilities for the system.

A Co-operative Research Centre in Waste Management project.

Provide an acceptable method of disposal of wastes from intensive rural industries.

Complete a report for the NSW Dam Safety Committee on public perceptions of acceptable risk and dam safety standards.

Develop psychological hazard theory and apply to community development in relation to salinity problems in the Murray-Darling Basin.

Continue activities with the CSIRO - Curtin Centre for Applied Psychology with joint doctoral students in social psychology in natural resources management.

Report on national priorities for social research in water resources management.

Report on Australian scientific technical and socio-economic research priorities in the urban water utilities and infra-structure area.

Implement a version of the CMSS for integrated catchment planning and development control in the Hawkesbury-Nepean Basin.

Maintain service commitments to users of the Queensberry hypertext database system for mult-objective analysis and policy development, including the Co-operative Research Centre in Waste Management.

By ecological research, promote environmentally safe management of surface waters.
- *15%*
- *EDEA-2*
- *EDEA-3*
- *EDEA-6*

Review the quality of irrigation drainage water, in particular, nutrient loads to the Murray-Darling River system.

Demonstrate the prospects for improving water quality in irrigation drainage channels by changing aquatic plant management practices.

Develop and trial instrumentation for the automatic measurement and satellite communication of water quality parameters, especially phosphorus, algal biomass and microbial indicators.

Review the role of constructed wetlands treatment of industrial effluents; complete pilot trials with BHP (coke oven, emulsified oils).

In association with the CRC on waste management and pollution control, develop the use of vertical flow constructed wetlands for sewage treatment.

Identify novel toxins from *Anabaena.*

Test hydrological management strategies for the control of cyanobacteria in weir pools.

Develop hydrological guidelines for water managers to enhance riparian plant communities.

Describe pesticide concentrations and loads in irrigation drainage water from rice/pasture, summer cropping and horticulture.

In association with CSIRO Division of Plant Industry, field test ELISA methods for chlorpyrifos, diuron and molinate concentrations in river water, town supplies and irrigation drainage.

Develop land and water use strategies in irrigated areas to reduce salinisation, increase productivity and maintain river water quality in the Murray Basin.
- *13%*
- *EDEA-6*

Validate soil water and groundwater simulation models which facilitate regional water management strategies in areas of the Murray Basin.

Demonstrate the application range of soil modification which reduces percolation of water under rice crops.

Establish representative water balance components for different irrigated crops grown in the presence of shallow water tables.

Develop criteria for the application and longevity of mole drains used to control waterlogging in irrigated clay soils.

Ensure application of SWAGMAN-WHATIF (computer based soil-water management package) and other SWAGMAN programs.

Collaboration links with our industry are well developed and ensures the successful transfer of research.

Industry and agency representatives have become "project associates". They are part of research project teams and are consulted regularly.

Increased teaching, research and supervisory involvement with Charles Sturt University will continue.

Involvement with interstate NRMS projects in Victoria and South Australia will occur in 1992/93.

Total funding levels will remain at about the current level. 32% of funds come from external fund sources.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenue)	$15,435,700
Sponsored research:	$4,050,000
Total Budget:	**$19,485,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 26% of the total annual budget will be spent from external funds in 1992-93 based on estimates as at April 1992, down from 27% in 1991-92. The Division has a target of 30% for external funding by 1994-95.

9.6 DIVISION OF WILDLIFE AND ECOLOGY

OBJECTIVE

To develop the scientific knowledge and techniques required to manage Australia's wildlife, plant and land resources for ecological sustainability.

STRATEGY

- Adopting a national perspective, develop multidisciplinary, integrated programs, based on priority assessments, using and developing modern ecological and biological techniques and theories.
- In such programs, emphasize processes and mechanisms and achieve applied aspects via collaborative projects with Federal, State and Local Governments, industries and other agencies responsible for management and conservation of wildlife and land resources.
- Adopt an innovative approach to exploring the potential for utilizing the unique features of Australia's biota.

INTER-DIVISIONAL COLLABORATION

Land and Water Care Program (co-responsibility with Division of Soils).

The Division is involved in three other formal inter-Divisional programs, which are the primary responsibility of other Divisions, and six informal projects.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
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. - *18%* - *EDEA-6*	Reassessment of national priorities for rangeland research: A joint effort by the Division's National Rangelands Program, other CSIRO Divisions and state agencies. A five year research plan will be developed. *Release of FORSITE, a computer-based management package incorporating three decision support systems to assess degradation, prevent degradation, and plan for restoration.* Completion of a research model to simulate the ecology and economics of semi-arid woodlands (SEESAW). Delivery of final results describing the land degradation status of a 30,000 km^2 area to the N.T. Conservation Commission. *Publication of a preliminary report on grazing impacts on biodiversity and implement full research project.* New models for incorporating the effects of topography into existing procedures for forecasting land degradation.

Completion of a grazing study which will provide management guidelines for restoration of degraded native pastures and for preventing degradation.

Completion of a geographic information system for tourism and conservation planning of the MacDonnell Ranges area, N.T.

Release of the commercial version of the PADDOCK module of the RANGEPACK decision support system and release of the CLIMATE module.

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.
- *17%*
- *EDEA-7*
- *ENV-3*

An assessment of the regenerative capacity of large seeded trees and of the population dynamics and dispersal patterns of small mammals in relict forest fragments in agricultural landscapes.

Information on the way Cassowary's use their habitat, essential for conservation management, and analysis of intensive Cassowary censuses.

A demonstration of the efficacy of a restricted set of plant functional attributes for predicting the spatial distribution of biota as a basis for TROFIS (a tropical forest information system).

A revision of the history of Australian tropical rainforest through the Quaternary.

An analysis of successional sequences in tropical forest recovery after clearing and disturbance on metamorphic soils in north Queensland.

An analysis of changes in the extent and character of sclerophyll replacement of rainforest vegetation due to the impact of fire in north Queensland over the last 50 years.

Production of a detailed overview of the scientific hypotheses and anticipated management outcomes of the on-going Kapalga fire experiment.

Development of research proposals based on a survey of a 1000 km savanna gradient to assess the impacts of global change and human-based development.

Establishment of a research project on the role of ants in mine-site rehabilitation and as bio-indicators.

An assessment of the efficacy and ecological consequences of herbicide application for the control of mimosa infestations for DASET.

An (externally funded) survey of the wildlife on the Nakai Plateau in Laos, as an input to the evaluation of the proposed Nakai dam.

Completion of report on fire management of seepage zones in tropical savanna for wildlife conservation for WWF (Australia).

To provide Governments and other land managers with improved strategies and techniques, including novel and environmentally benign biological agents, for controlling introduced or native vertebrate pests.
- *30%*
- *EDEA-1*

Complete the establishment of the Cooperative Research Centre for the Biological Control of Vertebrate Pest Populations (with the Australian National University, the Department of Conservation and Land Management, WA, the Agriculture Protection Board, WA).

Prosecute an integrated ecological, virological, reproductive and molecular-biological research program for biological control of foxes and rabbits by viral vectored immunocontraception.

A systems analysis of the rabbit-fox-myxoma-endangered species complex.

A field release on the Darling Downs, Queensland, of *Capillaria hepatica* for preventing plagues of house mice.

A management information system for use in preventing mouse plagues.

Preliminary results on cane-toad ecology and pathogens in Venezuela and Brazil; and continued management of the research program funded by the Department of Prime

Minister and Cabinet, DITAC and ANZECC.

A management information system to respond to an outbreak of an exotic disease of domestic animals, and incorporation of that system into AUSVETPLAN.

Hormonal and biochemical studies on marsupial lactation to exploit the special properties of the marsupial mammary gland and to develop benign methods of control of kangaroo populations.

To develop principles for conservation biology and genetics, and to assist in the application of these principles to the conservation of Australia's biological diversity.
- *12%*
- *ENV-1*
- *ENV-4*

An assessment of the status of breeding populations of seals at Heard Island and Macquarie Island.

Consolidation of the research into re-introductions of endangered marsupials to the Shark Bay area of W.A.

Completion of the research identifying the basis of systems of remnant patches for persistence of kangaroos.

Integration of the aims of biological conservation and salinity control with the State Land Planning System for the Western Australian wheat belt.

Initial effects of forest fragmentation on scorpion populations from the experiment at Wog Wog, N.S.W.

Planning and implementation of a new project on experimental evaluation of the concept of population viability.

Initiation of research on the impacts of global climate change on Australia's terrestrial ecosystems.

Publication of "Aves, Volumes 2 & 3", for the Zoological Catalogue.

Undertake an inventory and produce an atlas of regional populations of Australian birds.

Completion of electronic databasing of mammal specimens in the Australian National Wildlife Collection, and continued curation and operation of the collection.

To develop and transfer computer-based packages to assist decision makers responsible for the inventory, evaluation, allocation and operational management of Australia's natural resources at a range of scales; and to assist in the management and conservation of forests, woodlands and other ecosystems in temperature Australia by predicting the patterns of distribution of vegetation and fauna, and their response to fire, logging, tourism and climatic change.
- *23%*
- *ENV-4*

Completion of analysis of data on distribution of plant and animal species along New South Wales forest environmental gradients.

Development of a plant community classification of south eastern forests.

Preliminary conclusions about the effects of forest management practices on the distribution of key species.

Commissioning of prototype of a Coastal and Marine Resources Information System for the Australian coastal zone.

Initiation of a study of determinants of sustainable development in the Australian ecumene.

Commissioning of a prototype GIS-based natural resource accounting system for New South Wales.

Incorporation of the minimal set algorithm for reserve selection into a spatial decision support system.

Verification of models which predict the distribution of Eucalypt species and major faunal elements.

RESOURCES SUMMARY 1992-93	
Appropriation Total Allocation: (includes earned appropriation revenues)	$16,179,900
Sponsored Research:	$4,250,000
Total Budget:	**$20,429,900**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Division expects that 23% of its total annual budget will be spent from external funds in 1992-93 based on estimates as at May 11, 1992 up from 21% in 1991-92.

9.7 CENTRE FOR ENVIRONMENTAL MECHANICS

OBJECTIVE

Develop a better understanding of physical processes in the natural environment and apply this knowledge to solve practically important problems in hydrology, environmental quality, plant productivity, land conservation and management, and industrial processes.

STRATEGY

- Focus research using a mixture of theoretical, experimental, and field investigations on perceived gaps in our scientific understanding of physical processes in the natural environment.
- Embody research results in techniques, analyses, and instruments to improve professional practice in the management of Australia's hydrological, environmental, and agricultural resources.
- Apply research results developed in the context of the natural environment to cognate industrial processes.
- Foster research collaboration with Federal and State Agencies, consultants, and with other CSIRO Divisions especially where there is scope for synergism and the speedy introduction of results into practice.
- Communicate the results of our work by scientific publication, workshops, consulting and the public media.
- Choose problems on the basis of their assessed solubility and by inputs from users in Federal and State agencies, and industry, and consultants.

INTER-DIVISIONAL COLLABORATION

The Centre is responsible for the management of the following inter-Divisional programs:

CSIRO Coastal Zone Program (5% of total Divisional resources) in collaboration with the Divisions of Coal and Energy Technology, Fisheries, Oceanography Soils, Tropical Crops and Pastures, Water Resources, Wildlife and Ecology.

In addition the Centre is actively involved in the CSIRO Land and Water Care, Climate Change, and Blue-Green Algae Programs.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Develop a better understanding of the effects of physical processes in soil, water, plants and the atmosphere on the growth and productivity of plants, concentrating on the terrestrial nitrogen cycle, fertilizer use, trace gas exchange between biosphere and atmosphere, evaporation in plant and forest canopies, and the solar radiation climate of plant communities. - *20%* - *ENV-1 (see page 18 for codes)*	New techniques for improved fertilizer efficiency in sugar cane. *Model to predict water use efficiency of wheat under increased atmospheric CO_2 conditions.* New techniques for measuring trace gas fluxes on local and regional scales.

Development adequately verified theoretical description of wind and flow and energy transfer over topography and in plant canopies, with specific reference to pollutant dispersion, wind engineering, erosion, and climate prediction; determine mechanics of air-sea energy transfer in the equatorial Pacific Ocean. - *30%* - *ENV-1,2*	Major report on wind energy resource assessment for ELCOM NSW. Completed preliminary experiments and analysis on the dynamics of saltation and dust emission. *Data on air sea exchanges from two major cruises of RV Franklin in TOGA-COARE Project.* New method for inferring regionally averaged surface fluxes from concentrations by utilizing scalar budgets in the atmospheric boundary layer.
Devise physically-based realistic mathematical descriptions of fluid flow in porous media occurring in the natural environment, agriculture and cognate industrial processes; develop new techniques for measuring important hydrological properties in the field and apply them for better management. - *25%* - *EDEA-6*	Novel TDR surface probes. *Description of changes in soil physical properties due to sustainable crop management.* Develop and install automatic, remote equipment to monitor acid drainage from estuaries. Tested theory of dynamics of salt plumes in heterogeneous porous materials.
Provide an experimentally verified description of those physical processes in fresh and estuarine water bodies which interact with the biological processes affecting water quality and apply this knowledge to improved water quality management. - *10%* - *EDEA-2*	Realistic understanding of major physical processes exchanging materials between estuarine sediments and overlying water. *Characterization of the interplay between biological and physical processes influencing phytoplankton and blue green algae blooms.*
Communicate results of Division's research to users in the community, industry and government agencies. - *15%*	Publish biennial report. Conclude negotiated agreement for TDR. Strengthen interactions with media.

1992-93 RESOURCES SUMMARY

Appropriation Total Allocation: (includes earned appropriation revenues)	$2,493,700
Sponsored Research:	$705,000
Total Budget:	**$3,198,700**

DIVISIONAL EXTERNAL EARNINGS TARGET

The Centre expects that 25% of its total annual budget will be spent from external funds in 1992-93 based on estimates as at 22 April 1992, down from 26% in 1991-92.

9.8 CSIRO OFFICE OF SPACE SCIENCE AND APPLICATIONS

OBJECTIVE

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

STRATEGY

- Liaise with national and international bodies to strengthen scientific links, represent CSIRO's remote sensing and other space science policies, and ensure the availability to CSIRO of space and related data,
- Provide scientific, information, technical and engineering advice and support services to CSIRO Divisions,
- Identify the needs of the users of remotely sensed data and applications and match those needs with existing technology,
- Facilitate Australian industry's appropriate participation in CSIRO's aerospace programs,
- Manage CSIRO access to research aircraft facilities,
- Communicate CSIRO and Australia's achievements in space science.

INTER-DIVISIONAL COLLABORATION

COSSA is responsible for the co-ordination of the following inter-Divisional programs:

The Multi-Spectral Imaging Program in collaboration with the Divisions of Exploration Geoscience, Water Resources, Wildlife and Ecology, Fisheries, Oceanography, Atmospheric Research, Mathematics and Statistics, Information Technology and various government departments and commercial organisations.

The Remote Sensing Data Access and Utilisation Program, in collaboration with the Divisions of Wildlife and Ecology, Oceanography, Fisheries, the Information Services Branch, and various Australian and overseas agencies.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Strengthen the ability of CSIRO's space-related research and development to contribute to Australia's economic development and environmental wellbeing. - *55%* - *EDEA-2 (see page 18 for codes)*	Coordination of the development and implementation of a coherent CSIRO space science policy and strategy, Management of the new arrangements for the support of airborne research in CSIRO. Continuation of the development of the Australian Airborne Imaging Spectrometer component of the Multi-Spectral Imaging Program, in conjunction with the Divisions of Exploration Geoscience, Water Resources, Wildlife and Ecology, Fisheries, Oceanography, Atmospheric Research, Mathematics and Statistics, Information Technology, and various government departments and commercial organisations.

Recommendations for, and if appropriate implementation of, redesign of the CSIRO Ocean Colour Scanner as a cost effective SEAWIFS simulator for use in coastal zone monitoring and mapping. This is a component of the Multi-Spectral Imaging Program.

Daedalus Airborne Scanner services, as a commercial enterprise, and as an applications and product path-finder component of the Multi-Spectral Imaging Program.

Negotiated data purchase arrangements to gain significant cost and shared resource benefits for CSIRO Divisions.

Strengthen participation by CSIRO and its scientific and technological collaborators in international space projects and global space programs.
- 25%

Co-ordination of the Australian component of the NASA DC8/Synthetic Aperture Radar/SIR-C Calibration Program, to enable Divisions in the Institutes of Natural Resources and Environment, Minerals, Energy and Construction, Plant Production and Processing and Information Science and Engineering to access Synthetic Aperture Radar data.

Co-ordination of the CSIRO and Australian policy position on international exchange of global satellite data, to be presented at the Committee on Earth Observation Satellites (CEOS) meeting in December 1992.

Exchange of satellite data with the United States Geological Survey and the Commission of European Communities. This component of the Remote Sensing Data Access and Utilisation Program is managed in conjunction with the Division of Wildlife and Ecology.

Increase awareness of the benefits of CSIRO's general achievements and capabilities in space-related research, and provide scientific information to researchers on space-related projects.
- 20%

Extension of the catalogue of Australian NOAA and CZCS passes to 15 000 records, completion and publicity of the catalogue users' handbook. This component of the Remote Sensing Data Access and Utilisation Program is managed in conjunction with the Divisions of Atmospheric Research and Oceanography, the Information Services Branch, and other partners.

Continuation of the acquisition of Marine Observation Satellite data in Australia. This component of the Remote Sensing Data Access and Utilisation Program is managed in conjunction with the Divisions of Fisheries and Oceanography, the Australian Centre for Remote Sensing, and the National Space Development Agency of Japan.

Establishment of the basic capability to access and utilise space science data sets published on CD-ROM disk. This is a component of the Remote Sensing Data Access and Utilisation Program.

Organisation of a CSIRO Remote Sensing Seminar Program to disseminate information about remote sensing work programs, their objectives, outcomes, developments and major impediments.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation: (includes earned appropriation revenues)	$2,600,000
Sponsored Research:	$455,000
Total Budget:	**$3,055,000**

DIVISIONAL EXTERNAL EARNINGS TARGET

COSSA expects that 15% of its total annual budget will be spent from external funds in 1991-92 based on estimates as at 22 April 1992 up from 11.6% in 1991-92.

10. SIROTECH LIMITED

OBJECTIVE

To promote the profitable commercial exploitation of CSIRO's research by Australian industry.

STRATEGY

- *Develop a close working relationship with CSIRO.*
- *Develop more effective commercial relations between CSIRO and Australian industry.*
- *Improve the commercial knowledge and understanding of key SIROTECH and CSIRO staff.*
- *Provide a challenging career and working environment for all staff.*

SPECIFIC OBJECTIVES *- Percent of Total Resources* *- CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Provide commercial support for CSIRO's multi-Division research programs.	Finalise magnesite industry agreement.
	Finalise active packaging agreement.
	Develop standard form collaborative agreements for major company sponsors of CSIRO's research.
Collect and distribute royalty and license fees for CSIRO.	Complete review of all CSIRO's license agreements.
	Remove dormant agreements from the portfolio.
Introduce secondment program for trainee CSIRO business managers.	Design specific training program for the selected participants.
	Assess benefit of first year's program.

1992-93 RESOURCES SUMMARY

CSIRO Expenditure Estimate:	$4,600,000
Fee Recoveries for CSIRO:	$2,500,000

11. CORPORATE CENTRE

11.1 CHIEF EXECUTIVE ADVISORY GROUP

11.1.1 OFFICE OF THE CHIEF EXECUTIVE AND BOARD

OBJECTIVE

To provide support to the Chief Executive, Chairman and Board Members to enable the effective functioning of the Board and Executive Committee, provide corporate/policy coordination and enhance CSIRO's external liaison.

STRATEGY

The Office will assist the Chief Executive, Chairman and Board Members in the efficient conduct of their responsibilities of Office; provide an effective and efficient Secretariat for the Board and Executive Committee; enhance interaction with Minister, Government, industry, the higher education sector and external bodies generally; maintain effective liaison with Institutes, Corporate Centre and Divisional staff in issue analysis, development of policy and input; and maintain awareness of relevant scientific, technological, social and political developments in Australia and overseas.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
To maintain and improve the effectiveness of the Board and Executive Committee and ensure coordination of their activities. - *15%*	Procedures will be streamlined to ensure smoother progression of the Organisation's business to Executive Committee and the Board. Guidance and assistance will be provided, where appropriate, in the preparation of papers and follow-up actions.
To develop and/or coordinate briefings or action advice on all correspondence to Chairman and Chief Executive. - *20%*	Full, timely and coordinated briefings in relation to all issues arising from the Chairman's and Chief Executive's correspondence; procedures will be streamlined to develop and coordinate briefs in consultation with Institute(s), Division(s) and/or Corporate Centre.
To facilitate the interaction of the Chief Executive and CSIRO generally with Government departments and agencies, and outside bodies. - *25%*	Assistance and briefing will be provided for the Chief Executive's visit and meeting programs and participation in high level committees. Government business will be monitored, issues analysed and input drafted or coordinated. The effectiveness of CSIRO liaison will be further developed. The Office will act as the general contact point for external interactions.
To develop and maintain contact with relevant Ministers and their staff. - *10%*	Communication with the Minister responsible for CSIRO will be coordinated, timely briefing provided and regular contact maintained with other relevant Ministers and staffs.

To provide opportunities for career development.	Secondment opportunities will be provided for Divisional research and administrative staff to undertake special projects, including as above.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation:	$1,723,700
Total Budget:	**$1,723,700**

These figures include $625,000.00 being salary and operating costs for the Chief Executive and Board.

11.1.2 CORPORATE AUDIT

OBJECTIVE

- **To assist CSIRO management to protect Organisational assets and to conduct the business of the Organisation in a fair and honest manner.**

- **To improve the performance of CSIRO by assisting managers at all levels in the efficient and effective discharge of their duties and by promoting cost-effective internal control.**

STRATEGY

The objective of the Corporate Audit Group is achieved by:

- providing appraisals of the adequacy and effectiveness of Organisational systems;
- providing suggestions for improved performance;
- performing monitoring on centralised computer systems; and
- participation in the systems design process.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
• ***Comprehensive Audit:*** **To provide a comprehensive audit coverage to the organisation providing useful advice and information at research unit, division and institute levels** - *85%*	
- ***Systematic Review:*** **Cyclic Review of Divisions covering asset protection, risk management and efficiency issues.**	Review of nine Divisions. Review of associated IT support.
- ***Risk-based Review:*** **Review of specific issues and systems across the Organisation on a risk rated basis.** - *55%*	Three IT-based project audits. Three other project audits. Completion of the Continuous Monitoring Program.
- ***Consultancy Service:*** **Review of tasks of specific interest to managers of the Organisation which were not programmed above.** - *4%*	Much of this will be performed on a fee-for-service basis

• ***Staff Development 11:*** **To provide training programs to improve skills in audit or as indicated by formal performance review and development appraisals.** - *10%*	Each staff member to receive 12 days training. 1% of payroll to be spent on eligible training.
• ***Staff Development 2:*** **Enhance awareness of audit and control issues within the Organisation by provision of seminars and development experience though staff exchange.** - *1%*	This can mostly be done as a by-product of other work.
• ***Audit Automation:*** **To establish and extend as resources permit the automation of audit documentation and audit management information on the Group's microcomputers and their use as audit tools in their own right. Provision of computer assisted audit tools.** - *15%*	Consolidate and update Audit Computing Strategy. Develop computer assisted audit tools as required.
• ***Information Systems*****: Participate in the design of all significant computerised information systems.** - *8%*	Participate in MIFFS development. Participate in HRIS development
• ***Organisational Procedures*****: To enhance systems of internal control within the Organisation by participation in the development of financial, human resource and other administrative procedures.** - *7%*	Continue implementation of Fraud Control Measures. Participate in Administrative Documentation project. Assist in site committees Assist in ad hoc reviews conducted by other units.

1992-93 RESOURCES SUMARY	
Appropriation Total Allocation:	$896,400
Total Budget:	**$896,400**

11.1.3 CORPORATE PLANNING OFFICE

OBJECTIVE

Activate the development and implementation of best planning practices by CSIRO line managers in collaboration with Institute Planning Managers.

STRATEGY

In collaboration with the Chief Executive, Directors and Institute Planning Managers

- *consolidate and extend research priority setting and planning processes;*
- *improve and expand supporting data and analysis for use in planning, priority setting and evaluation;*
- *establish systematic and consistent performance assessment and reporting against planned outcomes;*
- *provide assistance on planning and priority setting to Institutes and Divisions.*

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Prepare corporate-level plans required by government which strengthen the capacity of Executive Committee members to meet their corporate management and line management responsibilities. - *50%*	Corporate-level Strategic, Operational and Evaluation Plans and Program Performance Statements which are integrated, outcome oriented and facilitate performance assessment against outcomes.
Improve data including scenario analysis to support priority setting at all levels in CSIRO. - *30%*	Consistent time-series data bases based on CSIRO research purposes for use at all levels in CSIRO, and development of scenario analysis methods to improve inputs to priority setting and planning.
Provide services to Institutes, Divisions, Corporate Services Department, Chief Executive Advisory Groups and other stakeholders on the implementation of best planning practices, as and when required. - *20%*	Continue action of assistance to CSIRO Institutes/Divisions and other stakeholders in the adoption of the CSIRO priorities methodology, retrospective and prospective economic evaluation of research, and provision of other appropriate services, on a user pays basis.

1992-93 RESOURCES SUMMARY	
Appropriation Total Allocation:	$485,100
Sponsored Research:	$5,000
Total Budget:	**$490,100**

11.1.4 PUBLIC AFFAIRS UNIT

OBJECTIVE

To gain widespread recognition of CSIRO as an organisation of scientific, excellence that gives an excellent return on public funds, good value to industry collaborators, and can be an "honest broker" on environmental and other sensitive issues.

STRATEGY

To work closely with Institutes and Divisions, especially through the Communication Working Group, to identify key stakeholders and plan major events, announcements and publicity opportunitites.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
Promote CSIRO to stakeholders and the general public. - *40%*	Positive media coverage of CSIRO. Effective CSIRO input to public issues. Development/touring of exhibitions on Genetic Engineering and Strategic Minerals Increaed contact with senior non-technical industry managers through events such as BRW-CSIRO Breakfast Seminars.
Ensure details of CSIRO's activities and organisation are made available on public record. - *40%*	Annual Report published to Parliamentary requirements. Suite of corporate publications and visuals for use by staff with stakeholders. Clear CSIRO identification on publications and sites. Monthly staff magazine, Coresearch, to keep staff informed of CSIRO policies and activities. Proactive stategy developed for merged PAU/NIN/SACE group.

1992-93 RESOURCES SUMMARY

Appropraition Total Allocation:	$864,200
Total Budget:	**$864,200**

11.2 CORPORATE SERVICES DEPARTMENT

OBJECTIVES

Provide professional advice and services to support financial planning and financial management within CSIRO;

Assist line management to implement the Human Resources Plan, and associated policies to attract, retain, develop and deploy high quality staff; provide professional human resource management advice to line managers;

Provide a professional, cost-effective and efficient information technology service to CSIRO;

Provide a corporate property management service to ensure adequate and cost-effective research accommodation and facilities;

Assist in the transfer of research results through providing 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;

Provide a corporate legal service to CSIRO;

Provide the focus for international relations in CSIRO; and,

Provide support and advisory services to CSIRO best delivered centrally.

STRATEGY

The Corporate Services Department is responsible for providing support to the Organisation for carrying out its main task to do efficient scientific and industrial research. Its activities are directed towards the development of policies, the provision of advice and the co-ordination and delivery of support services best handled centrally to meet the needs of the Organisation.

The Department ensures that CSIRO's financial, administrative and personnel management practices are consistent with relevant Government policies for the operation of statutory authorities and business enterprises, and monitors and reports on the implementation of devolution and on adherence to corporate systems and policies;

The Corporate Services Department is comprised of the Corporate Finance Branch, the Human Resources Branch, the Management Information Systems Branch, the Information Services Branch, the Corporate Property Unit, the Corporate Legal Service, the CSIRO International Relations Centre and the Limestone Avenue Site Administration. The heads of these groups all report to the Director Corporate Services. The Director is also responsible for the Corporate Library and Information Service which, as part of the library network, supports the CSIRO headquarters site in Canberra in the areas of science and technology policy and research management.

The work of the Corporate Services Department is presented in summary form in the following pages. More details about the Department's objectives and projects can be found in the Department's operational plan for 1992-93, Supporting Science in the Nineties.

SPECIFIC OBJECTIVES - *Percent of Total Resources* - *CSIRO Strategic Plan*	*PLANNED OUTCOMES* *(Italicised text indicates outcome is related to planned outcome(s) in CSIRO Strategic Plan)*
11.2.1 FINANCES	
Provide professional advice and services to support financial planning and financial management within CSIRO. - *5%*	Support of long term financial planning for CSIRO. Develop and implement a periodic budgeting system for both Revenue and Expenditure by 1 July 1993. Preparation of the Organisation's budgetary documentation to meet Government timetables in the prescribed format for Commonwealth Budget Papers. Monitor CSIRO 's financial position and produce regular financial performance reports to the Executive Committee (monthly) and Board (quarterly), and produce CSIRO statutory reports. Strategic development and formulation of new `accrual based CSIRO accounting policies, procedures and systems ensuring accounting standards are upheld and produce the outcome in financial directions. Implementation of new accrual financial systems in all Divisions by June 1993 and ensure adequate systems and accounting training are provided. Provision of reliable, accurate and informative data on the Organisation's research effort and the deployment of its human and financial resources.
11.2.2. HUMAN RESOURCES	
Assist line management to implement the Human Resources Plan and associated policies to attract, retain, develop and deploy high quality staff; provide professional human resource management advice to line managers. - *20%*	By June 1993 evaluate and report on a Workforce Planning pilot study and the potential to transfer the methodology to other Divisions. Refinement and enhancement of the Human Resources Information System to assist Divisional and Corporate human resource managers with workforce planning and management. Corporate development programs to develop the skills and improve the effectiveness of CSIRO's research and other senior managers; in particular, one intake for the Leadership Development scheme; two intakes for Research Management Courses. Development and implementation of a program for the Development of Chiefs. By April 1993, development of better strategic processes for handling the human resources consequences of Divisional restructuring associated with workforce planning. By August 1992, review of the final stages of the Performance Planning and Evaluation Program to improve its effectiveness and links to research planning and human resource planning and management.

Investigation of and report by December 1992 on flexible reward options including team rewards for team performance.

Review of the provision of organisational counselling services (July 1992); explore options for a range of flexible work practices for staff with family responsibilities (March 1993); and development of a strategy to further devolve EEO responsibilities and processes to line management (July 1993).

Pursuit of enterprise bargaining opportunities which build on Award Restructuring achievements in respect to salary, conditions and related matters.

Continuation of provision of agreed HR support services (such as corporate pay, health and safety advice) which are provided on behalf of Institutes on a cost-effective basis.

11.2.3. INFORMATION TECHNOLOGY SERVICES

Provide a professional, cost effective and efficient information technology service to CSIRO.
- *31%*

Plan for and manage corporately required information technology services and contracts for CSIRO.

Provide for mainframe services under a five year commercial agreement with Fujitsu Australia Ltd.

Provision of and maintenance of the Corporate network infrastructure for the transmission of voice, data and image Australia wide. Continue the capital replacement program of PABX's and replace the PABX software for call accounting by June 1993.

Commencement of the integration of voice and data networks where practicable and cost justified.

Management of the relationship with AARNet and continue the installation of links for research managers to mail and the administrative systems.

By October 1992, commencement of the implementation and training for machine independent local financial systems to maximise existing Divisional Unix systems and provide a path away from proprietary NGen hardware.

Completeness of modifications to the corporate general ledger and associated systems for implementation of accrual accounting by June 1993.

Provision for local budget system integration to existing local systems with the associated interfaces by 30 June 1993.

Support of the human resource initiatives in workforce planning with the implementation of competency and skills data by October 1992. Complete work for redeployment and retraining by December 1992.

Maintenance of all existing systems providing for statutory and corporately required changes and maintain the existing user manuals and communications systems for CSIRO's IT client community Australia wide.

Establishment of computer based learning centres in Sydney and Melbourne by June 1993.

11.2.4. PROPERTY AND ACCOMMODATION

Provide a corporate property management service to ensure adequate and cost-effective research accommodation and facilities.
- 4%

Annual review of the Property Management Strategy and recommend amendments as necessary including on-going property consolidation and rationalisation.

Management of the Approved Capital Investment plan of $105 million over the Triennium, including externally funded items of approximately $20-30 million per annum.

Manage the successful implementation of an internal leasing scheme for CSIRO's accommodation.

Implementation of Stage 1 of the North Ryde redevelopment project.

Implementation of Stage 1 of the $14 million Parkville (Royal Parade) redevelopment project.

PPWC approval for the relocation of the McMaster Laboratories to Prospect as part of Stage 1.

Feasibility study for the relocation of the Limestone Avenue site.

11.2.5. INFORMATION SERVICES

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.
- 29%

Publication of the twelve Australian Journals of Scientific Research, *Australian Journal of Experimental Agriculture and Materials Forum.*

Publication of at least twenty-five CSIRO monographs.

Development of new products and services using emerging technologies such as multimedia, electronic transfer of files, networks and CD-ROMs.

Production of Divisional videos and material for TV broadcasting.

Publication of the science magazines *Ecos* and *Rural Research* and the business magazines *CSIRO Business.*

Production of science and research in progress databases on behalf of external customers and CSIRO.

Provide a quality assurance role in graphic design and print production services. Production of educational material for school inquiries.

Communication of CSIRO's research through multi-media displays and corporate videos.

Active marketing of CSIRO's science publishing through a Bookshop service.

Dissemination of science information through on-line networks, inquiry services, consultancies and advice.

Pursue economics of scale in purchasing and providing access to the $4.5M worth of science journals purchased annually by CSIRO.

Provision of cost-benefits through central management of the CSIRO library network catalogue the identification and preservation of CSIRO archives.

Provide design and print buying economies for a variety of Divisional reports..

Effective preservation and dissemination of CSIRO research publications and organisational records.

11.2.6. LEGAL SERVICES

Provide a professional corporate legal service to CSIRO.
- *2%*

Provision of legal policy advice to senior management and provision of general legal services to CSIRO especially in major commercial, litigation, administrative and compliance matters.

Monitor the status of CSIRO's legal affairs and ensure compliance with legislation and general law; review new legislation and developments in law.

Management of CSIRO's responsibilities under administrative law (FOI etc) and the Income Tax Assessment Act.

11.2.7. INTERNATIONAL RELATIONS

Provide the focus for international relations in CSIRO.
- *1%*

Provision of advice to the Chief Executive and Directors on international relations matters and support the development of corporate policy on international relations.

In cooperation with Corporate and Institute Planners, development of a methodology for determining priorities for international activities.

Foster CSIRO's contributions to international scientific collaboration and technical cooperation.

Arrangement and management of training and study tours for UN and other aid agencies, promote training opportunities to those agencies.

Arrangement and facilitation of four meetings of the CSIRO International Consulting Working Group.

11.2.8. CENTRAL SERVICES

Provide support and advisory services to CSIRO best delivered centrally.
- *8%*

Provision of effective and efficient accounting services to senior and line managers in the Organisation.

Provision of a personal counselling and management consultancy service for CSIRO staff.

Provision of technical and specialist advice to Divisions on occupational health and safety issues through Health and Safety Advisers.

Achieve savings for CSIRO through print buying services.

Provision of pay, superannuation and specialist administrative services for the whole of CSIRO.

Provision of local support services to Divisions/Units relating to the production of cheques, bank reconciliations, processing of accounts and claims and travel.

CORPORATE SERVICES DEPARTMENT
SUMMARY OF RESOURCES

Branch/Unit	Total Staff	Appropriation Allocation ($'000)	Revenue Allocation ($'000)	Total Budget ($'000)
Corporate Finance	21.7	1,315.1	0.0	1,315.1
Human Resources	62.8	5,668.5	0.0	5,668.5
Management Information Systems	53.5		0.0	9,639.9
Information Services	118.6	7,572.6	1,728.2	9,300.8
Corporate Property	12.0	1,030.9	0.0	1,030.9
Corporate Legal	5.6	385.0	0.0	385.0
CSIRO International Relations Centre	7.0	459.0	0.0	459.0
HQ Library & Informatio Service	4.0	260.1	0.0	260.1
Director	3.0	390.3	0.0	390.3
Senior Principal Adviser-Special Projects	2.0	174.3	0.0	174.3
Site Administration	21.1	2,961.0	0.0	2,961.0
Unallocated	0.0	588.2	0.0	588.2
TOTAL	311.3	30,445.0	1,728.2	32,173.2

12. LOCATION DIRECTORY

INSTITUTE OF INFORMATION SCIENCE AND ENGINEERING

Headquarters, North Ryde, NSW

Division of Information Technology:

Headquarters and Centre for Spatial Information Systems. Acton, ACT
Sydney Laboratories, North Ryde, NSW
Melbourne Laboratories, Carlton, VIC

Division of Mathematics and Statistics

Headquarters, North Ryde, NSW
Sydney Laboratories, Lindfield, NSW
Melbourne Laboratories, Clayton, VIC
Adelaide Laboratories, Urrbrae, SA
Canberra Laboratories, Yarralumla, ACT
Perth Laboratories, Floreat Park, WA

Division of Radiophysics

Headquarters and Radiophysics Laboratories, Marsfield , NSW
Ultrasonics Laboratory, Chatswood, NSW

The Australia Telescope National Facility

Headquarters and Sydney Laboratories, Marsfield, NSW
The Parkes Observatory, Parkes NSW
The Paul Wild Observatory, Narrabri, NSW

INSTITUTE OF INDUSTRIAL TECHNOLOGIES

Headquarters, Clayton, VIC

Division of Applied Physics

Headquarters and Laboratories, Lindfield, NSW
Adelaide Laboratories, Woodville, SA
Melbourne Laboratories, Clayton, VIC

Division Of Biomolecular Engineering

Headquarters and Laboratories, Parkville, VIC
Sydney Laboratories, North Ryde, NSW

Division of Chemical and Polymers

Headquarters and Laboratories, Clayton, VIC
Water and Wastewater Experimental Station, Lower Plenty VIC

Division of Manufacturing Technology

Headquarters and Melbourne Laboratories, Preston, VIC
Adelaide Laboratories, Woodville, SA
Sydney Laboratories, Lindfield, NSW
Brisbane Laboratories , St Lucia, QLD

Division of Materials Science and Technology

Headquarters, Clayton, VIC
Melbourne Laboratories, Clayton, VIC

INSTITUTE OF MINERALS, ENERGY AND CONSTRUCTION

Headquarters, North Ryde, NSW

Division of Building Construction and Engineering

Headquarters and Highett Laboratory, Highett, VIC
North Ryde Laboratory, North Ryde, NSW
Western Australia Laboratory, Rivervale, WA

Division of Coal and Energy Technology

Headquarters and North Ryde Laboratory, North Ryde, NSW
Lucas Heights Laboratory, Lucas Heights, NSW
"The Hermitage Site", Ryde, NSW

Division of Exploration Geoscience

Headquarters and Floreat Park Laboratory, Floreat Park, WA
North Ryde Laboratory, North Ryde, NSW
NML Laboratory, Lindfield, NSW
University of Canberra, Bruce, ACT

Division of Geomechanics

Headquarters and Syndal Laboratory, Syndal, VIC
Lucas Heights Laboratory, Lucas Heights, NSW
Port Melbourne Laboratory, Port Melbourne, VIC

Division of Mineral and Process Engineering

Headquarters and Clayton Laboratory, Clayton, VIC
Lucas Heights Laboratory, Lucas Heights, NSW
Port Melbourne Laboratory, Port Melbourne, VIC
North Ryde Laboratory, North Ryde, NSW

Division of Mineral Products

Headquarters and Port Melbourne Laboratory, Port Melbourne, VIC
Curtin University of Technology, Bentley, WA
Floreat Park Laboratory, Floreat Park, WA

INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING

Headquarters, North Ryde, NSW

Division of Animal Health

Headquarters and Animal Research Laboratory, Parkville, VIC
Australian Animal Health Laboratory, East Geelong, VIC
Maribyrnong Experiment Station, Maribyrnong, VIC
Werribee Field Station, Werribee, VIC
McMaster Laboratory, Glebe, NSW
McMaster Farm, Badgery's Creek, NSW
Pastoral Research Laboratory, Armidale, NSW

Division of Animal Production

Headquarters and Ian Clunies Ross Animal Research Laboratory, Prospect, NSW
Ryde Laboratory, North Ryde, NSW
McMaster Field Station, Badgery's Creek, NSW
Pastoral Research Laboratory (at Chiswick Research Centre and University of New England) Armidale, NSW
Arding Field Station, Armidale, NSW
Longford Field Station, Armidale, NSW
Laboratory for Rural Research, Floreat Park, WA
Yalanbee Field Station, Bakers Hill, WA

Division of Food Processing

Headquarters and Food Research Laboratory, North Ryde, NSW
Dairy Research Laboratory, Highett, VIC
Biochemistry and Microbiology of Cheese and Fermented Milk Products Group, University of Melbourne, VIC
Meat Research Laboratory, Cannon Hill, QLD
Extension Officers at Division of Animal Health, Parkville, VIC; Hawkesbury Agricultural College, Richmond, NSW; and Department of Agriculture, South Perth, WA

Division of Human Nutrition

Headquarters and Adelaide Laboratory, Adelaide, SA
Glenthorne Laboratory, O'Halloran Hill, SA

Division of Tropical Animal Production

Headquarters and Long Pocket Laboratories, Indooroopilly, QLD
Amberley Field Station, Amberley, QLD
Tropical Cattle Research Centre, Rockhampton, QLD
National Cattle Breeding Station, Rockhampton, QLD
Nutrition Group, Davies Laboratory, Townsville, QLD

Division of Wool Technology

Textile Physics Laboratory, Ryde, NSW
Textile Industry Laboratory, Belmont, VIC
Protein Chemistry Group, Parkville, VIC

INSTITUTE OF PLANT PRODUCTION AND PROCESSING

Headquarters, Canberra ACT

Division of Entomology

Headquarters and Canberra Laboratories, ACT
Myall Vale, NSW
Long Pocket Laboratories, Indooroopilly, QLD
Highett Laboratories, Highett, VIC
WA Laboratories, Perth, WA
Darwin Laboratories, NT
Adelaide Laboratory, Urrbrae, SA
Biological Control Unit, FRANCE
Screw-worm Fly Unit, NEW GUINEA

Division of Forest Products

Headquarters, Clayton, VIC
Highett Laboratories, Highett, VIC

Division of Forestry

Headquarters, Yarralumla, ACT
Tasmanian Forest Research Group, Hobart, TAS
Plantation Forest Research Centre, Mt Gambier, SA
WA Forest Research Group, Floreat Park, WA

Division of Horticulture

Headquarters and Adelaide Laboratory, Urrbrae, SA
Merbein Laboratory, VIC
Darwin Laboratories, NT
Brisbane Laboratories, St Lucia, QLD
Post-harvest Group, North Ryde, NSW

Division of Plant Industry

Headquarters and Canberra Laboratories, ACT
Cotton Research Unit, Myall Vale, NSW
Grain Quality Research Laboratory, North Ryde, NSW
Dryland Crops and Soils Research Unit, Floreat Park, WA
Rainforest Taxonomy Research Unit, Atherton, QLD

Division of Soils

Headquarters and Canberra Laboratories, ACT
Adelaide Laboratory, Urrbrae, SA
Davies Laboratory, Townsville, QLD

Division of Tropical Crops and Pastures

Headquarters and Cunningham Laboratory, ST Lucia, QLD
Davies Laboratory, Townsville, QLD
Samford Pasture Research Station, Samford, QLD
Cooper Laboratory, Lawes, QLD
Narayen Research Station, Mundubbera, QLD

INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT

Headquarters, Canberra, ACT

Division of Atmospheric Research

Headquarters and Melbourne Laboratories, Aspendale, Victoria

Centre for Environmental Mechanics

Headquarters and Canberra Laboratories, Canberra, ACT

Division of Fisheries

Headquarters and South and Southeastern Regional Laboratory, CSIRO Marine Laboratories, Hobart, TAS
North and Northeastern Regional Laboratory, CSIRO Marine Laboratories, Cleveland, Brisbane, QLD
West and Northwestern Regional Laboratory, CSIRO Marine Laboratories, Marmion, Perth, WA

Division of Oceanography

Headquarters and CSIRO Marine Laboratories, Hobart, TAS
CSIRO Marine Laboratories, Marmion, Perth, WA

Division of Water Resources

Headquarters and Perth Laboratories, Floreat Park, WA
Black Mountain Laboratories, Canberra, ACT
Waite Laboratories, Urrbrae, SA
Griffith Laboratories, Griffith, NSW

Division of Wildlife and Ecology

Headquarters and Canberra Laboratories, Gungahlin, ACT
Centre for Arid Zone Research, Alice Springs, NT
Tropical Ecosystems Research Centre, Berrimah, NT
Tropical Forest Research Centre, Atherton, QLD
Western Australian Laboratory, Helena Valley, WA

Biometrics Unit

Headquarters, Canberra, ACT

Coming up . . .

- **ultra-clean coal** — a low-ash, low-polluting coal may replace oil in industry and power generation
- **cleaner pulp mills** — our advice is the key to the Government's pulp mill effluent standards
- **gene shears** — a major breakthrough in biotechnology: harmful or unwanted genes can be prevented from doing their work
- **vaccines** — targets include the cattle tick, the sheep blowfly, worm parasites and diseases such as footrot and salmonellosis
- **climate modelling** — predicting drought and long- and short-term changes in the Australian climate
- **wireless communications** — high capacity systems for transmission of video, images, data and voice, with the flexibility associated with mobility
- **plasma waste technology** — very high temperature plasma destruction of toxic chemical wastes

And beyond with Australia's Youth . . .

- **CSIRO's Double Helix Science Club** — bringing the excitement of today's science to tomorrow's leaders
- **CSIRO Science Education Centres** — hands-on science experiences outside the classroom
- **CSIRO Women in Science Project** — encouraging girls to go on with maths and science in their schooling and beyond
- **CSIRO Student Research Scheme** — final-year secondary students try on the shoes of the scientists with real-life research projects
- **BHP Science Awards** — fostering excellence with real rewards to tomorrow's researchers and today's best teachers
- **Scholarships** — supporting talented students at all levels of tertiary study

CSIRO
AUSTRALIA

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.

Australian Science, Australia's Future