

# **Operational Plan**

1990–91



R e s e a r c h

A d v a n c i n g

A u s t r a l i a

**COMMONWEALTH SCIENTIFIC AND INDUSTRIAL  
RESEARCH ORGANISATION**

**OPERATIONAL PLAN  
1990–91**

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## **FOREWORD**

Scientific research and technological innovation will be critical factors in lifting Australia's economic performance over the 1990s. CSIRO takes a leading role in its contribution to the scientific and technological capability of the nation.

Australia must become more competitive in the 1990s, with export growth outpacing growth in imports. At the same time, growing concern for the quality of the natural environment means that Australia's future economic growth should not occur at the expense of a degraded or depleted natural environment. CSIRO will play an important role in establishing the foundations for sustainable economic growth in Australia.

The allocation of CSIRO's resources among the many research areas for 1990-91 reflects these needs to a large extent.

The 1990-91 Operational Plan is a document which we use for management, communication and evaluation purposes. At the end of the year the Organisation's performance will be gauged by how well we have achieved our objectives in terms of actual outcomes. The planned activities and outcomes set out in this document represent a substantial return on investment for 1990-91.

My aim is to provide the best possible work environment for CSIRO staff to ensure that objectives are met effectively and efficiently. Also, I am keen to boost the Organisation's performance in delivering research output and technology to industry. This will mean talking to industry representatives early in the planning phase of many of our research projects.

The CSIRO Operational Plan is required by legislation. Planning, however, occurs not only because the government says we must. Planning is of paramount importance in the development of research and technology. Now that we know our budget beyond the current fiscal year, planning can be more effective. The 1990-91 Operational Plan complements the Organisation's Strategic Plan 1988-92, and the Corporate Management Plan 1988-89 to 1990-91.

I trust that, as a result of better planning, CSIRO will be recognised as much for its contribution to Australia through timely delivery of relevant research as for its excellence in science.

Dr John W Stocker  
CHIEF EXECUTIVE  
June 1990

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## 1. INTRODUCTION

### **1.1 Planning In CSIRO**

The CSIRO Plan comprises three interrelated components: the Strategic Plan, the Corporate Management Plan and the Operational Plan.

#### **Strategic Plan**

- Required by law with the CSIRO Board responsible for its preparation.
- Outlines broad strategic goals, corporate objectives, policies and strategies of the Organisation.
- Covers five years, with updates as necessary.
- For use by CSIRO staff, Parliament and external stakeholders.
- Submitted to the Minister before it comes into effect.

#### **Corporate Management Plan**

- Meets the requirements of the Commonwealth Budget Cycle with the Chief Executive and Directors responsible for its preparation.
- Prepared, through inputs from line managers, to drive CSIRO's three-year budget.
- Relates strategies and actions for the key performance areas of research, technology transfer, funding, human resource development, communication and corporate development to their proposed budgets and allocations of resources.
- Updated annually.
- For use by CSIRO managers.

#### **Operational Plan**

- Required by law, approved by Board, Chief Executive responsible for its preparation.
- Gives effect to the Strategic Plan and the Corporate Management Plan by giving details of strategies, activities, resources and projected outcomes of programs in key performance areas.
- Covers one year, prepared annually.
- For use by CSIRO staff and Parliament.
- Submitted to the Minister prior to the beginning of the financial year which it covers.

The Operational Plan is designed for planning purposes within CSIRO Institutes and Divisions, and concentrates on objectives, strategies and annual outcomes.

Descriptive information on programs is contained in the annual *Directory of CSIRO Research Programs*, which lists individual project titles. Specific project

details may be obtained direct from the Divisions or via CSIRO's research management information system, a significant sub-set of which is publicly available through AUSTRALIS.

### **1.2 Corporate Goals And Strategies**

#### **Strategic Goals**

CSIRO has three strategic goals as expressed in the CSIRO Strategic Plan 1988-92:

- *Carry out research which can be applied by Australian industry, or by government for community benefit.*
- *Collaborate with other institutions and industry to strengthen the research effort and ensure the transfer and application of that research.*
- *Lead and promote an expanded science and technology effort in Australia.*

CSIRO will conduct and apply research from a broad spectrum of disciplines into areas of potential economic, social and/or environmental gain to Australian industry and the wider Australian community. In addition, CSIRO will advance scientific knowledge through all its endeavours for the long term benefit of science in Australia.

#### **Corporate Management Goals**

The corporate management goals of CSIRO, as presented in the Corporate Management Plan 1988-89 to 1990-91 are:

#### **Research Priorities and Funding**

- *Strengthen mechanisms for determining research priorities and resource allocation across the Organisation in order to maximise the contribution of CSIRO research to national economic and social welfare.*

#### **Research Sectors**

- *Enhance the efficiency, international competitiveness and growth of Australia's:*
  - *information and communications industries*
  - *manufacturing industries*
  - *minerals and energy industries*
  - *rural production and processing industries*
  - *construction industries*
- *Provide the scientific knowledge required for effective management and conservation of Australia's natural resources and environment.*
- *Improve human wellbeing and community health in Australia.*

### ***Research Management Support***

*Provide support to facilitate the conduct of efficient and effective research by the Organisation.*

### **1.3 Corporate Activities/ Outcomes 1990-91**

Activities and outcomes in the areas of research, technology transfer, funding, communication, people management and corporate development are presented throughout this document. The specific outcomes of the Divisions are predominantly in the areas of research and technology transfer. The following is a list of planned activities and outcomes for 1990-91, at the Corporate level.

#### **Research**

- Align CSIRO scientific research priorities with stated and perceived national priorities;
- Determine strategic directions for CSIRO for inclusion in the Strategic Plan for the 1991-96 period; and
- Participate in the implementation of the Government's Cooperative Research Centres.

#### **Technology transfer**

- Demonstrate increased adoption by industry and the community of results of CSIRO research; and
- Seek to increase real returns from intellectual property.

#### **Funding**

- Continue efforts to increase the percentage of non-appropriation funds in the total CSIRO budget consistent with a 30% target by June 1991;
  - coupled with this, to assess continually the effect of meeting this target on essential strategic research programs in the Organisation;
- Seek to secure the Government's guarantee to at least maintain the Organisation's appropriation budget in real terms relative to 1990-91 with an increase in the capital base and to maintain their policy on retention of external earnings from all sources; and
- Continue efforts to increase the value of research contracts in real terms during 1990-91.

#### **Communication**

- Finalise communication planning documents for release – Promotional Communication Plan, Internal Communication Plan, and an Industry/Stakeholders Communication Plan.
- Update and release policy concerning public statements by CSIRO employees; and

- Publish Directory of CSIRO Research Programs for 1990-91.

- Produce the CSIRO Annual Report for 1990-91.

#### **People Management**

- Prepare a Human Resources Strategic Plan;
- Implement the new structures, pay scales and skills training arrangements agreed by the Industrial Relations Commission as part of award restructuring;
- Implement tenure and redundancy awards covering all staff classifications to provide improved career opportunities;
- Assist with developing further performance assessment measures for Directors, Chiefs, program managers and senior administrative staff;
- Promote science as a career for young people;
- Introduce career planning for senior managers; and
- Implement flexible reward systems which encourage performance through incentives.

#### **Corporate Development**

- Promote the CSIRO Vision throughout the Organisation.
- Prepare the Strategic Plan 1991-96 and the Corporate Management Plan 1991-92 to 1993-94; and
- Develop further corporate information systems to meet the needs of managers and complete installation of CSIRO's integrated voice and data network.

#### **CSIRO Evaluation Plan 1990-91**

There is substantial ongoing review and evaluation of CSIRO functions and programs. During 1989 CSIRO prepared an Evaluation Plan to meet new a planning requirement set by the Government. The *CSIRO Evaluation Plan 1989-90* outlines past and current reviews of the Organisation and provides a detailed listing of reviews and evaluations for 1989-90.

The CSIRO Evaluation Plan 1990-91 will provide the results of evaluations completed during 1989-90 and details of evaluations proposed for 1990-91.

### **1.4 Resources Summary 1990-91**

Table 1 presents the sources of income for CSIRO as a whole for 1990-91 based on estimates as at 16 May 1990. Estimates of earned revenue and sponsored research funds, which comprise the Organisation's external funds, represent some 27.9% of CSIRO's total funds in 1990-91.

**TABLE 1: CSIRO SOURCES OF INCOME 1990-91**  
 (estimates as at 16 May 1990)

TOTAL APPROPRIATION FUNDS	EARNED APPROPRIATION REVENUE	SPONSORED RESEARCH FUNDS	TOTAL FUNDS
\$M	\$M	\$M	\$M
392.52	22.15	130.03	545.70

**TABLE 2: ESTIMATED ALLOCATION OF FUNDS 1990-91**  
 (estimates as at 16 May 1990)

	APPROP ANNUAL	APPROP CAPITAL	APPROP TOTAL	SPONSORED RESEARCH	TOTAL FUNDS
	\$M	\$M	\$M	\$M	\$M
Institute of Information Science and Engineering	34.94	1.85	36.79	4.09	40.88
Institute of Industrial Technologies	55.32	2.95	58.27	18.50	76.77
Institute of Minerals, Energy and Construction	55.82	2.92	58.74	22.90	81.64
Institute of Animal Production and Processing	60.49	3.50	63.99	39.60	103.59
Institute of Plant Production and Processing	74.63	2.30	76.93	27.01	103.94
Institute of Natural Resources and Environment	51.29	1.70	52.99	16.00	68.99
Corporate Services Department	22.67	0.31	22.98	1.84	24.82
Corporate Centre (excluding Corporate Services Department)	3.76	0.00	3.76	0.09	3.85
Special Purpose Funds	23.64	0.75	24.39	0.00	24.39
Repairs & Maintenance	9.00	0.00	9.00	0.00	9.00
Contingency	3.75	0.50	4.25	0.00	4.25
Research Initiatives	0.57	2.00	2.57	0.00	2.57
<b>TOTAL</b>	<b>395.89</b>	<b>18.78</b>	<b>414.67</b>	<b>130.03</b>	<b>544.70</b>

**Note:** Total External Funds of \$152.18M comprise Sponsored Research Funds of \$130.03M and Earned Appropriation Revenues of \$22.15M (the latter amount being included in Appropriation Annual and Appropriation Capital Expenditure figures).

Due to rounding, columns may not add exactly to totals.

**TABLE 3: CSIRO STAFF NUMBERS**  
(as at 23 May 1990)

	IISE	IIT	IMEC	IAPP	IPPP	INRE	CORP CENTRE	TOTAL
Prof. Staff	211.8	439.5	525.2	567.3	607.5	445.0	74.4	2870.7
Total Staff	404.1	907.3	1037.0	1559.3	1483.3	855.8	368.5	6615.3

\* Numbers are expressed in equivalent full time units. Excludes non-CSIRO personnel, eg visiting scientists, students and Board Members.

Table 2 summarises the allocation of funds to Institutes and the Corporate Centre for 1990-91 in terms of estimated expenditure. The figures presented in Tables 1 and 2 are preliminary estimates for 1990-91 and are subject to revision.

Table 3 presents a summary of staff numbers as at May 1990.

### **1.5 Corporate Structure**

The Corporate structure of CSIRO and the relationships between the different centres in the Organisation are shown in Figure 1.

CSIRO policy is determined by the Board of CSIRO.

Research is carried out in six research Institutes, relating to major sectors of the Australian economy or major areas of community interest. Each Institute comprises a number of Divisions which generally correspond to a particular industry or significant area of economic activity or interest within the sector covered by the Institute.

The Corporate Services Department supports the Chief Executive and the CSIRO Executive Committee in areas of policy development for corporate management, and provides corporate

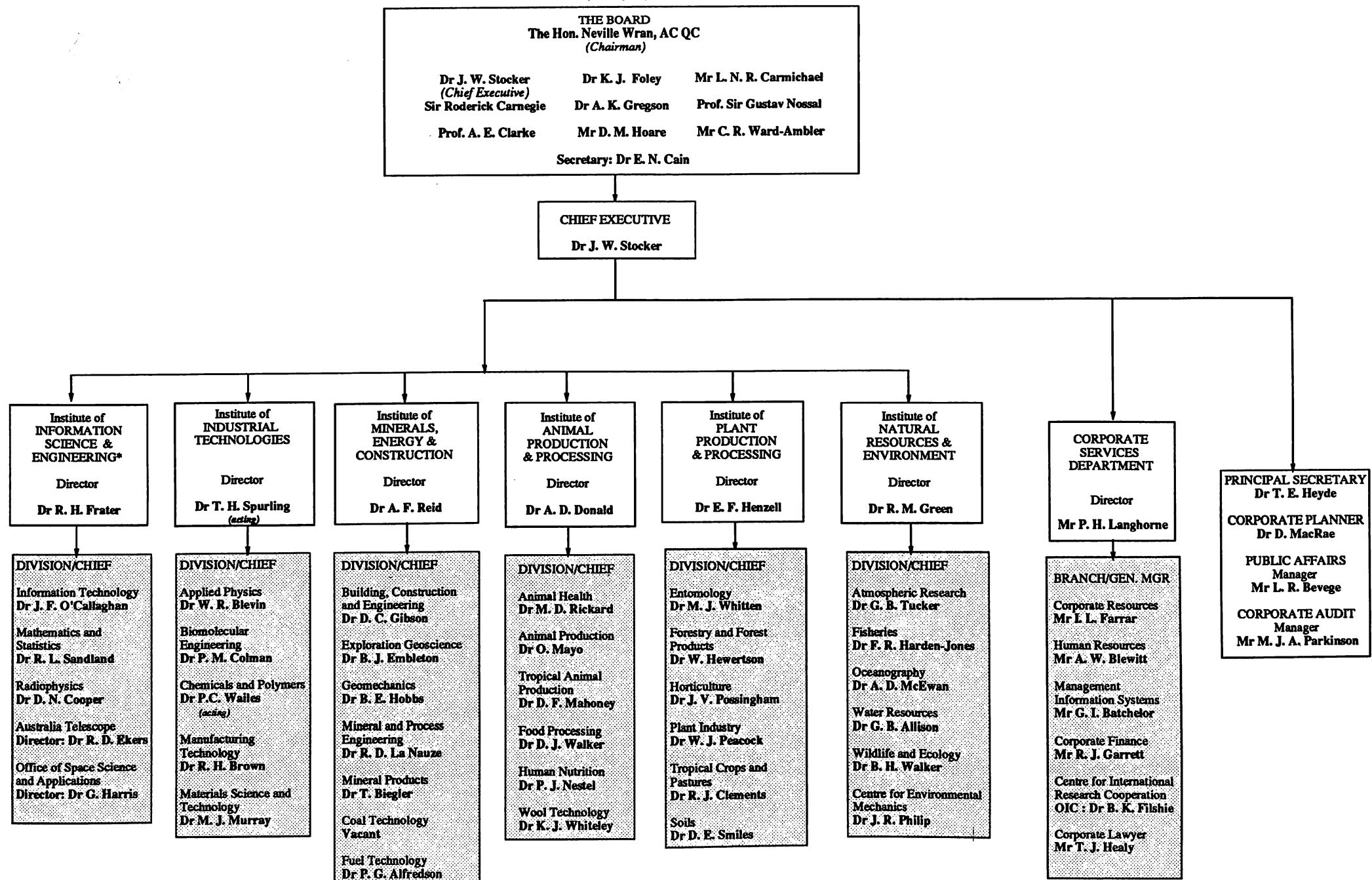
advice and coordination. It also provides services, such as payroll, best undertaken at the corporate level.

The Chief Executive and the Executive Committee are also supported by the activities of the Office of the Chief Executive, the Corporate Planning Office, the Public Affairs Unit and the Corporate Audit Group.

### **1.6 Outline Of The Operational Plan**

Presentation of the Operational Plan is by Institute. In addition there are plans presented for each of the Corporate Centre functions, the Corporate Services Department and SIROTECH. The objectives, strategies and activities/outcomes of each Institute are presented together with estimates of Institute financial and staff resources available for the coming year. Details on capital expenditure are also presented. At the Divisional level, in addition to objectives and strategies, planned outcomes are detailed. The percentage of total resources committed to each specific objective is recorded, as well as an indication of the proportion of the Division's funds expended from external sources.

**FIGURE 1 CSIRO ORGANISATIONAL STRUCTURE**  
(As at May 1990)



\* Formerly Institute of Information & Communications Technologies

**2. CORPORATE CENTRE**  
 (excluding Corporate Services Department)

**2.1 OFFICE OF THE CHAIRMAN AND BOARD SECRETARIAT**

**Objective**

*To provide advice and support to the Chairman and Board Members to enable them to perform effectively their functions as a Board as prescribed in the Science and Industry Research Act 1949 and the Ministerial Guidelines issued on 2 June 1988.*

**Strategy**

*To assist the Chairman and Board Members in the efficient conduct of their statutory and other responsibilities of office.*

*To enhance the operations of the Board by provision of an effective and efficient Secretariat.*

**Specific Objectives**  
*(Percent Resources)*

**To maintain and improve the effectiveness of the Board's meetings and operations. (30%)**

**To facilitate and coordinate the interaction of the Chairman and the Board Members with the Chief Executive and his Office, Directors, the Minister and other relevant Ministers and senior officers from Government, industry groups and the tertiary education sector. (55%)**

**To keep abreast of policy and technical developments in government, science, industry and technology. (15%)**

**Planned Outcomes**

Guidance will be provided in framing agendas and where appropriate, assisting with the content of Board agenda papers to ensure integration of the activities of the Board and the Executive Committee; oversee follow-up action.

The Office will identify key policy issues and provide full and timely briefings to the Chairman and Board Members; comprehensive assistance to be provided with correspondence, speeches and visit and meeting programs.

The Office will monitor relevant published material for significant national and international developments and advise Board Members where appropriate.

**Appropriation Total Allocation:** \$600,000

**Total Budget:** \$600,000

## **2.2 OFFICE OF THE CHIEF EXECUTIVE**

### **Objective**

***To provide support to the Chief Executive and enable the effective functioning of the Executive Committee, enhancing the effectiveness of CSIRO's external liaison and internal interaction.***

### **Strategy**

***The Office will provide effective and efficient support for the Chief Executive and the Executive Committee, in a range of interactions with the CSIRO Board, Ministers, government, industry and the tertiary education sector.***

***The Office will maintain effective liaison with Institute, Divisional and Corporate Centre staff, co-ordinating action and providing professional assistance with issue analysis and the development of policies as required. Staff will also facilitate the interaction of outside bodies with the Organisation.***

***The Office will maintain awareness of relevant scientific, social and political developments in Australia and overseas, identifying issues relevant to CSIRO and science and technology generally. It will participate in developing procedures for promoting awareness of the value of science and technology in government, industry and the community.***

### **Specific Objectives (Percent Resources)**

### **Planned Outcomes**

**To facilitate the interaction of the Chief Executive with Institutes and Divisions, Parliamentarians and senior government officers, industry, and the tertiary education sector. (30%)**

Assistance will be provided with the Chief Executive's visit and meeting programs, correspondence, speeches and briefings, and participation in the Prime Minister's Science Council and the Coordination Committee on Science and Technology.

**To enhance the efficiency of Executive Committee meetings and the effectiveness of papers to be presented to the Executive Committee and by the Chief Executive to the Board. (25%)**

Assistance will be provided as required in the presentation of papers; follow-up action will be promptly defined, systematically monitored and facilitated.

**To gather information, delineate issues and prepare relevant papers. (10%)**

Papers will include some for the Executive Committee and the Board; discussion papers for circulation within CSIRO; surveys to assist analysis of current activities and development of policy; and support for the involvement of CSIRO in external issues and activities.

**To enhance CSIRO's interaction with Ministers and their staff. (5%)**

Assistance will be provided for the Chief Executive and senior executives through advice, strategies and briefing on matters of political or public importance to CSIRO.

**To draft or co-ordinate advice, responses and briefings for the Minister responsible for CSIRO. (10%)**

The Office will co-ordinate communication with the Minister so that appropriately drafted responses to Ministerial correspondence and topical briefings are provided in a timely manner.

**To co-ordinate or draft submissions and responses for external inquiries and activities. (5%)**

Corporate submissions and responses will be co-ordinated, developed or monitored in consultation with the appropriate areas in CSIRO.

**To assist the interaction of government departments and agencies, industry and the tertiary education sector with the Organisation. (10%)**

The Office will support the activities of the CSIRO/DITAC Liaison Committee, the CSIRO/DSTO Liaison Committee, the joint CSIRO/AVCC (Australian Vice-Chancellors) committee, facilitate liaison with the Australian Research Council, and assist the interaction of Institutes and Divisions with AUSTRADE and appropriate areas of Departments such as Industry, Technology and Commerce, and Primary Industries and Energy, and the Arts, Sport, the Environment, Tourism and Territories.

**To keep abreast of developments in science, industry and technology including national and international policy issues. (5%)**

The Office will monitor the press and literature for relevant developments in Australia and overseas, including OECD literature, and draw the attention of senior management to issues which are relevant to CSIRO and to science and technology generally.

**Appropriation Total Allocation:** \$1,080,000  
 (includes salary and operating expenses for Chief Executive)

**Total Budget:** \$1,080,000

## **2.3    CORPORATE AUDIT**

**Objective**

*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 systems; and*
- participation in the systems design process.*

**Specific Objectives**  
*(Percent Resources)*

**Planned Outcomes**

**To provide a comprehensive audit coverage to the Organisation providing useful advice and information at research unit, division and institute levels. (50%)**

Perform comprehensive reviews of 12 Divisions covering all six Institutes. Perform reviews of those EDP systems assessed at more than 22 risk points in the EDP Audit Strategic Plan. Perform reviews of the most significant administrative functions as identified in risk assessment process. Identify in excess of \$1M in reduced risk and increased efficiency.

**To maintain and increase as required the level of involvement of internal auditors in the development of administrative systems. (15%)**

Participate in the design of all major administrative systems (EDP and other) developed during 1990-91.

**Provide a high quality consultancy service. (10%)**

Identify potential efficiency savings or reduced risk in excess of \$100,000.

**To enhance systems of internal control within the Organisation. (5%)**

Implement formal Devolved Compliance Checking within 4 Divisions. Implement Centralised Continuous Monitoring on Receivables systems.

**To enhance internal audit management. (5%)**

Perform a formal quality assurance review of the operations of the group.

**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. (2%)**

Implementation of computerised audit documentation. Use of Electronic Mail for document transfer.

**As opportunities become available, to maintain the program of exchanges of auditors and research unit staff to further their experience of each other's environment. (3%)**

Continue exchange of information with DSIR Internal Audit. Establish links with audit groups of similar Organisations. Maintain transfer of experience between Corporate Audit and other administrative units within the Organisation by recruitment and temporary transfer.

**To provide training programs to improve skills in the following areas or as indicated by formal Performance Review and Development appraisals:**

- **auditing practice (especially in an accrual accounting environment), comprehensive audit techniques and systems analysis for all auditors;**
- **EDP auditing for field auditors, including techniques for audits of microcomputer-based systems;**
- **auditing on-line database management systems for EDP auditors;**
- **interviewing skills for all auditors; and**
- **a combination of formal courses and work experience for trainee Internal Auditors. (10%)**

All staff to receive 12 days of formal training.

**Appropriation Total Allocation:** \$900,000

**Total budget:** \$900,000

## **2.4 CORPORATE PLANNING OFFICE**

**Objective**

***Facilitate the development and operation of CSIRO corporate level planning processes.***

**Strategy**

***Promote the development and application of mechanisms which will assist the Chief Executive and Directors to determine and implement the Organisation's strategic directions and priorities.***

<b>Specific Objectives (Percent Resources)</b>	<b>Planned Outcomes</b>
<b>Provide planning assistance to the Chief Executive and Directors. (35%)</b>	<p>This includes the provision of:</p> <ul style="list-style-type: none"> <li>· advice on corporate level planning processes and planning methodologies, eg application of priority setting framework;</li> <li>· supporting data and information as required, eg integrating corporate planning information and corporate finance information, preparation of outlook reports, coordination of situational analyses;</li> <li>· a watching brief on external studies;</li> <li>· secretariat support to strategic planning workshops and other planning meetings as required;</li> <li>· assistance in retrospective evaluation and prospective appraisal of research as required by Directors; and</li> <li>· assistance in preparation of business plans as required by Directors.</li> </ul>
<b>Coordinate preparation/revision of the CSIRO Plan. (50%)</b>	<p>This involves the following components:</p> <ul style="list-style-type: none"> <li>· Strategic Plan 1991–96 by October 1990;</li> <li>· Corporate Management Plan 1991–92 to 1993–4 by October 1990;</li> <li>· Operational Plan 1991–92 by June 1991;</li> <li>· Evaluation Plan 1990–91 by November 1990; and</li> <li>· assessments of the external and internal environment in support of these plans.</li> </ul>
<b>Training. (15%)</b>	<p>This includes assisting Institutes and Divisions as required by Directors:</p> <ul style="list-style-type: none"> <li>· to access and make effective use of corporate planning information and databases;</li> <li>· to conduct situational analyses;</li> <li>· to develop and apply priority setting frameworks; and</li> <li>· to conduct research evaluation workshops.</li> </ul>

<b>Appropriation Total Allocation:</b>	\$360,000
<b>Sponsored Research:</b>	\$ 30,000
<b>Total Budget:</b>	\$390,000

## 2.5 **PUBLIC AFFAIRS**

**Objective**

***To gain recognition within Government, industry and the general community of CSIRO as an organisation of excellence and dynamism which generates an exceptional return on the funds allocated to it by Government or invested in it from the private sector, and which can play the role of "honest broker" on environmental matters.***

**Strategy**

***Public Affairs works closely with Institutes and Divisions to meet these objectives. The focus of this interaction is the Communication Working Group (CWG) on which Institute Public Affairs and Communication Manager are represented.***

***Through the CWG, major events, announcements and publicity opportunities are planned. Stakeholders are identified and avenues of communication are developed in order to reach these stakeholders and to gain their support.***

***Liaison on day to day public affairs activities and Institute and Divisional input to corporate publications are obtained through frequent working interactions outside the formal sessions of the CWG.***

**Specific Objectives**  
**(Percent Resources)**

**Promote CSIRO to stakeholders and the general public. (40%)**

**Planned Outcomes**

Positive media coverage of CSIRO. Regular public appearances and interaction with stakeholders by CSIRO scientists and senior managers. Three issue oriented media campaigns. Seminars for key stakeholders on CSIRO's directions and national outlook. Collaborative promotions with industry and other Government Departments.

**Promote a consistent and co-ordinated approach to CSIRO's external relations. (40%)**

Greater/shared awareness among CSIRO staff of changing ethos, such as new vision for CSIRO. A distinctive style for all corporate publications. Correct usage of the logo throughout the Organisation. Monthly staff magazine, CoResearch, to keep staff informed of CSIRO policies and activities.

**Ensure details of CSIRO's activities and structure are made available on public record. (20%)**

Annual Report published to Parliamentary requirements. Review of corporate publications and their distribution completed to ensure that stakeholders are informed or have access to a full record of CSIRO's activities. Descriptions of CSIRO kept up-to-date in commonly used Directories.

<b>Appropriation Total Allocation:</b>	<b>\$830,000</b>
<b>Sponsored Research:</b>	<b>\$ 60,000</b>
<b>Total Budget:</b>	<b>\$890,000</b>

### **3. INSTITUTE OF INFORMATION SCIENCE & 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, telecommunications and space industries.***
- . to assist other industry sectors to improve their competitiveness through the use of advanced computer, communications and space systems.***

#### **Strategy**

***The Institute conducts its research programs in collaboration with other CSIRO Institutes, academic institutions and industrial research groups, and encourages education and training in the information and communications technologies. It plans to exploit the results of its research through joint ventures, collaborative research, development projects and consultancies with Australian industries.***

***The Institute will maintain itself at the forefront of international research on information and communications technologies to ensure the continued excellence of its technology. This will involve, in particular, improvement of software engineering and collaboration technology environments and practices.***

***The Institute hosts the Australia Telescope in recognition of its strategic importance for the development of key technologies relevant to the Australian information, telecommunications and space 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. The Institute will also become involved in education and training, both undergraduate and postgraduate.***

***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.***

### Specific Activities

- Establish demonstrator projects which draw together skills from across the Institute.
- Finalise arrangements for CSIRO-Flinders Joint Research Centre and establish two more joint research centres.
- Finalise support arrangements for the new CSIRO supercomputing facility.
- Develop prototype multi-mode mail, directory and related services to support communication within the Institute.
- Plan development of new accommodation at Macquarie University, ANU and Clayton, for co-location of parts of COSSA, Division of Mathematics and Statistics and Division of Information Technology.
- Work with industry towards establishment of an information industries research association.
- Complete cost-benefit review of ground station antenna technology in conjunction with BIE and finalise series of cost-benefit analyses for other Institute projects.
- Complete review of effectiveness of ICON and Industrial Research News and develop effective communication techniques for reaching outside the Australian information industry.
- Coordinate appropriate professional and career development training activities across the Institute.

The Institute encompasses the following Divisions and Units.

<b>Division of Information Technology</b>	Headquarters and Sydney Laboratories, North Ryde, NSW Centre for Spatial Information Systems, Acton, ACT Melbourne Laboratories, Carlton, Victoria
<b>Division of Mathematics and Statistics</b>	Headquarters, North Ryde, NSW Sydney Laboratories, Lindfield, NSW Melbourne Laboratories, Clayton, Victoria Adelaide Laboratories, Urrbrae, South Australia Canberra Laboratories, Yarralumla, ACT Perth Laboratories, Floreat Park, WA
<b>Division of Radiophysics</b>	Headquarters and Radiophysics Laboratories, Marsfield, NSW Ultrasonics Laboratory, Chatswood, NSW
<b>The Australia Telescope National Facility</b>	Headquarters and Sydney Laboratories, Marsfield, NSW The Parkes Observatory, Parkes, NSW The Paul Wild Observatory, Narrabri, NSW
<b>CSIRO Office of Space Science and Applications (COSSA)</b>	Headquarters, Barton, ACT Research Aircraft Facility, Marsfield, NSW

The Institute Headquarters is at North Ryde, Sydney, NSW

**INSTITUTE OF INFORMATION SCIENCE AND ENGINEERING**

**SUMMARY OF RESOURCES**

**(estimates as at 16 May 1990)**

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
Information Technology	35.4	51.0	5,708.3	1,650.0	7,358.3	700.0	8,058.3
Mathematics & Statistics	47.8	60.8	3,864.5	150.0	4,014.5	900.0	4,914.5
Radiophysics	70.8	166.5	8,054.6		8,054.6	2,000.0	10,054.6
COSSA/RAF	7.0	14.7	2,575.8		2,575.8	185.0	2,760.8
Australia Telescope National Facility	45.8	98.6	7,902.9	50.0	7,952.9	300.0	8,252.9
CSIRO Supercomputing	2.0	2.0	2,405.6		2,405.6		2,405.6
Institute Headquarters <sup>c</sup> Office Centrally managed funds	3.0	9.5	995.6		995.6		995.6
			1.0	3,434.9	3,434.9		3,434.9
<b>Total</b>	<b>211.8</b>	<b>404.1</b>	<b>34,942.2</b>	<b>1,850.0</b>	<b>36,792.2</b>	<b>4,085.0</b>	<b>40,877.2</b>

a Staff numbers, expressed in equivalent full time units, as at 23 May 1990.

b Annual and Capital Appropriation includes earned appropriation revenues.

c Includes \$1.3M collaboration with Universities in information technology and \$0.78M collaborative work in information technology.

Includes \$0.25M administered on behalf of all Institutes.

Includes \$1.1M administered on behalf of Divisions.

### **3.1 DIVISION OF INFORMATION TECHNOLOGY**

#### ***Objective***

***To provide a strategic research capability in information technology for the benefit of Australian industry and to develop innovative computer-based products which can improve the international competitiveness of Australian industry.***

#### ***Strategy***

***The Division pursues its objectives through strategic research on computing and communications technologies, through the integration of these technologies into generic computer-based systems and through product development for targeted applications.***

***In this activity, the Division collaborates with other research groups in information technology, with other CSIRO Divisions (which have established industry relationships) and with the Australian information industry.***

#### **Specific Objectives (Percent Resources)**

**To develop tools and techniques for processing spatial (geographic) data and to exploit these technologies in spatial information systems. (45%)**

#### **Planned Outcomes**

Prototype implementation of kernel image processing systems (KIPS). Establish collaborative arrangements with other groups to develop application modules for KIPS.

Design and develop image processing and visualisation techniques for parallel architectures.

Complete pilot projects on spatial database toolkit.

Design and develop prototype system for image-based natural resource and environmental management.

Design and develop additional spatial optimisation techniques for territory assignment and site location.

Demonstrate decision support framework incorporating terrain analysis, spatial planning and visualisation techniques.

**To develop tools and methodologies for engineering of knowledge-based systems. (25%)**

Commercialise relational algebra accelerator (RAA) board, and determine commercial potential of related knowledge processing projects.

Develop applications of knowledge analysis techniques to problems in the government, financial and insurance sectors.

Demonstrate knowledge management systems for examining hypotheses about complex issues such as environmental management, process control and wool quality assessment.

**To investigate and develop computational architectures and techniques for high-performance computing. (15%)**

Establish a technical advice and support service for CSIRO supercomputing users.

Design parallel architecture toolkit.

Analyse computational techniques in meteorology, geomechanics, molecular dynamics and event logic.

**To demonstrate and develop communications services in advanced computing environments. (15%)**

Establish communications network and services for CSIRO research community.

Prototype mail, directory and related services to support collaborative research and group communications.

Demonstrate multi-media information exchange using extended mail protocols.

**Appropriation Total Allocation (includes earned appropriation revenues): \$7,358,300**

**Sponsored Research:** \$ 700,000

**Total Budget:** \$8,058,300

**Appropriation Capital:** \$1,650,000

The Division expects that 13% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **3.2 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 quality and process improvement, in science, government and industry.*

**Strategy**

*The Division pursues its objectives by means of a mix of strategic and tactical research in mathematics and statistics, with the emphasis on working directly with Australian companies and other organisations on important tactical problems and by identifying strategic research in that context. The Division will concentrate on increasing resources for longer-term projects for which external funding is actively being sought, including through industrial partnerships and joint ventures. Following an analysis of market opportunities, the Division will actively seek joint ventures with other CSIRO Divisions to add value to projects in which high-level mathematical, statistical and related computing technologies play a central role. The Division will continue to foster active collaboration with a number of Australian universities and research groups to enhance the Division's ability to meet its objectives.*

**Specific Objectives**  
(Percent Resources)

**Planned Outcomes**

**To develop appropriate mathematical models and computational algorithms for a range of industrial applications, and to deliver the benefits of this research to users. (30%)**

Develop mathematical models for understanding and improvement of a number of specific processes/products.

Publish the Proceedings of the 1990 Mathematics-in-Industry Study Group (MISG), prepare a triennial report for the years 1988-1990, and review MISG operations and concept.

Develop finite-element-based software, with high-quality graphics output, for material flows.

**To improve the quality of Australian manufactured goods and services. (39%)**

Develop experimental methods for identifying and reducing sources of variability in a number of manufacturing environments.

Establish at least three long-term relationships with organisations implementing total quality management, and continue to work with existing clients.

Develop statistical models, methods and automated procedures for understanding and improvement of a number of specific processes/products.

**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. (22%)**

Develop and test robust regression-based methods for change detection in image processing.

Develop algorithms for accurate registration of remote sensing and other image data.

Develop flexible image analysis algorithms for use in automatic feature extraction.

Develop and evaluate algorithms for signal extraction from non-white noise.

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.  
(9%)

Extend the ACE software to provide multiple simultaneous graphics windows and to enable the display of digital images to be combined with statistical graphics.

Manage the connection of all computer systems using the Internet Protocol by connecting all sites to AARNet with low or medium speed links and prepare a timetable for upgrading these speeds.

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,014,500**

**Sponsored Research:** \$ 900,000

**Total Budget:** \$4,914,500

**Appropriation Capital:** \$ 150,000

The Division expects that 20% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **3.3 DIVISION OF RADIOPHYSICS**

**Objective**

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

**Strategy**

***The Division conducts research into microwave and millimetre-wave technologies, signal processing and ultrasonics and is extending into opto-electronics. The Division provides a fund of high-calibre expertise in the key areas of imaging and communications systems.***

***The Division collaborates with industry, Government Business Enterprises and bodies such as DSTO, and promotes multi-disciplinary projects incorporating the Division's skills.***

**Specific Objectives  
(Percent Resources)**

**Planned Outcomes**

**To develop techniques for the design and manufacture of passive microwave devices for communication systems. (10%)**

Develop shaped-beam antennas for on-board satellite use.

Develop technology for the design and manufacture of earth station antennas and provide antenna design expertise for the Australia Telescope National Facility.

Develop millimetre-wave antennas for integration with active components.

Develop techniques for the design of wideband microwave components, including ortho-mode transducers, polarizers and filters.

**To provide professional coordination between industry and the Division and to support the Australian industrial base in satellite earth-station antenna technology. (7%)**

Fulfil contractual obligations for satellite earth-station antennas.

Manage the commercialisation of the Synthetic Aperture Radar project.

Develop the electronically-scanned L-Band MOBILESAT antenna in collaboration with the commercial partner.

**To develop advanced gallium arsenide GaAs-based semiconductor devices and monolithic integrated circuits for communications systems. (20%)**

Transfer base GaAs microwave device and integrated circuit fabrication technology to the Division's commercial partner.

Develop pseudomorphic high electron mobility transistors and hybrid I.C. HEMT low-noise amplifiers.

Investigate the application of mm-wave radiometry in the aluminium and steel processing industries.

**To develop ultrasonic imaging and Doppler techniques for medical diagnosis and the meat and livestock industry. (18%)**

Produce an experimental clinical system for automatic measurement of the volume rate of blood flow.

Demonstrate a technique for subcutaneous tissue aberration removal (STARS) in ultrasonic imaging.

Develop ultrasonic yield and quality measurements for the meat and livestock industry.

<b>To develop digital signal processing for video, audio and general industrial applications. (6%)</b>	Complete a proximity detection device for mining applications. Complete the communication system and acoustic radar for the NUMBAT mine rescue vehicle. Develop further applications of the joint CSIRO/Austek Fourier Domain Processor.
<b>To develop devices, systems architectures and methodologies for future computing and communication systems. (5%)</b>	Develop new technologies for combining silicon and GaAs. Develop high speed GaAs digital processing sub-systems. Develop digital IC and system software tools for specification and verification. Investigate multiprocessor architectures for high performance graphics workstations.
<b>To develop fundamentals and applications of signal processing beamforming arrays. (17%)</b>	Develop a system design for airborne synthetic aperture radar (SAR) with on-board processing. Develop methods for reduction of data obtained from cross-borehole radio imaging measurements.
<b>To develop new methods for image processing, including reconstruction, coding and compression. (17%)</b>	Review high quality image compression techniques. Extend a biomagnetism modelling technique to electro-encephalography.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 8,054,600**

**Sponsored Research:** \$ 2,000,000

**Total Budget:** \$10,054,600

The Division expects that 20% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **3.4 THE AUSTRALIA TELESCOPE (A NATIONAL FACILITY)**

**Objective**

***To operate and develop the Australia Telescope as a prestigious and world class radio astronomical observatory.***

**Strategy**

***Exploit the unique Southern location and technological advantages of the Australia Telescope to maintain its position as a world class facility used by both Australian and International researchers. Use the strong basic scientific research program to direct the instrument development and ensure a high profile for radioastronomical research in Australia.***

**Specific Objectives  
(Percent Resources)**

**To complete the construction of the Australia Telescope and to commission it as a National Research Facility for radioastronomy. (38%)**

**To pursue a program of research in astronomy and astrophysics. (12%)**

**To operate and develop the Parkes–Narrabri radiotelescopes as a National Facility. (45%)**

**To operate the joint ATNF–RP computing facility. (5%)**

**Planned Outcomes**

Bring the 3km array up to full design specifications by the end of 1990.  
Commence general scientific observations.  
Complete the long baseline array.  
Complete the development of software for array monitor and control and data editing and calibration.

Investigate properties of stars, pulsars, nebula galaxies and quasars.  
Provide input for the future instrument developments.  
Use the AT in conjunction with other telescopes in Australia and overseas for high resolution long baseline interferometry observations.  
Develop policies for use of the AT as part of the USSR (RADIOASTRON) and Japan (VSOP) programs.

Make facilities available to the community of scientific users.  
Develop the next generation of instrumentation.  
Provide public relations and education programs.

Satisfy ATNF and Division of Radiophysics users and provide new capabilities.

Appropriation Total Allocation (includes earned appropriation revenues): \$ 7,952,900

Sponsored Research: \$ 300,000

Total Budget: \$ 8,252,900

The ATNF expects that 5% of its total annual budget will be spent from external funds in 1990–91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **3.5 CSIRO OFFICE OF SPACE SCIENCE AND APPLICATIONS**

**Objective**

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

**Strategy**

***COSSA pursues its objective by fostering, facilitating and supporting a coordinated approach to space-related research and development across CSIRO.***

**Specific Objectives**  
*(Percent Resources)*

**Planned Outcomes**

**Strengthen the ability of CSIRO's space-related research and development to contribute to Australia's economic development and environmental wellbeing. (55%)**

Circulate for comment a strategic plan for CSIRO's space related R&D for the next decade.

Introduce an effective mechanism for harmonising CSIRO Space initiatives with the activities of other research bodies in Australia and the Australian Space Office.

Advise user groups and coordinate programs on the operational benefits of remote sensing technology.

Prepare a 10-year plan for the establishment of a network of new generation environmental satellite data stations. Coordinate and support the development of CSIRO's Airborne Imaging Spectrometry program, the Atmospheric Pressure Scanner and the L-band receiver for the Radioastron spacecraft.

Define and implement a Business Plan for the Research Aircraft on the basis of its use as a National Facility.

**Strengthen participation by CSIRO and its scientific and technological collaborators in international space projects. (30%)**

Facilitate research and development participation by CSIRO in selected international space missions, including ERS-1, TOPEX-POSEIDON, Radioastron, VSOP, ADEOS, JERS-1, and the Earth Observing System.

Assist in CSIRO's involvement in International Space Year activities, in particular the Land Cover Change project.

**Provide information on space projects and programs to researchers inside CSIRO, to scientific colleagues outside the organisation, and to the general public. (15%)**

Issue at least six COSSA Space Industry News newsletters and four CSIRO Remote Sensing Information circulars.

Maintain a flexible, up-to-date display for space related conferences and coordinate and produce a large remote sensing display on the International Geosphere Biosphere Program.

**Appropriation Total Allocation (includes earned appropriation revenues): \$2,575,800**

**Sponsored Research: \$ 185,000**

**Total Budget: \$2,760,800**

COSSA expects that 11% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

#### **4. INSTITUTE OF INDUSTRIAL TECHNOLOGIES**

##### **Objective**

*The Institute aims to increase the international competitiveness, efficiency and scope of Australia's manufacturing industries.*

##### **Strategy**

*In view of the long-term slow growth trend in demand and prices for primary products, Australia's current account position will rely increasingly on its manufactured exports.*

*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.*

*The Institute aims to increase its interaction with the manufacturing sector through research collaboration. This will facilitate the flow of knowledge and technology and enable the finer focusing of research on industry problems or areas 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 necessary for internationally competitive performance.*

*Research areas within the Institute include:*

- . scientific, industrial and medical instrumentation;*
- . biotechnology, waste management and recycling;*
- . the design and production of specialty chemicals and of agricultural, veterinary and pharmaceutical products;*
- . integrated manufacturing systems;*
- . the production, fabrication and properties of materials (metals, ceramics, polymers and composites); and*
- . surface modification (including wear enhancement, decorative coatings, biocompatibility).*

*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 the formation of Management Investment Companies (MICs), 150% tax deduction for research and development, the Grants for Industry Research and Development (GIRD) and the National Industry Extension Service (NIES).*

### ***Specific Activities***

- *Finalise financing of \$25 million from an Australian banking consortium under the syndicated R&D legislation to commercially develop special projects in anti-viral compound synthesis, biomaterials, and scientific instruments.*
- *Complete project definition studies and R&D contracts in waste management, gas conversion and remote sensing following our Memorandum-of-Understanding with BHP.*
- *Develop an operational plan for the formation of a scientific instruments company to manufacture and market the CSIRO ultra-microhardness instrument system, scanning tunnelling microscope, and other recently developed instruments.*
- *Continue the exploration of joint research activities with the Boeing Company, Seattle, to identify Australian manufacturing opportunities which will lead to export markets to the international aerospace community.*
- *Continue the exploration of joint research activities with the DuPont Company to identify Australian manufacturing opportunities which will lead to export markets in agricultural chemicals and engineering resins.*
- *Develop strategic alliances with the five major equipment manufacturing companies in Australia to establish long-term research programs in areas of current Australian competitive weakness.*
- *In conjunction with the Institute of Minerals, Energy and Construction, develop a Centre for Advanced Technologies in Queensland to serve the Australian mining equipment manufacturing sector.*
- *In conjunction with external consultants, the Institute of Minerals, Energy and Construction, and the Institute of Information Sciences and Engineering, complete a thorough review of the Division of Manufacturing Technology and recommend areas of strengthened research activity.*
- *In conjunction with the Institute of Minerals, Energy and Construction, plan development of a new advanced metals/minerals research centre at Clayton.*
- *Implement and continue formal Divisional Science and Technology Reviews, and Business Area Reviews as precursor activity for Institute resource allocation decisions.*

The Institute encompasses the following Divisions:

**Division of Applied Physics**

Headquarters and Laboratories, Lindfield, NSW  
Adelaide Laboratories at Woodville, SA  
Melbourne Laboratories at Clayton, VIC

**Division of Biomolecular Engineering**

Headquarters and Laboratories at Parkville, VIC  
Sydney Laboratories at North Ryde, NSW

**Division of Chemical and Polymers**

Headquarters and Laboratories, Clayton, Vic  
Water and Wastewater Experimental Station at Lower Plenty, VIC

**Division of Manufacturing Technology**

Headquarters and Melbourne Laboratories at Preston, VIC  
Adelaide Laboratories at Woodville, SA  
Sydney Laboratories at Lindfield, NSW  
Brisbane Laboratories at St Lucia, QLD

**Division of Materials Science and Technology**

Headquarters at Clayton, VIC  
Melbourne Laboratories at Clayton, VIC

The Institute Headquarters is at Clayton, VIC

**INSTITUTE OF INDUSTRIAL TECHNOLOGIES**

**SUMMARY OF RESOURCES**

(estimates as at 16 May 1990)

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
Applied Physics	122.5	283.9	17,150.0		17,150.0	4,500.0	21,650.0
Biomolecular Engineering	80.1	164.6	9,980.0 <sup>+</sup>	2,300.0	12,280.0	2,500.0	14,780.0
Chemicals and Polymers	73.5	162.7	9,060.0		9,060.0	3,500.0	12,560.0
Manufacturing Technology	69.6	124.9	6,730.0	650.0	7,380.0	3,000.0	10,380.0
Materials Science and Technology	91.8	160.2	10,130.0 <sup>++</sup>		10,130.0	4,000.0	14,130.0
Institute Headquarters <sup>c</sup>	2.0	11.0	2,270.0 <sup>++</sup>		2,270.0	1,000.0	3,270.0
<b>Total</b>	<b>439.5</b>	<b>907.3</b>	<b>55,320.0</b>	<b>2,950.0</b>	<b>58,270.0</b>	<b>18,500.0</b>	<b>76,770.0</b>

a Staff numbers, expressed in equivalent full time units, as at 23 May 1990.

b Annual and Capital Appropriation includes earned appropriation revenues (including \$2M from sale of banknote technology to Reserve Bank).

c Includes \$1.07M administered on behalf of Divisions.

+ Plus \$492,000 from IPPP for Gene Shears.

++ Includes \$250,000 to be

## 4.1 DIVISION OF APPLIED PHYSICS

**Objective**

*To apply the Division's expertise in physical sciences and related disciplines to assist 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**

*The Division undertakes strategic and short-term R&D in physics and engineering with emphasis on developing new or improved products, industrial measuring techniques and manufacturing processes. Particular attention is paid to collaboration with Australia's scientific and medical instrument industry. As a basis for uniform measurement throughout Australia, the Division maintains the national standards of measurement, provides a first-level calibration service, and collaborates with national and international organisations concerned with measurement and testing.*

<b>Specific Objectives (Percent Resources)</b>	<b>Planned Outcomes</b>
<b>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. (22%)</b>	<p>A prototype magnetometer utilising high-temperature superconductors will be developed to the stage that testing can commence for the detection of flaws in steel plate.</p> <p>A bio-magnetometer for studying abnormal behaviour in the human brain will be developed to a prototype stage sufficient for initial testing by Westmead Hospital.</p> <p>A strategy for the future commercialisation of several precision electrical instruments will be finalised.</p> <p>Field testing will commence for implanted prostheses made of novel materials.</p>
<b>Develop magnetoelectronic 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%)</b>	<p>Australian Magnet Technology was established in 1989 as a joint venture to manufacture high-energy, rare-earth, permanent magnets and will move from pilot-plant to full-scale production.</p> <p>Development of a permeameter and a high-energy pulse magnetiser for the company will be completed and research on new applications for high-strength magnets will be expanded.</p> <p>Funds provided by the Department of Defence will be used to extend to 40 GHz the microwave standards and calibration facilities for measurement of power, attenuation and impedance.</p> <p>Two feasibility studies on failure prediction in electrical plant will be completed for the electricity supply industry.</p>
<b>Develop plasma, thin film and thermometric technologies of current or potential value to Australian industry, and provide standards and calibration services for temperature. (22%)</b>	<p>A continuing collaborative investigation with Boeing into stratospheric chemistry and its impact on ozone depletion is continuing.</p> <p>Work on wear-resistant and corrosion-resistant coatings for tools and dies will progress from the research to the development and commercialisation stage.</p>

Several new electrode materials will be assessed for high-power arcs used in mineral processing and a theoretical model of the cathode sheath will be developed.

New research aimed at developing higher quality magneto-optical coatings will be commenced with an industrial partner.

Commercial use of the Division's facilities for producing sophisticated optical coatings will be broadened.

Sputtering technology will be developed for depositing photovoltaic films of copper indium diselenide at rates appropriate for commercial production.

**Develop acoustical and ultrasonic technology 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%)**

The main outcome will be the completion prototype stage of a commercially confidential invention expected to have a wide international market.

Earnings of \$0.5 million to be generated by the continued development and international marketing of a novel ultra micro-indentation system will be used to initiate new research on the mechanical properties of surfaces and surface coatings.

Existing know-how on wireless communication aids and ultrasonic techniques for characterising blood will be further developed, following a positive report from an external assessment of the commercial potential.

Field trials on a novel liquid flow meter will be completed.

A commercial partner will be engaged to collaborate in the development of an ultrasonic imaging system based on novel transducer arrays.

**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%)**

A non-contact system for measuring die profiles, developed under contract to the Royal Australian Mint, will be delivered and further clients sought in this area.

A contract with the University of Sydney for the manufacture of precision optical flats for a stellar interferometer will be completed.

Marketing of high quality optical components produced by the Division will continue.

The development to prototype stage of a fibre sensor for ultrasonic power will be commenced and opportunities for collaboration in other aspects of fibre optic sensors will be sought.

**Appropriation Total Allocation (includes earned appropriation revenues): \$17,150,000**

**Sponsored Research: \$ 4,500,000**

**Total Budget: \$21,650,000**

The Division expects that 24.5% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **4.2 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**

***The Division maintains 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, biomaterials and biosensors and seeks to develop appropriate links with other organisations for the further development and ultimate commercial exploitation of this knowledge. The Division maintains high level experimental facilities and capabilities for the analysis of the structure and function of biological macromolecules.***

**Specific Objectives  
(Percent Resources)**

**Planned Outcomes**

**To generate and utilise knowledge of the three-dimensional structure of proteins for the production of new pharmaceuticals. (12%)**

Analyse influenza virus neuraminidase and its complex with novel inhibitors in collaboration with the Pharmacy College of Victoria under the Biota/Glaxo agreement, leading to improved binding specificity.

Complete atomic refinement of the bean storage protein phaseolin.

Develop electron diffraction technology for high resolution analysis of thin crystalline arrays.

Continue determination of the 3-dimensional structure of the tymovirus ELV.

**To devise new pharmaceutical agents, therapeutic strategies and diagnostic strategies based on the structural analysis and engineering of proteins and to design and develop valuable products and processes using naturally occurring proteolytic enzymes and/or engineered enzymes. (16%)**

Use information on the molecular interface between antibodies and influenza neuraminidase to produce genetically engineered antibodies and other immunoglobulin-like molecules with designed target specificity.

Improve expression systems capable of high-level production of these novel pharmaceuticals.

Establish collaborations and appropriate funding for both the design of genetically altered antibodies and for the measurement of binding affinities.

Integrate personnel and resources which have been redeployed from the Clayton laboratory to Parkville.

Establish fermentation capacity for the production of antibodies in sufficient yield for physical studies.

Use the techniques of protein engineering to prepare novel proteases with altered specificities and handling characteristics.

Evaluate the use of these and natural proteases in (a) enzymatic peptide synthesis; (b) the C-terminal modification of antibody fragments for biosensor and bio-assay application; (c) the preparation of peptide-fatty acid conjugates for immune presentation and delivery of peptides and (d) the production of the artificial sweetener, Aspartame.

**To integrate analysis of nucleic acid structure, nucleic acid protein interactions and genetic regulatory mechanisms to provide strategies for the development of new pharmaceutical agents and for manipulation of biological function for applications in human health care and agriculture. (25%)**

Determine the minimal structural requirements for specific cleavage of RNA targets by ribozymes at physiological temperatures.

Develop new approaches to analysis and manipulation of gene regulation via artificial regulatory RNAs, including ribozymes ("gene shears"); DNA methylation and the structural properties of DNA; structural features of chromatin; specific protein nucleic acid interactions (Human and Drosophila transcription factors).

Identify a suitable disease model for application of basic studies to therapeutic design.

**To develop new pharmaceuticals and disease control strategies from an understanding of the molecular basis of cell surface receptor function. (5%)**

Transfer staff from Clayton laboratory to Parkville laboratory and establish a multi-disciplinary team largely by redeployment from agricultural projects in the Division.

Complete EGF expression contract for the Ludwig Institute of Cancer Research, Melbourne.

Synthesise reagents to label receptor proteins involved in glucose induced insulin secretion by pancreatic islet cells.

Obtain cDNA clones for the insulin receptor for expression and structure/function studies.

Commence assessment of commercial opportunities and competing technology in areas of allergy, neuroreceptors and cardiovascular receptors.

Commence cloning genes for putative regulatory proteins of human immunodeficiency virus (HIV) and influenza virus.

Develop improved host-vector systems for the efficient production of these proteins by fermentation.

Initiate the development of probes to monitor the biochemical changes associated with HIV and influenza virus replication cycles.

Establish experimental conditions to produce defective mutants of these viruses in tissue culture.

Develop protocols for the efficient transfer of recombinant proteins into cells harboring the defective mutants.

Assess the antigenicity of a novel rotavirus antigen in tissue culture cells and whole animals using a recombinant adenovirus vector.

Commence cloning additional rotavirus genes.

Initiate research to determine whether rotavirus antigens interact with a common cellular component to co-ordinate capsid formation.

**To elucidate the molecular mechanisms employed in virus replication cycles in order to devise compounds and strategies to control viral diseases in humans. (14%)**

<b>To develop biomaterials and biosensing systems from an understanding of the organisation of the extracellular matrix and its interactions with cells and an understanding of the signalling processes by which information is transmitted in biological systems. (12%)</b>	Develop new biocompatible surfaces by attachment of biomolecules. Continue development of collagen-based materials for wound healing. Develop immunological methods for assessing biomaterial performance. Initiate development of technology for attachment and orientation of biosensing molecules.
<b>To develop recombinant vaccines against animal diseases; devise new strategies for the production and immune enhancement of vaccine antigens and peptides; and develop molecular approaches to plant virus detection, identification and control. (16%)</b>	<p>Complete the cloning and expression of the overseas infectious bursal disease virus variant.</p> <p>Assist the commercial partner in the development phase of the export oriented IBDV vaccine.</p> <p>File the completed patent for the yeast derived IBDV vaccine.</p> <p>Complete the cloning, characterisation and expression of the pili genes from the key <i>Moraxella bovis</i> serotypes for the bovine pink-eye vaccine.</p> <p>Complete the cloning, characterisation and expression of the excretory-secretory antigens of the sheep nematode parasite, <i>Trichostrongylus colubriformis</i>.</p> <p>Continue development of recombinant expression strategies for the footrot protease vaccine.</p> <p>Develop the self polymerising expression vector for antigen presentation and immune enhancement and lodge provisional patent.</p> <p>Evaluate combinations of antigen, immunostimulatory lipopeptides and fatty acylated polysaccharides in biodegradable microspheres for enhancement of immune responses.</p> <p>Establish collaboration with Division of Plant Industry to engineer resistance to potyviruses in plants.</p> <p>Redeploy staff from these agricultural based projects to the new pharmaceutical research projects as the funding and research obligations in this area are completed.</p>

**Appropriation Total Allocation (includes earned appropriation revenues): \$12,280,000**

<b>Sponsored Research:</b>	\$ 2,500,000
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<b>Total Budget:</b>	\$14,780,000
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<b>Appropriation Capital:</b>	\$ 2,300,000
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The Division expects that 17.5% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **4.3 DIVISION OF CHEMICALS AND POLYMERS**

#### **Objective**

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

#### **Strategy**

***The Division seeks opportunities to apply its research results and to utilise its expertise in chemical synthesis, chemical processing, polymer chemistry, and physical chemistry, to develop new products and processes for Australian manufacturing. The Division also seeks to utilise its experience in chemical engineering, microbiology and physical chemistry to develop new processes for the Australian wastewater treatment industry to achieve better environmental outcomes. An important feature of this strategy is that research projects are undertaken in collaboration with industry at as early a stage as possible.***

<b>Specific Objectives (Percent Resources)</b>	<b>Planned Outcomes</b>
<b>To generate novel biologically active chemicals for evaluation in crop protection. To investigate pre-industrial scale production of fine chemicals to determine optimum conditions for maximising outputs. (29%)</b>	<p>Scheduled synthesis of around one thousand new compounds for evaluation as environmentally safe insecticides, herbicides and fungicides.</p> <p>Selection of a small number of compounds for extensive field trial.</p> <p>Staged development of process chemistry to synthesize selected bioactive compounds for field or pre-clinical trial.</p> <p>New routes to chemical synthesis based on the interaction of microwaves with chemical compounds.</p> <p>Further major funding from Dunlena joint venture to maintain impetus of research on crop protection chemicals.</p> <p>Closer links with Australia centres of biological research to support a major thrust in developing new biologically active chemicals.</p>
<b>To generate novel antiviral and pharmacologically active chemicals for ultimate use as clinical drugs. (6%)</b>	<p>Synthesis of new chemicals based on dideoxy nucleosides, inorganic complexes and organic polyanions for evaluation of activity against HIV and Hepatitis B viruses. Major funding from syndicated R&amp;D group to support antiviral research.</p> <p>Closer links with Australian centres of biological research to initiate innovative research in this area.</p>
<b>To develop separation membranes for processes associated with chemicals production, catalysis and gas separation. To develop physico-chemical surface modification techniques. To develop novel surface active chemicals to produce thin films and to give specific end-use effects. (18%)</b>	<p>Development of integrated membrane reactors, including fabrication and surface modification of membranes for the low energy synthesis of organic compounds.</p> <p>Use of surface modification techniques in some biomedical and chemical applications.</p> <p>Use studies of surfactant cleaning action on specific surfaces as basis for development of new cleaners</p>

**To develop new polymer matrices in high performance, low cost, carbon fibre-based composite materials for aircraft. To develop improved polymeric materials for medical implants by means of polymer synthesis or surface modification. To use new techniques for polymer synthesis to prepare polymers for specific industrial applications. (26%)**

**To develop processes based mainly on the use of magnetite for treating sewerage and industrial wastewater, plus product recovery from waste streams and sludge treatment. To develop microbial processes to remove nutrients from sewerage and industrial effluents for inland disposal, and disinfection of water by generation of ozone by UV irradiation of oxygen. (20%)**

Development of surfactant aggregates for the preparation of ordered surfactant or polymer layers for use as particle coatings or opto-electronic devices.

Development of new, impact-modified plastics and their blends for the polymer matrix in composites.

Generate more stable, biocompatible polyurethanes by polymer blending, synthesis and surface modification and develop systems to test their haemocompatibility and stability.

Development of higher temperature styrenic polymers for use in automotive and similar plastics applications.

Finalisation of a strategic alliance with Du Pont to fund the development of engineered resins to meet specific market needs.

Evaluation of pilot plant development of process for treatment of "sewerage concentrate" using magnetite and transfer of technology to the building of a full-scale plant.

Adaptation of ion exchange processes to the recovery of heavy metals from industrial wastewaters.

Pilot plant development of patented pre-fermentation technique to enable all-biological removal of nitrogen and phosphorous from sewerage.

Lab-scale development of new processes to treat wool scouring and food industry wastewaters.

Represent CSIRO on national associations involved in managing water resources and wastewater disposal.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 9,060,000**

**Sponsored Research: \$ 3,500,000**

**Total Budget: \$12,560,000**

The Division expects that 30.2% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

#### **4.4 DIVISION OF MANUFACTURING TECHNOLOGY**

**Objective**

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

**Strategy**

***To achieve these objectives, the Division will apply its skills in electronics, materials and mechanical engineering and computer science to assist the Australian manufacturing industry with the development of new products and processes; establish collaborative agreements with companies which have strong export orientation; seek further external funding from grant schemes for new research initiatives; expand communication links with industry groups and research associations; and actively encourage the training of engineers through close interaction with universities.***

**Specific Objectives  
(Percent Resources)**

**Planned Outcomes**

**To develop flexible manufacturing systems, robotics, industrial lasers, industrial vision systems, machine tool control, factory communication, computer aided design and process modelling and simulation for Australian industrial use.  
(30%)**

Develop robot controller to commercial stage and complete commercial negotiations.  
Develop specialised laser drilling and processing technology.  
Develop cutting and handling manufacturing equipment with a commercial partner.  
Finalise arrangements with BHP for manufacture and marketing of a high-speed industrial vision system for quality control.

**To develop new electric arc devices for applications such as waste destruction, thermal spraying, and materials treatment. (15%)**

Develop waste destruction system to prototype stage in collaboration with industrial partner.  
Complete negotiations for commercialisation of a plasma spraying system.  
Finalise commercial negotiations for intelligent battery tester, and develop a new tester for automobile batteries with commercial partners.

**Improve arc welding processes and equipment by developing a greater understanding of the factors controlling metal transfer in the consumable electrode arc, and the mechanical properties of the weld metal deposit. (15%)**

Complete the formulation of flux-cored welding electrodes designed for pulse welding operation and provide support to the commercial partner in production and marketing.  
Finalise process developments for multi-wire submerged arc welding of high-strength steels.

**Develop and promote the use of novel tools and methodologies to facilitate more effective practices in planning and production in manufacturing enterprises.**  
(15%)

Develop narrow-gap submerged arc and gas-metal arc welding technology for joining heavy section alloy steels.

Produce a regular newsletter on this work for distribution to fabrication companies.

**Improve manufacturing productivity of, and enhance processes in, foundry technology, die casting, process simulation and control, materials forming and processing, tools and dies, materials joining and surface modification.** (25%)

Complete the development of a shopfloor scheduler, and establish the means to commercialise it both as a stand-alone package and as an embedded module in existing Manufacturing Requirements Planning (MRP) systems.

Develop a software framework suitable for progressive introduction of integrated manufacture information systems.

Complete the first version of a new software tool for planning for assembly and apply it with an industrial collaborator.

Generate consultancy income from use of the software tools for cellular manufacturing and assembly planning.

Establish arrangements for the commercialisation of cast bonding technology for manufacturing heavily-clad products, metal-ceramic bonding technology for applications in the mining, manufacturing and agricultural industries.

Complete the prototype electroslag surfacing machine and develop new electroslag clad plate alloy formulations.

Develop diffusional surface treatments and short-run injection moulding dies.

Develop a software package for modelling the solidification process, as an aid in casting design.

Complete the development of pc-based software packages for the design of dies for die casting and market this world-wide.

Develop an inspection system for non-destructive testing of cast objects.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 7,380,000**

**Sponsored Research:** \$ 3,000,000

**Total Budget:** \$10,380,000

**Appropriation Capital:** \$ 650,000

The Division expects that 29.7% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **4.5 DIVISION OF MATERIALS SCIENCE AND TECHNOLOGY**

### **Objective**

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

### **Strategy**

***To meet these objectives 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 resource.***

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

### **Specific Objectives (Percent Resources)**

### **Planned Outcomes**

<p><b>To develop and assist industry in the exploitation of advanced alloys; to provide facilities and develop technique and instrumentation, based upon our materials expertise, to produce pilot quantities of, and characterise, novel materials suitable for commercial application in high technology industries. (18%)</b></p>	<p>Bring into full operation vacuum melting/casting facility for use in aluminide and medical implant alloy development.</p> <p>Complete technical assessment, purchase and installation of medium scale vacuum melt spinning apparatus for rapid solidification processing of aluminium alloys.</p> <p>Finalise negotiations for involvement of commercial partners in CATPIX II project and medical alloys initiative.</p> <p>Carry out enabling collaborative research on the development of optoelectronic materials and devices.</p>
<p><b>To develop novel advanced ceramics with improved properties, or new ceramic components or devices in order to create manufacturing opportunities for Australian industry and to provide expanded markets for Australian markets. (30%)</b></p>	<p>Develop facilities for mechanical testing at high temperatures.</p> <p>Commence fabrication of advanced diamond-based composites.</p> <p>Establish program on the development of a solid oxide fuel cell.</p> <p>Evaluate advanced refractories in conjunction with commercial partner, and assist local aluminium industry in the selection and use of refractories.</p> <p>Demonstrate the production of sialon ceramics from local raw materials.</p>
<p><b>To develop collaborative projects based on advanced scientific and analytical instrumentation, which will lead to the establishment of embryonic businesses, and to solving important problems in materials analysis and processing. (22%)</b></p>	<p>Develop new techniques for rapid evaluation of corrosion resistance of aluminium, stainless steel and copper alloys.</p> <p>Complete detailed optical design of advanced technology imaging spectrometer and begin prototype manufacture.</p> <p>Use NMR microimaging to investigate flow of fluids in a range of porous media.</p>

<b>To develop innovative product and process technology by the application of chemical and chemical engineering science to the molecular design, synthesis and processing of inorganic and organic materials with particular emphasis on catalysts, sorbents, performance carbon fibres, specialty and commodity polymers. (25%)</b>	Extend technique of laser spectroscopy in isotope analysis to the element lead.
	Develop and commercialise novel X-ray instrument-ation and extend commercial development.
	Establish state-of-the-art carbon fibre fabrication at pilot plant scale and polymer processing activities.
	Evaluate performance of a patented CSIRO catalyst for the selective oxidation of methane to methanol over a range of process conditions.
	Develop improved sorbents for use in storage of perishable foods.
<b>To collaborate with the Victorian Government, Melbourne University and other sponsors in operation of the National Advanced Materials Analytical Centre, the Industrial Materials Design Centre, and the Australasian Corrosion Centre, within the Division of Materials Science and Technology. (5%)</b>	Utilise NAMAC microscopes, analytical accessories and specimen preparation equipment in collaboration with industry and research establishments to further research objectives relevant to Australia's needs.
	Finalise negotiations and appointment of a Chief Executive Officer and Secretariat.
	Train research workers in the use of electron microscope techniques for the study of advanced materials.
	Maintain consultancy with IMDC.
	Expand interaction with Australasian Corrosion Centre through membership of Australasian Corrosion Network.

**Appropriation Total Allocation (includes earned appropriation revenues): \$10,130,000**

<b>Sponsored Research:</b>	\$ 4,000,000
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<b>Total Budget:</b>	\$14,130,000
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The Division expects that 28.8% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **5. INSTITUTE OF MINERALS, ENERGY AND CONSTRUCTION**

### **Objective**

**The Institute aims to increase the contribution made by the minerals, energy and construction industries to the sustainable development of the Australian economy. Its research is, therefore, directed to:**

- **the better location, definition, extraction and processing of mineral and energy resources;**
- **more efficient and cost effective practices, procedures and products;**
- **developing value-adding processes, particularly in simply transformed manufactures which will capture additional value in Australia;**
- **improving product quality and specification to meet market needs;**
- **maximising the Australian input to support technologies and services used by the minerals, energy and construction industries;**
- **protecting the environment and promoting a better understanding of the socioeconomic aspects of these industries; and**
- **diversifying into products and services with significant market potential.**

### **Strategy**

**In setting priorities, and developing and applying strategies to meet them, the Institute will seek input from its Sector and Divisional Advisory Committees, and will cooperate closely with industry and industry organisations, commodity councils and boards, research organisations, and relevant State and Federal Government Departments and agencies. The Institute's key strategies are:**

- **Direct research to major technology needs of industry, both present and future, by establishing and maintaining strategic relationships with existing major companies and those now entering the market.**
- **Enhance industry's technological capability in support of competitive marketing.**
- **Add value to and increase opportunities for exports of products and services.**
- **Identify areas of high benefit to cost ratio, (preferably greater than 5:1) for research implemented in commercial practice.**
- **Support spin-off applications of expertise, where these can create a substantial commercial opportunity.**
- **Set and manage to external objectives for programs and projects.**
- **Integrate fund sources at project level, and structure industry-funded projects to contain a strategic component.**
- **Reallocate resources annually to emerging priorities.**
- **Seek 30% or more of external funding by active collaboration and joint venture.**
- **Implement prospective and retrospective evaluation in support of 5:1 benefit to cost target for research implementation.**
- **Reward Divisions, programs and projects that succeed.**
- **Strengthen line management through policy of devolution.**
- **Encourage management by performance contract.**

### Specific Activities

- *Develop strategic alliance with up to three major companies involving initiation of portfolios of research projects addressing identified long and short term industry needs.*
- *Initiate development of Centre for Advanced Technologies in Queensland, on basis of agreement with State Government.*
- *Establish Western Australian Industry and Education Centre for Remote Sensing, jointly with industry and State Government, at CSIRO's Floreat Park facilities.*
- *Lead CSIRO's North Ryde Redevelopment planning, to establish appropriate new accommodation.*
- *Plan development of new building at Clayton, and investigate potential for new research centres at that site and other prospective locations.*
- *Initiate research relating to Greenhouse Effect response technologies, on basis of strategic analysis of technical and economic issues.*
- *Develop, jointly with Department of Primary Industries and Energy, mineral strategy paper to address priorities for minerals R&D.*
- *Complete ex-ante evaluation of aluminium industry R&D in CSIRO, in collaboration with ABARE.*
- *Commence program of ex-post and ex-ante evaluation in support of 5:1 benefit: cost target for IMEC research.*
- *Establish consistent program and project structures and terminology across IMEC, for both resource allocation and reporting.*
- *Improve quality of database of IMEC program and project plans, and produce IMEC Research Directory.*
- *Complete workshop process for strategic and structural issues analysis, and commence formal strategic and operational planning process across IMEC.*
- *Pilot career development in three Divisions, in consultation with Human Resources Branch.*
- *Assess Institute's contribution to building and construction industry, in relation to industry needs.*
- *Increase coal research effort by completion of merger of Divisions of Coal Technology and Fuel Technology, to create new Division of Coal and Energy Technology on basis of workshop process to recommend programs, structure, administration and support services.*
- *Formalise annual resource allocation process on basis of contribution to research area/subsector.*

The Institute encompasses the following Divisions.

<b>Division of Building, Construction and Engineering</b>	Headquarters and Hightett Laboratory, Hightett, VIC North Ryde Laboratory, North Ryde, NSW Western Australia Laboratory, Rivervale, WA
<b>Division of Coal Technology</b>	Headquarters and North Ryde Laboratory, North Ryde, NSW Lucas Heights Laboratory, Lucas Heights, NSW "The Hermitage Site", Ryde, NSW
<b>Division of Exploration Geoscience</b>	Headquarters and Floreat Park Laboratory, Floreat Park, WA North Ryde Laboratory, North Ryde, NSW NML Laboratory, Lindfield, NSW University of Canberra, Bruce, ACT
<b>Division of Fuel Technology</b>	Headquarters and Lucas Heights Research Laboratory, Lucas Heights, NSW
<b>Division of Geomechanics</b>	Headquarters and Syndal Laboratory, Syndal, VIC Ritchie Laboratory, St Lucia, QLD Lucas Heights Laboratory, Lucas Heights, NSW Port Melbourne Laboratory, Port Melbourne, VIC
<b>Division of Mineral and Process Engineering</b>	Headquarters and Clayton Laboratory, Clayton, VIC Lucas Heights Laboratory, Lucas Heights, NSW Port Melbourne Laboratory, Port Melbourne, VIC North Ryde Laboratory, North Ryde, NSW
<b>Division of Mineral Products</b>	Headquarters and Port Melbourne Laboratory, Port Melbourne, VIC Curtin University of Technology, Bentley, WA Floreat Park Laboratory, Floreat Park, WA

The Institute Headquarters is at North Ryde, NSW.

**INSTITUTE OF MINERALS, ENERGY AND CONSTRUCTION**

**SUMMARY OF RESOURCES**

**(estimates as at 16 May 1990)**

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
Building, Construction and Engineering	113.0	269.6	15,596.0		15,596.0	4,500.0	20,096.0
Coal Technology	52.3	130.6	6,241.0		6,241.0	3,000.0	9,241.0
Exploration Geoscience	84.0	149.5	7,204.0		7,204.0	3,400.0	10,604.0
Fuel Technology	42.0	81.5	4,957.0		4,957.0	1,700.0	6,657.0
Geomechanics	52.1	97.1	5,003.0		5,003.0	4,000.0	9,003.0
Mineral and Process Engineering	99.8	162.3	7,989.0		7,989.0	3,800.0	11,789.0
Mineral Products	78.0	135.1	6,109.0		6,109.0	2,850.0	8,959.0
Institute Headquarters <sup>c</sup>	4.0	11.3	3,725.0	2,920.0*	6,645.0		6,645.0
<b>Total</b>	<b>525.2</b>	<b>1,037.0</b>	<b>56,823.0</b>	<b>2,920.0</b>	<b>59,743.0</b>	<b>23,250.0</b>	<b>82,993.0</b>

\* NOTE: – \$2.0M towards cost of \$4.5M building at Lucas Heights of which \$1.0M will be funded from 1989/90 savings.

- \$.92M towards cost of purchase of ACIRL site at North Ryde.
- Various Divisions both with this Institute and in other Institutes will benefit from these developments.

a Staff numbers, as at 16 May 1990.

b Annual and Capital Appropriation includes earned appropriation revenues.

c Includes \$2.5M administered on behalf of Divisions.

## **5.1 DIVISION OF BUILDING, CONSTRUCTION & ENGINEERING**

### ***Objective***

***To facilitate more efficient, profitable and competitive activity in Australia's building, construction and related engineering industries.***

### ***Strategy***

***Develop strong collaborative research ties with the major industry associations, government agencies and private companies serving our industries.***

***Establish efficient communication links with the many small companies and individuals that service the industries at a professional and sub-professional level.***

### ***Specific Objectives (Percent Resources)***

### ***Planned Outcomes***

**Improve the life cycle performance of materials and components for constructed facilities. (21%)**

Completion of the estimation of frequency distribution of temperatures of roofs expected for various construction types for any site in Australia over long periods.

Completion of the corrosivity contours mapping of Newcastle and operation of a corrosivity assessment service for the building industry based on bimetallic sensors (ATCORR index).

Commencement of MIMEE (Metals in Marine Environment Exposure) for 10 year assessment of multi-fabrication simulated specimens prepared from an international set of metal and protected metals.

Development of criteria for encapsulants for asbestos products, including improved method for assessing erosion resistance in terms of respirable fibre emissions.

Completion of code of practice for installation of UFFI (urea formaldehyde foam insulation) in buildings.

Development of procedures to validate and improve the theoretical prediction of service life of UPVC water reticulation systems under cyclic loading.

Development of procedure to commission UPVC water reticulation systems to ensure that lead levels meet WHO guidelines.

Development of theory and experimental procedures to evaluate the contribution of acid base interactions to the strength of adhesion.

Development of geometry and stressing of stimulated glazing systems to ensure adhesive failure mode, so as to assess quantitatively adhesive strength of sealants.

Provision of information to enable optimum selection of sealant system to reglaze the Sydney Opera House.

Development of the application of water sorption and carbonation characteristics of concrete as durability parameters to assist industry to meet provisions of the new concrete code where necessary.

Evaluation of effectiveness of current procedures for *in situ* and factory curing of concrete.

Collaborative agreement to develop super-strength products based on pore-reduced cement (provisional patent application).

- Determination of mix design for concrete building blocks based on patented slow-cure low energy novel cement from blended waste/byproduct.
- Optimisation of procedure for production of calcium alumino sulphate seed for patented rapid-cure novel cement.
- Development of procedure for pilot plant production of foamed gypsum meeting specific density, stability and strength parameters.
- Development of procedures for assessing potential efflorescence of masonry and ways of improving performance of concrete products.
- Operation of testing facilities for soft and hard floor finishes to assist selection procedure by building owners.
- Development of code of practice for fixing ceramic tiles in wall and flooring applications.
- Development of improved procedure for quality control of potential moisture expansion of ceramic tiles.
- Development of new procedure, based on international bank of reactive specimens, for prediction of expansive alkali aggregate reaction, and assessment of Queensland and West Australian aggregates.
- Improve the commissioning, operation and refurbishment of engineered products, components and services. (25%)**
- Development of procedure to simulate unsteady rainfall on metal roofs and evaluation of influence of roof construction on the transmission of rain noise.
- Investigation of rain flow over inclined roofs in relation to drainage requirements.
- Identification of user groups to market water flow-balancing devices for domestic applications.
- Promotion of the use of the hydraulic testing facility for product testing.
- Completion of market survey and feasibility study on wool as an advanced insulating material.
- Construction and commissioning of pulse combustion test facility.
- Completion of study of fluid mechanic structures in diffusion flame and publication of the results.
- Evaluation of NO<sub>x</sub> emissions from gas burners for space heaters.
- Identification of users to support funding of investigations into the thermal properties of building materials.
- Evaluation of the potential for liquid/vapour phase change to enhance heat exchange capability.
- Evaluation of wicking technology as a means of wetting heat exchanger surfaces, and development of a self-adhering wick.
- Construction and commissioning of wind tunnel for studies of mixed convection heat transfer.
- Completion of development of high effectivity heat exchanger for space heating and cooling applications.
- Continued development of models for the transmission of sound through composite building structures.
- Incorporation of video technology for image capture in laser speckle velocimetry.

Design, test and calibration of microphone turbulence screen for sound measurement in exhaust stacks.

Identification of users and promotion of the use of acoustic chamber complex for external support of investigations into the acoustic properties of building materials.

Development of advanced algorithms to predict fluid flow and heat transfer in aluminium processing equipment.

Commissioning of British Standard fan-testing facility for Australian manufacturers to meet offshore requirements.

Establishment of AMIRA-sponsored project to determine the causes of wear in pumping equipment.

Measurement of the instantaneous fluid and solid particle velocities in time-dependent particulate flows.

Theoretical determination of the trajectory of solid particles in time-dependent particulate flows.

Completion of experiments of active control of acoustic resonance and vibration in flow equipment.

Continued strategic research into the stability of shear layers: (a) measurement of instantaneous flow associated with two-dimensional vortices interacting; (b) measurement of the evolution of three-dimensional behaviour; and (c) development of computational techniques to predict three-dimensional flows.

Continued long-term experimental and theoretical research into the generation of noise by flow past objects: (a) measurement in the water tunnel of the flow around a circular cylinder, detailing the boundary layer; (b) computation of the sound radiated by the flow; and (c) measurement of the sound radiated in an air tunnel placed in the anechoic chamber.

**Improve the lifetime performance of structures in terms of the competing demands of safety, function and cost. (16%)**

Draft of new limit-state timber engineering design code for Standards Australia.

Draft of new standard on the assessment of structural design properties of timber connectors for Standards Australia.

Redraft of existing standards on species classification and machine stress grading for Standards Australia.

Completion of construction and commissioning of a prototype stress-grading machine for timber, based on microwave scanning technology.

Substantial completion of the construction of a prototype machine for automatically testing timber in bending.

Publication of results of a study of the structural behaviour of timber connectors and their implication for design.

Commencement of construction of controlled environment chambers for research on the effect of environment on the lifetime structural behaviour of timber.

Completion of computation of revised framing tables for radiata pine, in association with the Radiata Pine Association of Australia.

Preparation of draft commentary on the timber engineering code, in association with the National Association of Forest Industries.

Draft of simplified timber engineering code for use in developing countries, in association with UNIDO.

Design of optimum-tuned sloshing liquid damper to reduce wind-induced vibration of communication towers.

Publication of commentary on the Australian wind loading code, in association with the Australian Wind Engineering Society and Monash University.

Determination of pressure coefficients for arch roof structures, using computational fluid mechanics, in association with Strach International.

Determination of pressure coefficients for L and T shaped structures, using computational fluid mechanics, in association with AUBRCC.

Measurement of pressure fluctuations in the vicinity of the leading edge of a flat plate in turbulent flow, with a view to gaining a better understanding of wind pressures on buildings adjacent to roof edges and corners of buildings.

Marketing of knowledge-based computer program on the new Australian snow loading code, in association with Standards Australia.

Marketing of knowledge-based computer program on the design of steel connections, in association with Standards Australia and the University of Melbourne.

Production of estimates of the structural reliability of broadcasting towers, in association with Telecom.

Development of computer program to simulate the structural behaviour of masonry walls under transverse loadings.

Preliminary understanding of the structural behaviour of masonry walls with doors and windows, based on a series of pilot tests.

Determination of correlation between the field bond strength of masonry and the properties of the constituent materials, in association with the University of Melbourne.

Completion of statistical analysis of data on the effect of age and exposure on the strength properties of masonry.

Preparation of state-of-art report on the liquefaction potential of soils subject to earthquakes.

Determination of effect of foundation conditions on the structural behaviour of selected buildings in the Newcastle earthquake, in association with the University of Melbourne and the University of Adelaide.

Production of analytical solutions for the behaviour of deep pile foundations during earthquakes.

Production of PC-based computer program for analysing the stresses in rectangular thin plates subject to transverse pressure for application to the design of glazing.

Development of computer program to simulate the structural interaction of glazing, sealant and supporting framework in a simple glazing system.

Development of computer program to analyse the thermal stresses in glazing.

Completion of assessment of the effectiveness of current Australian standards in mitigating injury and trauma due to human impact on glass.

Preparation of state-of-art report on the behaviour of building facades exposed to wind driven rain.

Initiation of studies on the application of computational fluid mechanics to the interaction of wind driven rain and building facades.

Finalisation of construction and commissioning of dynamic weather testing facility for use in research and development on the design of facades to minimise rain water entry.

Re-assembly and commissioning at North Ryde of the boundary layer wind tunnel formerly located at Highett.

Finalisation of four-year study of live loads in office buildings.

**Improve planning and management procedures in the building and construction industry. (19%)**

Development of tools to improve access to and application of existing information by project decision makers.

Development of prototype system to manage regulated and non-regulated information within the building industry.

Design and piloting of knowledge-based computer systems in the areas of access for people with disabilities, and selection and installation of floor finishes.

Preparation of commentary on the Building Code of Australia.

Release of BCAider computer software for the Building Code of Australia to architects, engineers and building surveyors.

Survey of industry to determine attitudes and issues for the introduction of robotics in building and construction.

Development of PC-based tools to assist Telecom Australia to locate its fibre optic metropolitan area networks and position its fast packet switching equipment to optimise customer access.

Production of small area forecasts of demand for high speed communication networks and associated infrastructure Australia-wide.

Development of models to simulate the impact of different city forms and government planning strategies on production of Greenhouse gases.

Implementation of criteria for optimal distribution of hospital beds in HOSPIM, and transfer of model to the private sector.

Completion of BRDAC study on the introduction of robotics into the construction sector.

Completion of development and commercialisation of 3D alignment system, in collaboration with industry.

Completion of passenger and freight market studies for VFT.

Completion of systems study optimising key parameters for VFT.

Expansion of expert system NOISEXPT to road traffic noise.

Commencement of evaluation of Greenhouse impacts on built environment in Australia.

Investigation of extent of reduction of Greenhouse gas emissions through modification of the built environment.

**Reduce the risks and costs of life and property losses through fire. (16%)**

Development of framework for the design of fire safety systems in buildings.

Publication of suite of programs for use in the design of fire safety systems.

Development of mathematical model to predict the behaviour of masonry walls exposed to fire.

Investigation of fire performance of diaphragm masonry walls as a replacement for traditional cavity walls.

**Development of alternative wall-tie to improve the fire performance of masonry walls.**

**Fabrication and commissioning of calorimeter to establish the fire performance of furniture.**

**Determination of fire performance of a range of common timber beams and comparison of the results with the Australian Standard.**

**Determination of contributions of wall-lining materials to fire spread in corridors.**

**Negotiation with industry of research project on the fire aspects of load-bearing framed construction.**

**Assessment of radiant heat hazard of at least 20 new buildings.**

**Validation of model on smoke exhaust from ceiling plenums by experiment.**

**Appraisals of the likely performance of smoke control systems on at least 10 new commercial developments.**

**Sponsored investigations to determine the fire resistance of structural elements.**

**Seminar on fire safety in buildings.**

**Negotiation of sponsored research project with AUBRCC on fire resistance and non-combustibility.**

**Publication of compendium on the fire properties of building materials.**

**Completion of experimental work on the international round-robin program on the room-fire test.**

**Publication of report on the ignition of buildings by bushfires.**

**Appropriation Total Allocation (includes earned appropriation revenues): \$15,596,000**

**Sponsored Research: \$ 4,500,000**

**Total Budget: \$20,096,000**

**The Division expects to receive 22% of its total annual budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.**

## **5.2 DIVISION OF COAL TECHNOLOGY**

**Objective**

***To maximise competitive advantage and environmental acceptability of Australia's coal and coal related industries.***

**Strategy**

- *Maintain a dedicated staff of high morale whose substantial reputations are based on skills and achievements in coal science and technology, and knowledge of the coal industry.*
- *Encourage the Australian coal industry to secure its strategic interests through well planned research and development activities.*
- *Apply scientific and engineering skills to increase efficiency and to minimise adverse effects in the preparation, marketing and use of coals.*
- *Apply specialised skills when appropriate in related and other areas of high priority.*

**Specific Objectives**  
*(Percent Resources)*

**Establish the relationships between coal characteristics and behaviour during processing and utilisation. Develop improved test procedures and information systems that determine coal quality and utilisation properties. (18%)**

**Planned Outcomes**

- Identification of speciations of phosphorus in Australian export coking coals.
- Introduction of proton magnetic resonance thermal analysis (PMRTA) as an advanced coal evaluation technique in coal industry laboratories.
- Commercialisation of PMRTA instrumentation with local manufacture.
- Completion of study of coal blending for coke making.
- Publication of methods for predicting thermo-plastic behaviour of blends from behaviour of the blend components.
- Publication of recent findings on the role of non-covalent interactions on the molecular conformation and stability of coals.
- Preliminary report on study of relationship between molecular structure and mechanical properties of coals.
- Relational data base on CSIRO's store of coal information, and publication of accurate predictive relationship of coal specific energy.
- Develop molecular model of coal-water system.
- Sample holder designed for coal dilatometry in thermal mechanical analysis equipment.
- Publication of findings of a recent research project on determining the morphoreactivity of the inertinite macerals in some Australian and Northern Hemisphere coals.
- Characterisation of inertinite (by FTIR microscopy) to demonstrate its variability from fusinite-like material to vitrinite-like material.
- Distribution of carbon and hydrogen in specific functional and structural groups in coal.
- Method for determination of the potential for self-heating of coal during transport and storage.

**More efficient and cleaner coal utilisation and profitability in coal production through innovative coal preparation technologies. (18%)**

Validation of computer model of coal stockpile self-heating against a suite of reactive coals.

Incorporation of heat and mass transfer mechanism of natural convection into the self-heating model.

Further penetration into coal industry of CSIRO's procedures for improved comminution/liberation schemes, based on washability finger-printing.

Development of new device for selective breakage of coal.

Significant progress in commercialisation of superclean (1-6% ash) and ultra clean (0.1-1% ash) coal and coal-water mixtures by AUSCOAL.

Development of demonstration unit for dewatering of coal fines and tailings using a "combined fields" vacuum filter incorporating an electric field, and initiation of discussions with equipment manufacturers with a view to commercialisation.

Initiation of discussions with equipment manufacturers on the full-scale development of the dry beneficiation process for coal, currently proved up to pilot-scale level.

Construction of 1 tonne/hour pilot plant as part of the CSIRO centre of expertise in coal preparation.

Introduction to coal industry of optimisation/integration schemes, using either conventional or new equipment, which will lead to improved coal recovery.

**Processing technologies for high value products from coal. (15%)**

High yielding coal hydrolysis process.

Brown coal-based slow release fertiliser.

Optimised parameters for the preparation of mesophase for high quality carbon fibre fabrication from coal tar pitch.

Procedures for the determination of mesophase quality and quantity, based on NMR measurements.

Progress towards development of an innovative procedure for the stabilisation of as-spun pitch filaments.

Identification of parameters influencing the performance of binder pitch and of filler coke in anode fabrication and use.

Fundamental and technical data on special carbons for use in metallurgy.

Identification of Australian coals suitable for Korean Yontan briquettes.

Completion of study of the manufacture of bio-coal briquettes.

Identification of valuable constituents of coal ash.

Completion of preliminary study of cenospheres separation from fly ash.

**More efficient and cleaner electricity generation and metal production through improved processes of coal combustion and carbonisation. (18%)**

Expert systems as a means of controlling the operation of electrostatic precipitators in pulverised-coal-fired power stations.

Improved performance of boilers burning high sodium brown coals.

Improved assessment of pulverised-coal injection into blast furnaces using Australian fuels.

Evaluation of CSIRO system for industrial plant char analysis, in collaboration with the Jonk Committee of the EEC.

Development of novel micropyrolyser, in conjunction with a commercial partner, and sale of associated intellectual property.

Relationship between spectroscopic data of clinkers with mineral composition of source coals.

Determination of effect of heating regimes on clinker structure.

Infra-red cell for *in situ* analysis of thermal transformations of minerals.

Determination of relationships between coke reactivity and PMRTA behaviour of the coal from which it was formed.

Quantification of effects of additives on coal thermoplastic properties.

Completion of preliminary survey on ultra-sonic agglomeration, as applied to the combustion of pulverised coal in engines.

**Capabilities to assess, model, predict and control the effects on land, water resources and the atmosphere of particulate, dissolved and gaseous emissions arising from the power, mining and related industries. (21%)**

Completion of detailed study of the impact of power station plumes on air quality of the Hunter Valley.

Determination of effect of averaging times on ground-level concentrations from strong point sources in convective conditions.

Improved predictability of plume dispersion models.

Prediction of effect of changed operating conditions on smelter downtime as affected by SO<sub>2</sub> ground-level concentrations.

Completion of investigation into fugitive industrial emissions at Rhodes, NSW.

Final testing of gas analysis package mounted in the NUMBAT remote controlled air sampling vehicle.

Completion of major part of experimental program on methane fluxes from major sources.

Improved prediction of photochemical smog formation.

Further development of AIRTRAK technique for photochemical smog monitoring.

New applications for AIRTRAK approach to photochemical smog management.

Determination of mechanisms of binding and diagenesis of fluoride, phosphorus, arsenic and selenium in aquatic sediments.

More accurate predictions of fate of arsenic and selenium pollutants in surface waters.

Assessment of potential for remobilisation of selenium from sediments.

Improved methods of selenium analysis.

Increased variety of water tracers available for specific applications.

Improved understanding of kinetics of mass transfer of pollutants from the water column to sediments.

Computer models for more reliable prediction of pollutant transport.

Determination of potential long-term effectiveness of blowing down Lake Liddell which may be limited by the ability of the sediments to buffer the concentrations of toxic solvents in the water column.

Development of industrially acceptable water treatment process for reducing total chromium levels in dyehouse effluents to below 50 ppb in a roughing step and then to below 0.1 ppm in a final polishing step.

**Commercial process for conversion of natural gas to olefins suitable as petrochemical feedstocks and for conversion to transport fuels. (6%)**

Identification of active and selective catalysts.

Identification of reactor configuration capable of scale-up

Optimisation of process chemistry, including the influence of pressure on the reaction.

Clarification of reaction mechanisms.

Development of patent prototype.

Evaluation of technical and economic feasibility of the process.

**Delivery of technology in high priority areas through application of specialised skills. (4%)**

Near-completion of first stage of project aimed at pharmaceutical application of novel electro-suspension techniques.

Completion of feasibility study on an efficient method for determining residual grease in scoured wool, and implementation of the technology developed in industry.

Determination of structure of organic matter in bauxite deposits.

Clarification of role on inhibitors in alumina crystallisation in the Bayer process.

Preliminary evaluation of agglomeration/briquetting techniques in waste management.

**Appropriation Total Allocation (includes earned appropriation revenues): \$6,241,000**

**Sponsored Research: \$3,000,000**

**Total Budget: \$9,241,000**

The Division expects to receive 32% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **5.3 DIVISION OF EXPLORATION GEOSCIENCE**

#### **Objective**

**To create and improve methods for locating new mineral and energy resources.**

#### **Strategy**

- Integrate a strong discipline-oriented research base with a focused project approach to support the development of new and improved concepts and techniques for exploration.
- Conduct 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 for the location of deeply weathered or concealed world class deposits.

#### **Specific Objectives** (Percent Resources)

**Develop a detailed knowledge of the origin and nature of orebodies and the relationships between orebodies and their host rocks, involving studies of chemical and physical mechanisms of regolith formation. (24%)**

#### **Planned Outcomes**

Completion of detailed stratigraphic study of ultramafic sequences within the Mt Keith greenstone belt, leading to development of genetic models for the development of nickel sulphide ores.

Planning and organisation of international conference on platinum mineralisation in mafic and ultramafic rocks.

Development of criteria for exploration for volcanogenic massive sulfide deposits through a study of the petrology and geochemistry of submarine volcanic rocks and exhalative minerals in the Woodlark Basin.

Use of stable isotope techniques to establish the genetic history for selected, high-level and mesothermal gold deposits.

Establishment of ore genetic and exploration criteria for Mt Read region through a detailed characterisation of major, trace element and isotope geochemistry of the Mt Read volcanics.

Determination of source and size of hydrothermal systems placing gold in the slate belt systems of Eastern Australia, using isotopic techniques.

Characterisation of the mineral assemblages of rare earths and rare metals in two major Australian deposits representing previously undocumented styles of mineralisation.

Determination of the mineralogy and residence sites of platinum group elements in Panton Sill and ophiolite-hosted deposit.

Completion of detailed petrological and geochemical study of the Marra Mamba Iron Formation, leading to an understanding of the relationship between parent iron formations and their derived iron ore deposits.

Development of understanding of the complex mineralogical and geochemical processes involved in the replacement of gangue minerals, in parent iron formations, by iron oxides.

Completion of first phase of the study of the distribution of Channel Ores (Robe River Ores) in relation to the various Hamersley palaeo-surfaces, leading to an understanding of the geological controls of the highly variable minor element distribution within these ore deposits.

Establishment of textural, mineralogical and geochemical parameters that enable parent rock-types to be identified from their weathering products.

Further establishment of patterns of secondary dispersion of gold and associated elements within the regolith.

Completion of first stage of determination of the chemical processes responsible for the dissolution, transport and precipitation of gold and platinum metals during weathering.

Determination of importance of calcrete and ferricrete as sites for gold concentration, and assessment of their importance as exploration sampling media.

Use of palaeomagnetic dating techniques to establish the nature of certain relationships between weathering profiles in Eastern Australia.

Report on mineralogical control of geochemical anomalies within laterites, iron stones and other near-surface materials.

**Develop geochemical techniques to aid mineral exploration based on an understanding of the processes of ore formation, weathering and element dispersion. Develop advanced instrumentation and methods for the efficient analysis of materials relevant to mineral and petroleum exploration. (26%)**

Completion of detailed study of the application of hydrogeochemical methods for the location of mineralised environments in areas of extensive cover.

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

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

Establishment of database of lead isotope "fingerprints" of gold mineralisation in the Lachlan Fold Belt in NSW for use in exploration.

Development of strategies for mapping regolith units associated with secondary gold deposits or overlying primary gold deposits in the Yilgarn Block, WA.

Report on a classification scheme for regolith materials.

Determination of methods for ensuring that exploration drilling programs achieve the maximum return of geochemical exploration data from the minimum depth of drilling.

Compilation of multi-element geochemical databases for laterites overlying prospective, deeply weathered bedrock in the Yilgarn Block, WA.

Establishment of unique signatures for trace element patterns in indicator minerals associated with diamondiferous intrusions.

Development of accelerator mass spectrometry techniques for <sup>14</sup>C and <sup>10</sup>Be analysis and for ultra-high sensitivity trace element analysis in mineral exploration.

Establishment of appropriate statistical approaches for anomaly recognition and interpretation of multi-element geochemical data.

**Recognise and interpret physical signals generated by distinctly different physical properties of orebodies and host rocks, including the development of equipment and aids to interpretation. (12%)**

Definition of parameters and design requirements for construction of an airborne electromagnetic system capable of examining extremely short time, transient signals for the purpose of mapping surface conductivity variations.

Commencement of development of new transient electro-magnetic systems based around advanced computer systems and novel three-component sensors.

Completion of software package for the management of a wide variety of electromagnetic and induced polarisation modelling programs.

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

Report on improved understanding of the relationship between observed petrological variation and rock magnetic properties, and use of this information in the improved interpretation of magnetic surveys.

Field test of advanced vector magnetometer system to enable the *in situ* measurement of remanent magnetism.

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

**Develop and demonstrate resource evaluation and mineral and petroleum exploration methods based on high resolution spectrometry and the spectral characteristics of minerals and vegetation in the visible to mid-infrared range of the electromagnetic spectrum. Develop applications of remote sensing to the management of Australian lands based on an understanding of the spectral response of vegetation at varying spatial and temporal scales. (23%)**

Determination of optimum approaches for use of remotely sensed data in particular aspects of geological mapping, regolith mapping, structure mapping and mineral mapping.

Evaluation of use of airborne and proximal spectroradiometers in mineral mapping, particularly their use in outcrop mapping of alteration phenomena and drill-hole logging.

Continued investigations of extent to which subtle variations in mineralogy can be determined by typical field instrumentation.

Continued development and flight-testing of airborne CO<sub>2</sub> 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 remote sensing data to enable detection of minerals in the presence of up to 50% vegetation cover.

Demonstration and application of operational remote sensing techniques for gold exploration in North Queensland.

Evaluation of SPOT panchromatic stereo data for mineral exploration.

Completion of program of six courses for the mining industry to transfer remote sensing technology developed over the past 10 years.

Establishment of CSIRO Remote-Sensing Laboratory incorporating inputs from the Division of Exploration Geoscience, the Division of Mathematics and Statistics and the WA State Government, to conduct research on mineral exploration and resource assessment, and establishment of consultancy bureau in collaboration with World Geoscience Corporation and other industry joint-venturers.

Collaboration with WA State Government in development of vegetation monitoring facility.

**Develop techniques to evaluate the generation, migration and accumulation of oil in Australian sedimentary basins and establish an economic method based on microbial processes for the enhanced recovery of residual oil from natural reservoirs. (15%)**

Establishment of maturity parameters based on fluorescence alteration of macerals.

Identification of best environments for oil source rocks in the Surat Basin on the basis of the relationships between organic matter type and palaeodepositional environment of the sediments.

Demonstration of use of isotopic and fluid inclusion studies to establish timing of generation and migration of hydrocarbons.

Completion of feasibility study to assess potential of isotopic analysis of surface gases for the delineation of seepage from petroleum reservoirs at depth.

Establishment of maximum palaeotemperatures and palaeogeothermal gradients for wells in Cooper and Eromanga Basins, using vitrinite reflectivity.

Evaluation of the usefulness of Nd model ages of sedimentary rocks in defining provenance and correlating stratigraphy in the Eromanga Basin.

Completion of study of the application of image processing techniques on Landsat Thematic Mapper Data for petroleum exploration in Papua New Guinea.

Assessment of field application of the Biological Oil Stimulation (BOS) process to determine its suitability for application to the Alton oil field.

Application of BOS technique to a variety of oil reservoirs in North America.

Completion of technology transfer of the BOS process to BWN Live-Oil Pty Ltd.

**Apply techniques developed for minerals and oil exploration, for understanding a range of environmental problems.**

Completion of assessment of applicability of transient electromagnetic and direct current resistivity measurements in monitoring groundwater pollution around waste disposal sites in Perth.

Comparison of results of transient electromagnetic/direct current resistivity measurements with drilling and monitoring of groundwaters as a basis for mapping soil salinity.

Completion of assessment of the use of lead isotope measurements in monitoring possible seepage from the Ranger uranium tailings dam.

Application of lead isotope measurements in monitoring lead levels in and determining provenance of wine.

**Appropriation Total Allocation (includes earned appropriation revenues): \$7,204,000**

**Sponsored Research: \$3,400,000**

**Total Budget: \$10,604,000**

The Division expects to receive 32% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **5.4 DIVISION OF FUEL TECHNOLOGY**

### **Objective**

***To develop new or improved processes for the production and use of liquid and gaseous fuels and their alternatives in order to maintain the maximum economic level of Australian production and self-sufficiency.***

### **Strategy**

- *Apply chemical and engineering skills to create new process routes, to improve and modify overseas fuel technologies and processes to better suit them to Australian feedstocks, and to identify possibilities for new technological approaches.*
- *Develop or enhance techniques for monitoring adverse health and environmental impacts of the production and use of energy and mineral resources.*

### **Specific Objectives (Percent Resources)**

### **Planned Outcomes**

**Develop and improve methods for increasing the oil yield and producing transport fuels from Australian oil shales. (34%)**

Determination of optimum conditions for selected process variables such as retort temperature, recycle ratio, combustion temperature and recycled solids temperature, for oil yield and quality within the integrated rig.

Incorporation of heavy oil recycle loop into the integrated facility, and mini-reactor studies of reactions associated with heavy oil recycle.

Completion of gas atmosphere and kinetic studies of the decomposition of clay minerals during retorting.

Completion of studies of rock type and mineral effects on oil shale processing and interpretation of results and preparation of NERDDC report.

Completion of study of the effects of steam injection during combustion of retorted shale, evaluation of the coking potential of the resultant combusted shale, and submission of report.

Completion of investigation of the effect of the presence of steam on the "denox" and "desox" reactions, and submission of report.

Completion of evaluation of combinations of steam injection with oxygen lean combustion, and submission of report.

Determination of response of three samples of oil generated from Stuart oil shale to variations in hydrotreating parameters such as pressure, temperature and space velocity.

**Establish factors that determine product selectivity in processes for converting synthesis gases and natural gas to liquid fuels. (23%)**

Completion of study of optimisation of selected Fischer-Tropsch catalysts for production of aviation turbine and diesel fuels from synthesis gas.

Initiation of study to assess the quality of middle distillates as a potential blending stock for Australian refineries.

Initiation of study to evaluate the feasibility of co-processing of brown coal and natural gas as a new route for synthesis gas production.

Determination of effects of pressure and the usefulness of the high pressure, staged oxygen injection reactor, on the oxidative coupling reaction, using selected catalysts.

Development and implementation of new research program for advanced routes of the conversion of methane to methanol.

**Devise better methods for natural gas storage in vehicles to increase their driving ranges. (11%)**

Optimisation of procedures for activated carbon preparation from preferred bituminous and lignitic coals.

Improvement of carbon density whilst maintaining high surface area by investigating novel carbon preparation techniques.

Determination of effects of carbon dioxide and water on the methane capacity of activated carbons in cycling test unit.

Measurement of heats of adsorption/desorption of active carbons, and determination of implications for "fast" versus "slow" refill operations.

Determination of methane and natural gas capacities of low molecular weight hydrocarbon solvents, and assessment of energy density versus pressure relationships for such mixtures.

**Measure trace elements in coal products and power station waste to determine the environmental consequences of coal use. (14%)**

Correlation of data on the partitioning of trace elements in ash from four NSW power stations, to the mineralogical association of the trace elements in the feed coal.

Initiation of development of procedures for the quantitative analysis of clay minerals in coal, using Siroquant.

**Develop analytical techniques for monitoring pollution of natural waters by mining and industrial operations. (11%)**

Commercialisation of Total Organic Carbon Analyser.

Development of new technology, based on photocatalytic oxidation, for the removal of organic contaminants from water.

Determination of fate and transport mechanisms of the insecticide endosulfan used on cotton crops in northwestern NSW.

Establishment of relationships between the selectively extractable fractions of heavy metals such as copper, lead and zinc, in sediments, and those accumulated by sediment-dwelling organisms.

Development of series of chemical markers suitable for determining sediment chronology and measurement of recent sedimentation in lakes, estuaries and rivers, to describe the sedimentation history of Lakes Macquarie and Illawarra.

Initiation of investigation into the contribution of roadways, freeways, etc to the metal content of stormwater runoff.

Measurement of contribution of existing sewage outfalls to dissolved heavy metal concentrations in seawater and the surface microlayer.

Assessment of relative contributions of ocean-dumped sediments and sewage discharge to the heavy metal concentrations in sediments off the coast of Sydney and Wollongong.

Determination of the impact of banning tributyltin-based antifouling paints on water and biota in the Georges River, and examination of environmental acceptability of alternative anti-fouling paints.

Definitive paper outlining the impact of marina development on the aquatic environment.

Development of new, rapid procedure to test for sewage pollution in seawater samples.

**Develop improved techniques for biologically monitoring exposure of workers in the mining and energy industries to toxic materials. (7%)**

Study of distribution of skin-absorbed lead within the body, to assess the danger to workers of skin exposure to lead.

Determination of extent of absorption of aromatic amines by chemical industry workers.

Initiation of study of exposure of health care workers to platinum cytotoxic drugs.

Determination of degree of skin absorption of nickel and cadmium.

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,957,000**

**Sponsored Research:** \$1,700,000

**Total Budget:** \$6,657,000

The Division expects to receive 26% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 5.5 DIVISION OF GEOMECHANICS

**Objective**

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

**Strategy**

- *Undertake both fundamental and applied geomechanics research focused on short and long term industry needs.*
- *Develop and apply technology to maintain the stability of rock mass structures under conditions of increasing temperature and stress.*
- *Develop concepts and technologies that improve the design and construction of engineering foundations, particularly piled foundations and enhanced natural foundations in the civil and offshore engineering industries.*
- *Develop new geophysical technologies and equipment specifically designed to measure, locally and in bulk, the composition, structure, stress state and mechanical properties of soil and rock masses in the mining and civil engineering environments.*
- *Develop and introduce into the appropriate Australian industry sectors, new or improved concepts and methods for cutting, breaking and fragmenting rock.*
- *Promote advances in understanding of the performance of sub-surface reservoirs, with a view to facilitating more efficient recovery of natural resources and/or the cost effective use of sub-surface reservoirs for commodity storage or isolation.*

**Specific Objectives**  
*(Percent Resources)*

**Assist the industrial development of design and construction concepts for piled foundations for both offshore and onshore structures, through the development and application of cement grouting technology, and through the artificial cementation of weak porous sediments. (10%)**

**Planned Outcomes**

- Development of model to describe the injection of cement grout into rock joints and interfaces such as that between a pile and soil.
- Development of generic process of artificial cementation for porous sediments, with the objective of enhancing mechanical performance.
- Identification and implementation of improvements to construction practice, including quality assurance, of piled foundations.
- Development of applications of cement grouting technology in conjunction with piling contractors.
- Development of understanding of the behaviour of the pile-grout-soil system for driven post-grouted piles, particularly for offshore applications, in conjunction with piling contractors and offshore operators.
- Development of resonant pile driver, in conjunction with a private inventor, a piling contractor and an established pile driver manufacturer.

**Improve efficiency and safety in coal mining by developing techniques and equipment for predicting geological structure and strength in rock and coal, by computational modelling of rock stress and mine support, by mine support methods and monitoring of strata and longwalls at the mining face and in long-term roadways, and by development of a prototype remote control mine emergency survey vehicle.**

(20%)

Construction of prototype remotely controlled mine reconnaissance vehicle designed for operation in mine emergencies and hazardous mine conditions.

Completion of development of instruments used in conjunction with coal-mine roof support systems to provide warning of changes in roof conditions prior to falls.

Completion of development of new computer-based techniques for Australian coal-mine layout design, and provision of mine planners with comprehensive mine design and analysis packages on desk-top microcomputers.

Improvement of predictability of geological hazards, and development of database and graphical techniques to aid mine-design assessment, by investigating mine-scale conceptual models of fault systems and structural deformation in Sydney Basin coalfields.

Completion of fracture analysis using aerial photography and TM satellite imagery to identify possible fault systems that may affect future developments at West Cliff Colliery, Southern Coal Field, Sydney Basin.

Compilation of data bases of parameters related to seam gas in Australian Coal Basins, and implementation of analytical techniques for 3-D modelling of geology, structure, and physical properties of coal seams at methane production sites, by investigating geological factors affecting methane production from coal seams, and geological processes that increase permeability in coal.

Establishment of numerical models of yield pillar stability and mechanisms of roof and floor behaviour in roadway development at moderate depth in Kembla Coal and Coke mines.

Completion of development with Queensland University of Technology of a real time electronic tilt monitoring instrument connected to a PC to measure attitude of drag lines in surface mining operations.

**Develop and apply technology related to controlling the behaviour of earthen materials under high stress conditions encountered in the use or recovery of resources in the civil, mining or petroleum industry.**

(20%)

Evaluation of results of field trials of rock support systems and obtain patents if appropriate.

Completion of theoretical description of rock support, rock and grout interaction, and incorporation in mine design software.

Initiation of investigation of alternative materials for rock reinforcement systems in hostile environments, and of discussions with industry to seek support to continue that work.

Completion of installation of equipment to record the long-term behaviour of rock chambers, and continued involvement on a review basis.

Commencement of research, with WA State Government support, to predict the long-term stability of open pit mines.

Evaluation of software written to describe non-elastic rock mass behaviour, and its incorporation in commercially successful packages.

Completion of pre- and post-processing software packages, and provision of links to commercially successful stress analysis programs.

Completion of development of boundary element stress analysis packages, and their commercialisation on a sales or bureau basis.

Commencement of major study of the prediction and control of subsidence caused by mining, and application for NERDDP support.

Commencement of major investigation of the causes and control of rock burst behaviour in metalliferous mines.

Discussions with petroleum industry to seek support for the development of technology associated with well-bore stability.

Completion of numerical studies of mining-induced subsidence, and submission of proposal for extended research.

Marketing of recently enhanced packages for computational stress analysis.

Application for funding for development of new software for computer-aided mine design.

Release of expert systems for choice of stress analysis programs for excavation design.

**Develop new, more efficient techniques for controlled cutting, drilling and fragmenting rock and for the assessment of fragmentation processes through size/shape classification using image analysis Place these developments within a framework of fundamental understanding of rock behaviour under elevated stress, temperature and fluid flow conditions. (15%)**

Completion of joint study, with the Division of Mineral and Process Engineering, on the fracture damage in ore particles generated by crushing in high-pressure rollers.

Commencement of study, in conjunction with the Key Centre for Mines, University of NSW, into fracturing processes accompanying hard rock machining.

Completion of study, conducted with the Research School of Earth Sciences, ANU, of the micromechanics of water weakening in quartz.

Commencement of study of fatigue fracturing of rock, related to mine stability and rock bursts.

Completion of joint CSIRO-Western Australian School of Mines study into mechanical properties of WA goldfield rocks, with emphasis on scale and time-dependent effects.

Commencement of joint CSIRO-Monash University project of post-graduate training in geomechanics for earth scientists.

Completion of series of physical experiments to investigate the velocity dependence on rock friction, with attention to scale effects.

Characterisation of discontinuities in rock, in conjunction with Monash University, by using ultra-sonic pulse techniques.

Use of acoustic emission monitoring to examine, with support from the British Council and DITAC, the damage developed during brittle failure of rocks.

Completion of the design and commencement of construction of a large volume, high pressure triaxial compression testing apparatus for rocks.

Completion of construction and commissioning of the Mark III CSIRO Simple Shear Apparatus.

Commencement of study on development of an image analysis-based system for particle size measurement of fragmented rock on moving conveyors.

Evaluation of methods for measurement of volume percentages of fine coal fragments in run-of-mine product from coal mines, with support from a NERDDP grant.

Completion and publication of experimental and numerical studies on the initiation of shear bands in weak rock.

Report to Western Mining Corporation, concerning results of studies of the structural control of orebody formation.

Completion and publication of study on the structural control of fluid flow in the Earth's crust.

Completion and publication of series of experiments, conducted in conjunction with the University of Tokyo, investigating the origins of earthquakes in the Earth's mantle through deformation of polycrystalline olivine.

Completion of study with Monash University of numerical modelling of effective slip systems and preferred orientations in deformed polycrystals.

Completion of study with Monash University on the effect of chemical environment on the microstructure and mechanical behaviour during deformation of polycrystalline quartz.

Completion of study for Ok Tedi Mining Ltd into the structural geology, geomechanics and slope stability of the area about the Ok Tedi Mine, Papua New Guinea.

**Apply reservoir engineering to assist the establishment of a coal-based methane extraction industry in Australia, and to pursue other specific developments such as secondary oil recovery, *in situ* leaching of mineral deposits, and sub-surface storage. (15%)**

Development of conceptual and mechanistic models to describe the dynamics of proppant movement within hydraulic fractures developed in porous visco-elastic materials such as coal.

Refinement of application of hydraulic fracture simulation practice to overcome the problems inherent with hydraulic fracturing in Australia's unique coal basin environment.

Development of improved understanding of the fundamental mechanics governing the dual flow of water and gas in coal.

Refinement of reservoir modelling capabilities for the prediction of coal-bed methane production, design of dewatering strategies and evaluation of economic potentials.

Determination of influence of coal mining on groundwater.

Development and demonstration of refined well testing techniques for the evaluation of coal bed methane prospects.

Identification of geological conditions characterising regions of better than average methane production potential.

Identification of geological conditions likely to be conducive to effective application of methane production stimulation techniques.

Investigation of pore size and distribution in cap-rock from potential petroleum reservoirs.

**Develop geophysical *in situ* methods of analysis including borehole logging and surface sensing for: investigations of ore and rock chemistry; development of technologies benefiting the mining and civil engineering industries in exploration, site examination, mine and quarry development and production; and monitoring variations of salinity concentrations in water bores as part of Australia's research programs into salinity control. (20%)**

Commencement of collaborative research project with Robe River Iron Associates to determine aluminium impurity concentration by production blast hole logging.

Commencement of research and development of a coal face ash analysis system by natural gamma ray spectroscopy as part of a NERDDP project.

Completion of study on coal seam identification and qualitative evaluation by combined natural gamma and gamma/gamma down-hole spectroscopy.

Completion of evaluation project, in collaboration with LCPC (France), of nuclear borehole logging techniques for civil engineering applications.

Development of SIROLOG Borehole Logging System for Hamersley Iron Pty Ltd applied to blast hole determination of ore grade, formation density and blast hole diameter at Paraburdoo Mine.

Development of SIROLOG system for Hamersley Iron Pty Ltd with application to exploration for iron ore.

Initiation of design and development of an excentralised combination of natural gamma-gamma/gamma borehole probe for use in wide, cased, water-filled boreholes for the SECV in the Latrobe Valley.

Commencement of collaborative investigations with Hamersley Iron Pty Ltd into borehole logging techniques for quantitative estimation of aluminium content and lithology in exploration boreholes.

Completion of field trials in the Hunter Valley with the Joint Coal Board of NSW.

Commercialisation of borehole logging system in the coal industry through Stratatalog Pty Ltd.

Establishment of research project with an Australian company to develop a system capable of *in situ* analysis of copper, lead, zinc and nickel.

Development of joint project with India regarding base metal analysis.

Determination of feasibility of analysing for gold in drill holes to a precision of 1.0 ppm.

Application of nuclear activation and passive nuclear devices to density determination, in fields other than iron ore and coal.

Completion of current suite of data processing programs for radar, and commencement of development of better algorithms for time/depth conversion.

Establishment of modified and focused radar system with State Government for road surface and sub-surface investigations.

Production of commercial airborne radar system, in conjunction with a major Australian airborne geophysical contractor, for salinity monitoring, pollution control and mineral evaluation.

Completion of investigations for a new style of radar antenna, using super-conducting material, in collaboration with Monash University.

Establishment of working relationship with BHP Engineering for the commercialisation of the existing ground probing radar system.

Development of research agreement with BHP Engineering to produce a state-of-the-art radar data acquisition and processing system.

Completion of development of acoustic monitoring techniques, including software, to enable the prediction of remnant life in metal and plastic structures (such as pressure vessels) and the stability of underground mine openings.

Instrumentation of 45 m dia. x 35 m high cryogenic pressure vessel in WA, with the intent to provide long-term or permanent integrity of the vessel, allowing continuous operation for a period of between 50 and 100 years.

Investigation of operation of a chemical processing plant in Newcastle, which has 200 large fibre reinforced plastic vessels operating at 95% of design capacity, and provision of on-line structural integrity evaluation and process control for the plant and process.

Development and evaluation of on-line acoustic monitoring and diagnosis package for use in aircraft to detect, locate and identify crack formation and growth in strategic areas of the aircraft.

Development of acoustic emission systems appropriate to an intelligent gyratory crusher.

Completion of seismic/micro-seismic monitoring and interpretation project, in conjunction with IBM, on the San Andreas Fault.

Commencement of project involved with the development of a new, stronger and improved radar nosecone for Australian submarines.

Completion of investigation into acoustic emission monitoring of a new design petro-chemical platform for Caltex, together with a real time structural integrity evaluation.

Continued development of blast vibration monitoring systems to minimise peripheral damage in blasting environments.

Completion of development and commencement of commercialisation of a cross-hole seismic system for the coal industry.

Commercialisation of borehole positioning system for use in non-magnetic environments, and commencement of the development of a system for use in general environments.

**Appropriation Total Allocation (includes earned appropriation revenues): \$5,003,000**

**Sponsored Research: \$4,000,000**

**Total Budget: \$9,003,000**

The Division expects to receive 44% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **5.6 DIVISION OF MINERAL AND PROCESS ENGINEERING**

**Objective**

***To increase the international competitiveness of mineral, energy, base-metal and process industries in Australia.***

**Strategy**

- *Apply skills in engineering and science, through theoretical, experimental and application studies, in conjunction with industry, to the stages of processing and beneficiation that offer the most cost effective returns or means of improvement for the industry.*
- *Emphasise instrumentation and control, material handling, ore and mineral beneficiation, and smelting and base metal production.*

**Specific Objectives**  
(Percent Resources)

**Understand and improve the beneficiation of minerals through the measurement, modelling and control of processing steps such as crushing, grinding, flotation, agglomeration, sintering and leaching. (30%)**

**Planned Outcomes**

- Commercialisation of successful laboratory scale research into the microagglomeration of titanium-bearing concentrates.
- Completion of development of a process for the granulation of a fine dust to improve hygiene, transport and processing operations.
- Completion of development of automatic analysis of mineral phase abundance in sintered materials.
- Completion of algorithms for identification and quantification of the various structure types in multi-phase sintered mineral materials.
- Measurement of specific features (eg pore and grain size distributions) in iron ore sinters.
- Report on specific relationships between ore properties, processing conditions and sinter characteristics.
- Completion of first stage of developing methods of improving flotation separation of valuable sulphides from gangue sulphides (especially pyrite), by establishing the roles of collectors and metal hydroxides.
- Initial evaluation of effects of recycle on the design and operation of sulphide flotation circuits.
- Determination of importance of pulp potential in silver mineral floatation.
- Use of reverse cleaning and separate treatment of coarse and fine particles to support the achievement of better metallurgical performance at WMC, Woodlawn and Broken Hill.
- Development of methods of producing a high grade heavy mineral concentrate by flotation from fine grain mineral sands.
- Quantification of metallurgical performance of selected concentrators through detailed size-by-size surveys.
- Evaluation of flotation simulator in an industrial environment.
- Trial models for the zinc electrowinning process at Pasminco.
- Completion of assessments of data and simulation studies to show how high pressure grinding rolls may be profitably used.

Use of small scale crushing data collected in 1989 to develop a mathematical model for cone crushing for Hamersley Iron and ANL-Ruwolt.

Comparison of fine grinding performance and efficiency of various comminution devices, with particular reference to the requirements of regrind circuits.

**Improve existing high temperature mineral processing systems and develop new processes for the secondary processing of mineral products. (40%)**

Completion of LDV measurements of velocity fields resulting from gas injection into water models.

Measurement of gas injection-induced surface waves in water models.

Completion of mathematical model of hydrocyclone, including second moment closure.

Development and installation of real-time model of the Moomba-Sydney-Newcastle gas pipeline network on operating companies control computers.

Supply of software package, SIROGAS 2.1, for simulation of gas pipeline networks by industry.

Development of computer model of the Kalgoorlie Nickel flash smelter.

Experimental validation of numerical fluid mechanics models of iron bath technology for CRA Ltd.

Provision of support to MIM in the marketing of SIROSMELT technology.

Completion of study of the factors affecting the condensation of zinc vapour.

Thermodynamic models of metallurgical slag systems.

Models for the reduction of lead slags.

Application of SMELT program to the modelling of smelting processes.

Development of treatments for the roasting of "sticky" ores and concentrates.

Application of circulating fluidised bed technology to mineral treatment and furnace offgas handling, in industry.

Development of technical scale process for regeneration of bleaching earth.

Secondment of staff to Comalco to assist with technology transfer in the commercial development of the reflux refining process.

**Develop sensors for the analysis of coal, minerals and petroleum products to provide accurate and timely information for process control strategies. (30%)**

Commercialisation of on-belt microwave moisture monitor, and continued demonstration of a prototype monitor at Howick coal.

Field test of microwave technique for the on-line determination of unburnt carbon in fly ash at Wallerawang power station, NSW.

Development and test of prototype instrument for the on-line determination of pulverised coal mass flow.

Selection of suitable technique as basis for prototype instrument to determine the mass flow rates of oil, water and gas in pipelines.

Evaluation and development of techniques for the on-belt analysis of brown coal.

Completion of study of the use of QEM\*SEM for ore characterisation.

Promotion of commercial activities of QEM\*SEM, through instrument sales and expansion of the Bureau activities.

Completion of field evaluation of a natural-gamma coal ash analyser for lightly laden conveyors.

Development of natural-gamma coal ash analyser for measuring the ash content of coal in stockpiles and wagons.

Evaluation of correlation between natural radioactivity and soil content of shredded sugar cane.

Evaluation of methods for simultaneous on-line determination of iron, aluminium, silicon and phosphorus in iron ore.

Evaluation of methods for on-stream analysis of cement raw mix.

Determination of accuracy of IRONSCAN for Channar ore.

Completion of plant trials of neutron absorber tracer methods for measuring residence times in reactor vessels, in collaboration with the Division of Coal Technology.

Completion of investigation and modelling of sample cutter operation, in collaboration with the Division of Mathematics and Statistics.

Completion of modifications to the borecore analyser (CORAN) for measurements in 100 mm diameter cores for coal washability studies.

Development and test of commercial version of the advanced control software (COALTROL) for coal preparation plants, in collaboration with BHP Engineering, and marketing of COALTROL software to the Australian coal industry.

Application of COALTROL software to heavy media circuits of mineral processing plants, in collaboration with BHP Engineering, and evaluation of the potential market for an equivalent MINTROL advanced control software.

Establishment of collaboration with Comalco to develop an advanced control system for aluminium reduction furnaces.

Commencement of investigations of laser methods for measurement of temperature and composition of hot dusty gases.

Completion of development of on-line laser methods for measurement of coking/caking properties of coals.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 7,989,000**

**Sponsored Research: \$ 3,800,000**

**Total Budget: \$11,789,000**

The Division expects to receive 32% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 5.7 DIVISION OF MINERAL PRODUCTS

**Objective**

***To develop products and processes that will generate added value and new markets for Australian mineral resources.***

**Strategy**

- *Collaborate with industry and maintain excellence in key chemical and mineral sciences.*
- *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.*

**Specific Objectives  
(Percent Resources)**

**Planned Outcomes**

**Develop technology to support industries based on Australian industrial mineral resources and to encourage their further processing to value-added products. (55%)**

Provision of product evaluation, analytical and sampling strategies for a new deadburnt magnesia plant processing Kunwarara magnesite.

Completion and commissioning of new assessment facilities for high-alumina refractories.

Evaluation of applications of caustic magnesia in effluent treatment and establishment of the possibilities of new speciality magnesium-based cements.

Establishment of x-ray analysis centre for developing and applying novel methods for determining phase abundance in complex mineral assemblages.

Evaluation of technology for use of spent potlining from aluminium smelters in several potential applications.

Development and application of improved strategies for laboratory predictions of the behaviour of ilmenite feedstocks in synthetic rutile plants.

Completion of commissioned projects on processing technology for fine-grained titanium minerals from the WIM-150 deposit, and characterisation of products from laboratory and pilot-plant trials.

Determination of mode of occurrence and behaviour of unwanted impurities in ilmenite; and development of procedures for lowering the content of such impurities to meet market specifications.

Completion of experimental program on solid-liquid reactions occurring in the washing of residues from alumina production via the Bayer process.

Characterisation of feed materials to, and products from, the "cold milling" process for rare earth minerals aimed at direct production of metal alloys.

Determination of composition of surface coatings, in relation to the surface properties and associated behaviour of treated titania pigment materials.

Commencement of experimental program on crystallisation and flocculation parameters in Bayer process reactors.

Analysis of data on floc properties from industrial thickeners, and development and test of a suite of methods to improve process control and efficiency.

**Develop improved technology for the production of metals from Australian metallic mineral resources. (30%)**

Optimisation of conditions for a novel process employing high temperature cyanidation to extract gold and platinum metals from ores and test of its applicability to several Australian deposits.

Demonstration that the automated electron beam method for locating rare phases is the best strategy for following the fate of precious metals through an extractive process.

Completion and evaluation of experimental program on novel approaches to extracting gold from refractory ores, including electrolytic treatment and low-temperature roasting of arsenopyrite concentrates and pretreatment of concentrates by pressure oxidation.

Completion at technical and pilot scale of trials of technology developed to allow continuous production of certain metals by electrowinning at high current density.

Design and construction of specialised high-temperature equipment for assessing the performance and behaviour of new materials for aluminium smelting electrodes and study of electrochemical properties of a range of cathode materials with commercial promise.

Completion of evaluation of processes for production of titanium diboride, and completion of pilot scale production runs of material for commercial evaluation in an aluminium smelter.

Initiation of research into the chemical basis of *in situ* leaching processes for base metal recovery, characterisation of ore samples, and determination of reactivity of individual minerals to a range of lixiviants.

**Encourage increased markets for lead and other metals through improved battery performance, new battery technology and new battery applications. (15%)**

Definition of key steps of new technology for producing lead/acid battery plates, and characterisation and evaluation of production batteries so as to optimise chemical parameters of manufacture.

Completion of data collection for batteries that have failed under the operating regime needed in remote area energy storage systems, analysis of information from battery operation at remote sites, and completion of the assessment of technologies for battery manufacture to suit such operation.

Initiation of research on valve-regulated lead/acid batteries for remote area power storage applications.

Initiation of research for determining an authoritative impurity specification for lead to be used in battery manufacture.

Development of methods to provide *in situ* monitoring of the processes leading to premature capacity loss in batteries that employ lead containing no antimony, and development and test of procedures to prepare the battery plates needed in such research and to assess their behaviour in service.

Assessment of potential of a new concept for an aqueous lithium battery.

Assessment of several possible methods of triggering cold fusion reactions in the deuterium/palladium system to provide the necessary supporting evidence for the occurrence of the phenomenon.

**Appropriation Total Allocation (includes earned appropriation revenues): \$6,109,000**

**Sponsored Research: \$2,850,000**

**Total Budget: \$8,959,000**

The Division expects to receive 32% of its total budget from external sources (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **6. INSTITUTE OF ANIMAL PRODUCTION & PROCESSING**

### **Objective**

*To improve the economic and social wealth of Australia by helping the animal and food industries to develop a wider range of quality products, and by enhancing the efficiency and international competitiveness of these industries.*

### **Strategy**

*The Institute carries out R&D to increase the productivity of Australia's livestock industries, to improve the quality and marketability of animal products within sustainable production systems, and to develop new value-added products and processes. Generic research for the food industry and research into human nutrition for the benefit of the Australian community also form part of its program. The Institute works in close collaboration with the rural and manufacturing industries, to ensure that research results are translated into benefits for all Australians.*

*The Institute is the major body performing longer-term research in Australia for the animal and food industries. The main commodities for which research is undertaken are wool, beef, sheep meats and dairy products. Research covers many areas from pastures through animal health, production and harvesting, to processing and products, including by-products. For chicken meat and egg production, research is mainly in poultry breeding and health. Particular emphasis is placed on processing and marketing and the transfer of research results to users.*

*Researchers collaborate with State Departments and Universities in order to achieve effective integration of the national research effort, and maintain links with other countries in many research areas, particularly textile research through the International Wool Secretariat.*

*The Institute's primary customers are Australian livestock producers; wool, meat and dairy marketing authorities and processing companies; manufacturers of vaccines and other veterinary products; and the world-wide wool processing and textile industry. Others include Departments of agriculture and community health authorities.*

*The Institute's research contributes to increasing:*

- . Australia's export market share and earnings for wool, meat and dairy products*
- . The proportion of rural products processed or part-processed in Australia where this will capture more net value in Australia.*
- . Producers' productivity and profitability*
- . Product diversification*
- . Consumption of meat and dairy products, consistent with good nutrition*
- . Community adoption of healthy eating habits and lifestyles that help to reduce the incidence of diet-related diseases.*

### ***Specific Activities***

- *Develop four proposals for Cooperative Research Centres.*
- *Conduct three Institute "think-tanks" on industry problems and R&D opportunities, involving scientists from different parts of the business system.*
- *In collaboration with ABARE, carry out rigorous ex-post evaluation of key Divisional programs.*
- *Engraft the use of ex-ante project appraisal into the Divisional ethos as a normal part of project planning.*
- *Negotiate medium-term arrangements with the Dairy Research and Development Council for the management and funding of dairy processing research.*
- *Reach agreement with major Rural Industry Research and Development Corporations and Councils on principles for sharing overhead research costs.*
- *Complete plans for rationalising Institute property holdings over the next five years.*
- *Increase expenditure on major items of scientific equipment by 25%.*
- *Achieve increased flexibility in all Divisions by reducing the proportion of total funds committed to salaries, and reducing expenditure on overheads.*
- *Develop performance contracts with all Chiefs.*
- *Finalise accommodation for Division of Wool Technology staff located at Parkville.*
- *In conjunction with Divisions, develop appropriate communication strategies for all Divisions and sites.*
- *Produce an Institute communication strategy to support Divisional strategies.*
- *Extend coverage in selected media sectors including:*
  - *Divisions of Human Nutrition and Food Processing in tabloid press and women's/family magazines*
  - *all Divisions in rural media, particularly The Land newspaper, ABC radio Country Hour and Cross Country TV program*
  - *meeting and maintaining agreed level of contributions to Australian Rural Times.*

The Institute encompasses the following Divisions:

<b>Division of Animal Health</b>	Headquarters and Animal Health 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
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**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

The Institute Headquarters is at North Ryde, NSW.

**INSTITUTE OF ANIMAL PRODUCTION AND PROCESSING**

**SUMMARY OF RESOURCES**

**(estimates as at 16 May 1990)**

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
<b>Animal Health</b>	<b>104.4</b>	<b>360.9</b>	<b>16,744.0</b>		<b>16,744.0</b>	<b>6,259.0</b>	<b>23,003.0</b>
<b>Animal Production</b>	<b>106.3</b>	<b>291.9</b>	<b>8,905.0</b>		<b>8,905.0</b>	<b>6,405.0</b>	<b>15,310.0</b>
<b>Food Processing</b>	<b>121.0</b>	<b>254.6</b>	<b>10,772.0</b>		<b>10,772.0</b>	<b>6,700.0</b>	<b>17,472.0</b>
<b>Human Nutrition</b>	<b>41.0</b>	<b>100.8</b>	<b>4,132.0</b>	<b>200.0</b>	<b>4,332.0</b>	<b>1,396.0</b>	<b>5,728.0</b>
<b>Tropical Animal Production</b>	<b>56.0</b>	<b>171.4</b>	<b>6,459.0</b>		<b>6,459.0</b>	<b>3,547.0</b>	<b>10,006.0</b>
<b>Wool Technology</b>	<b>129.1</b>	<b>358.1</b>	<b>9,966.0</b>	<b>3,300.0</b>	<b>13,266.0</b>	<b>15,295.0</b>	<b>28,561.0</b>
<b>Institute Headquarters</b>	<b>3.0</b>	<b>14.0</b>	<b>1,036.0</b>		<b>1,036.0</b>		<b>1,036.0</b>
<b>Institute Funds Management<sup>c</sup></b>	<b>6.5</b>	<b>7.6</b>	<b>2,477.0</b>		<b>2,477.0</b>		<b>2,477.0</b>
 <b>Total</b>	 <b>567.3</b>	 <b>1,559.3</b>	 <b>60,491.0</b>	 <b>3,500.0</b>	 <b>63,991.0</b>	 <b>39,602.0</b>	 <b>103,593.0</b>

**a** Staff numbers, expressed in equivalent full time units, as at 23 May 1990.

**b** Annual and Capital Appropriation includes earned appropriate revenues.

**c** Institute Funds Management covers funds administered for Divisions by Institute Headquarters.  
The main provisions are:

Sirotech	\$ 1,050,000
Biometrics Unit	\$ 455,913
Director's pool and contingency fund	\$ 250,000
Research fellows	\$ 152,117
Regional Safety Officers	\$ 144,241

## 6.1 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, and to enhance Australia's capability and preparedness to combat exotic livestock disease outbreaks.***

**Strategy**

***To exploit skills in bacteriology, virology, parasitology and toxicology, combined with modern methods in immunology, molecular biology and chemistry, to develop new diagnostic tests, sub-unit vaccines, vaccine delivery systems and disease control methods compatible with sustainable agricultural systems.***

***To collaborate with other bodies and institutions to facilitate research and to transfer this Division's research results to end-users for the benefit of the Australian community.***

***To develop a diagnostic capability and effective control methods for those exotic diseases that represent the greatest threat to Australia, and in so doing, to complement the activities of State and Commonwealth disease control authorities.***

**Specific Objectives**  
*(Percent Resources)*

**Develop vaccines and diagnostic tests to control or eradicate the economically important bacterial diseases of farm livestock, and enhance vaccine efficacy by using novel delivery systems or by manipulating host immune responses. (16%)**

**Planned Outcomes**

Negotiate a commercial agreement for a cross-protective protease vaccine against footrot in sheep.

Complete field trials in Australia and overseas for a simple and rapid blood-based test for bovine TB.

Complete field evaluation of *Pseudomonas* vaccines for controlling fleece rot/flystrike.

In collaboration with a commercial partner, evaluate a genetically-modified vaccine against *Salmonella* in sheep.

Evaluate kits for the diagnosis of Johne's disease.

Clone and express genes for protective antigens from at least one pathogen in the vaccine vector *Mycobacterium bovis* BCG, and initiate vaccine trials.

Produce sequence data for pilin genes from seven serogroups of *Moraxella bovis* for development of a vaccine against pinkeye in cattle.

Evaluate the effect of colostral factors on antibody responses in sheep and mice.

**Develop sustainable control strategies for internal parasites of sheep and cattle through better understanding of the dynamics of transmission, genetic selection for resistance to parasitism, development of efficient anti-parasite vaccines and advances in chemotherapy which minimise drug use and resistance. (20%)**

Evaluate the *in vitro* assay for field diagnosis of anthelmintic resistance in sheep parasites and finalise commercialisation agreement.

Develop DNA probes for detecting benzimidazole resistance in a single parasite.

Assess the impact of intraruminal controlled release of anthelmintics on development of resistance in the field.

Identify DNA probes for linkage analysis of loci affecting parasite resistance in merino sheep.

<b>Develop methods for preventing or treating poisoning diseases of livestock caused by naturally-occurring environmental toxins of plant and microbial origin, for reducing or eliminating tissue residues of these toxins, and for developing diagnostic tests for them. (5%)</b>	<p>Characterise repeat sequences in DNA of Trichostrongylid parasites and initiate commercial development of a diagnostic kit.</p> <p>Complete cloning and expression of antigens of two sheep parasites and evaluate their vaccine potential.</p> <p>Finalise recommendations for dosage of benzimidazoles in goats.</p> <p>Evaluate a patent option for a new anthelmintic arising out of collaboration with a pharmaceutical company.</p>
<b>Develop vaccines and diagnostic tests to control or eradicate the economically important diseases of poultry, and enhance vaccine efficacy by using novel delivery systems or by manipulating host immune responsiveness. (12%)</b>	<p>Complete negotiations for manufacture and marketing of a lupinosis vaccine and develop a prototype vaccine for field trials.</p> <p>Isolate a toxin responsible for acute Phalaris toxicity.</p> <p>Determine the specificity and affinity of a pyrrolizidine alkaloid binding agent.</p> <p>Clone and restriction map a corynetoxin detoxication gene.</p>
<b>Develop and maintain diagnostic services for exotic diseases of livestock and diseases of fish. (11%)</b>	<p>Collaborate with a commercial company to prepare a recombinant infectious bursal disease vaccine for poultry for registration trials.</p> <p>Evaluate a genetically attenuated infectious laryngotracheitis (ILT) vaccine in chickens, and construct a model recombinant vector-based vaccine using ILT virus and a fowl adenovirus vector.</p>
<b>Establish procedures for the rapid diagnosis of bluetongue, and develop carrier viruses as vectors for vaccines. (11%)</b>	<p>Determine the nucleotide sequences of four structural genes of the Victorian S strain of infectious bronchitis virus.</p> <p>Evaluate the CSIRO precocious strain of the caecal coccidiosis parasite as a vaccine in collaboration with poultry meat producers.</p> <p>Make available to industry a diagnostic immunofluorescence assay for antibodies to chicken anaemia agent and clone the genome.</p> <p>Establish bioassays for various chicken cytokines.</p>
	<p>Establish final protocols for diagnostic procedures developed to date and develop diagnostic methods for rinderpest, African swine fever, Maedi-visna, scrapie and African horse sickness.</p> <p>Extend foot-and-mouth disease research to field studies in Thailand.</p> <p>Initiate environmental pollution studies in relation to fish health.</p> <p>Use monoclonal antibodies to develop rapid serotyping procedures for bluetongue viruses (BTV) and to detect virus in individual insects.</p> <p>Generate attenuated strains of five Australian BTV serotypes and evaluate an attenuated BTV-1 vaccine. Test synthesised core proteins of BTV as antigen in diagnostic tests.</p> <p>Test recombinant fowlpox viruses carrying genes of Newcastle disease, avian influenza and infectious bronchitis viruses as vaccines in poultry.</p> <p>Construct vaccinia virus recombinants expressing BTV antigens and test in laboratory animals.</p> <p>Develop tests for cell mediated immunity to BTV in mice and test modified antigens of BTV and rotaviruses in experimental vaccine studies.</p>

<b>Develop new techniques for the diagnosis of certain animal diseases using molecular virological techniques. (12%)</b>	Assess the potential of antibodies to synthetic peptide region of Newcastle Disease virus (NDV) haemagglutinin for rapid pathotyping of virus isolates.
	Evaluate nucleotide sequence analysis and polymerase chain reaction (PCR) of NDV and avian influenza protein genes in pathotype-specific diagnosis.
	Improve bluetongue diagnosis using PCR of BTV genes.
<b>Develop and carry out tests to establish and maintain microbiological security and safety at the Australian Animal Health Laboratory, and introduce approved procedures for working with microorganisms based on risk. (13%)</b>	Standardise biological tests for validating decontamination procedures.
	Develop air filtration systems comparable in efficiency to air incineration.
	Develop the use of ionizing radiation for sterilising serum and other biologicals before removal from the Laboratory.
	Adapt gas analysis procedures for monitoring formaldehyde gas during decontamination.
	Complete a risk classification system for organisms used at AAHL and rewrite standard operating procedures to comply with this.

**Appropriation Total Allocation (includes earned appropriation revenues): \$16,744,100**

<b>Sponsored Research:</b>	\$ 6,258,900
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<b>Total Budget:</b> (excluding Aid Project expenditure incurred overseas)	\$23,003,000
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The Division expects that 27% of its total annual budget, excluding DPIE contribution to AAHL budget, will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

#### **Australian Animal Health Laboratory Budget**

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,877,100**

<b>Sponsored Research:</b>	\$ 690,000
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<b>Total Budget:</b>	\$5,567,100
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AAHL, Australia's high-security exotic disease preparedness facility, also receives a matching contribution of \$4,957,100 from the Department of Primary Industries and Energy.

#### **Armidale, Glebe, Parkville Budget**

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 6,928,900**

<b>Sponsored Research:</b>	\$ 5,569,000
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<b>Total Budget:</b>	\$12,497,900
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## **6.2 DIVISION OF ANIMAL PRODUCTION**

<b><u>Objective</u></b>
<i>To solve livestock problems of national significance, especially for the sheep industry, through research and development directed at achieving substantial and sustainable gains in livestock productivity and improved quality of derived animal products.</i>
<b><u>Strategy</u></b>
<i>Establish closer working relations with rural funding bodies to develop agreed research priorities more closely aligned with industry needs. Reorganise Program structure to meet the new priorities and to accommodate recent budget reductions.</i>
<i>Expand links with agribusiness to develop more effective commercialisation of Divisional products and a better return from them.</i>
<i>Train Program and Project Leaders in management.</i>

<b><u>Specific Objectives (Percent Resources)</u></b>	<b><u>Planned Outcomes</u></b>
<b>Evaluate and improve the nutritive value of forages and supplements to increase production efficiency and quality of animal products. (15%)</b>	<p>Adapt models of the seed dynamics of subterranean clover to include medics.</p> <p>Begin evaluation of white clover germplasm.</p> <p>Develop near-infrared analytical techniques for measuring the nutritional quality of pastures and continue work on the use of comminution energy as it relates to intake.</p> <p>Establish techniques and procedures to identify and describe the relationship between the main factors influencing diet selection in sheep.</p> <p>Further develop techniques for measuring responses in wool growth to manipulation by anabolic steroids, and seasonal responses to protein and amino acids.</p> <p>Begin work on identifying characteristics of "tender wool" obtained from farms.</p> <p>Continue building a data base on chemical constituents and calorimetric estimation of protein and energy for pasture plants in Australia.</p>
<b>Develop ruminant feed supplements that improve the quality and efficiency of feed use. (3%)</b>	<p>Further develop and continue to transfer protected supplement technology to industry.</p> <p>Establish specific parameters for the strategic use of feed supplements for ruminants of differing metabolic and physiological status.</p> <p>Develop techniques for lucerne fractionation.</p> <p>In consultation with feed and associated agricultural industries, assist in developing more efficient feed technologies for the Australian industry.</p>

**Modify the rumen microbiota to improve the efficiency of feed use and the quality of animal products. (6%)**

Develop additional chemical treatments to remove natural anaerobic fungal populations from the rumen of sheep so that they may be replaced with one or more pure strains selected for their ability to degrade plant fibre.

Prepare and test, *in vitro*, oligonucleotide probes for identifying and quantifying rumen anaerobic fungal populations *in vivo*.

Develop methods for labelling rumen microbes with specific nuclides in order to identify their contribution to protein synthesis *in vitro*.

Develop techniques for counting, sizing and fractionating the rumen microbial population for chemical analysis.

**Diagnose trace mineral deficiencies and develop technologies to reduce or eliminate the problems they cause. (9%)**

Call for licensees in other States for a sheep mineral supplement (Siromin) already licensed to four producers in WA.

Release a new formulation, Siromin-L (for lupin), that in preliminary tests has increased wool production more than lupins alone.

Establish a dose-response relationship for selenium and copper toxicity.

Test the effect of *in-utero* zinc deficiency on immunocompetence in lambs.

Identify a possible selenium-iodine interaction.

Determine quantitative mineral requirements for pregnancy in ewes.

Publish recommendations for effects of genetic and agronomic factors for selenium requirements.

**Increase the efficiency of fertilizer use for livestock production. (8%)**

Complete testing of remote sensing data based fertilizer status maps and a supporting microcomputer package in collaboration with district advisers of NSW Agriculture and Fisheries.

**Apply computer technologies to improve the nutritional management of livestock. (6%)**

Commercialise internationally, through the International Foods Information Centre, the Australian Feeds Information Centre's computer software and database.

Release in Australia a commercial version of AUSPIG, a computer software package to improve the management and productivity of pig producers, and to work with the overseas licensee towards its international release.

**Integrate genetic and physiological data to improve selection criteria and to develop breeding programs to improve efficiency and product quality. (17%)**

Negotiate overseas sales of the Division's unique poultry layer lines.

Complete the commercial evaluation of the "F" gene in meat sheep.

Offer the SIROMEAT terminal sire meat sheep and the high twinning cattle herd for sale.

Analyse the economic significance of fibre diameter variability for wool selection programs.

Establish a fine wool flock to estimate genetic parameters and design appropriate breeding programs.

Begin the analysis of accumulated data on behavioural and other perinatal traits in newborn lambs to develop improved selection criteria for lamb survival.

**Develop controlled release devices for administering bio-active materials to ruminants. (3%)**

Patent new controlled-release capsule technology and discuss several new product developments with licensees.

**Study the pattern and control of wool and hair follicle development in skin. (12%)**

Isolate and culture cell populations from the developing wool follicle and study the effects of specific growth factors on cell proliferation and differentiation.

Identify the patterns of gene transcription in the developing wool follicle using probes for growth factors and known proto-oncogenes.

Test theories of follicle morphogenesis and function through studies of mitotic rates in the follicle bulb and fibre composition.

Review the role of pineal hormones and prolactin in controlling seasonal effects on wool growth.

Field test promising agents for non-surgical mulesing in different breeds, strains and environments.

Continue the transfer to industry of biological wool harvesting technology, based on epidermal growth factor (EGF) or its analogues.

**Develop new methods for the genetic improvement of livestock. (9%)**

Determine the effects of new growth hormone fusion genes in mice and sheep.

Test new genes for cysteine biosynthesis, with higher levels of expression, in mice, and micro-inject into sheep.

Transfer the genes encoding the glyoxylate cycle into mice and evaluate. Transfer to sheep if preliminary mouse data look encouraging.

Study expression of a wool keratin type 1 gene and fusion genes containing keratin promoters and various coding sequences in transgenic mice.

**Develop vaccines for enhancing body and wool growth, reproductive potential and quality of meat and fibre. (12%)**

Register a commercial vaccine for regulating sexual activity in cattle, developed in collaboration with the Division of Tropical Animal Production and commercial partners.

Complete development of a technology for micro-encapsulation, necessary for single dose vaccines, and begin biological evaluation.

Complete characterisation of polyelectrolyte adjuvants identified as promising.

Select a commercial partner for Multivac, a new multi-steroid based vaccine to increase fecundity in sheep, especially Merinos.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 8,904,500**

**Sponsored Research: \$ 6,404,700**

**Total Budget: \$15,309,200**

The Division expects that 40% of the total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

**Capital Works:** \$5.81M for new laboratory building at Pastoral Research Laboratory, Armidale, to house staff from the Divisions of Animal Production and Animal Health, funded by the Australian Wool Corporation. \$4.77M for new laboratory building at Ian Clunies Ross Laboratory, Prospect, funded by the Australian Wool Corporation.

### **6.3 DIVISION OF FOOD PROCESSING**

**Objective**

***To develop ways to handle and process foods with improved efficiency, quality and safety, particularly to facilitate export of value-added products.***

**Strategy**

***To extend knowledge of the chemical, physical, sensory and nutritional properties of foods and their components and apply this to the development of new packaging, processing and control technologies for the generation of high quality products, especially for specific export markets.***

**Specific Objectives**  
*(Percent Resources)*

**Planned Outcomes**

**Improve the efficiency of converting livestock to meat. (15%)**

Finalise negotiations for commercialising new slaughtering and dressing technology.

Complete and partially evaluate an experimental semi-automated deboning rig.

Begin evaluation of vision sensing as an aid to meatworks operations.

Enhance the utility of mathematical models for meat chilling.

**Improve knowledge of the structure, chemistry and biology of muscle and its components to enable better exploitation of meat. (4%)**

Characterise and identify distribution of pyridinoline crosslinks in meat collagen.

Further define factors in post-mortem muscle that are important in specialised meat products.

Complete assessment of the value of immunological control of fattening in ruminants.

**Improve the quality, especially for export, of Australian meats. (6%)**

Establish commercial effectiveness of carcass decontamination.

Establish the status of meat in respect of pathogenic bacteria.

Finalise quality comparisons between grass and grain-fed beef.

Finalise protocols that will allow all chilled meats to be exported to all world markets.

Establish priorities for a major new program of pigmeat research.

**Improve the quality of meat products and devise new types of products based on meat. (5%)**

Conduct pilot-scale trials on producing foods based on isolated mutton protein.

Develop to commercial utility one shelf-stable meat product.

**Develop technologies for the manufacture of new fermented dairy products. (9%)**

Identify factors affecting texture in dairy foods made from fermented retentates.

Stabilise genetic modifications in starter bacteria.

Final commissioning of Sirocure installation in the USA.

Determine flavour component lacking in low-fat cheese.

**Isolate milk components with unique functionality and high market value. (10%)**

Finalise conditions for commercial production of whey protein isolate.

Develop (to large scale) techniques for the isolation of casein-derived peptide.

Prepare casein sub-fractions through physiochemical and enzymatic modifications.

**Develop novel food processing and packaging technologies, and improved transport of foods; and isolate value-added proteins from primary products, with emphasis on export. (15%)**

Establish Phase 1 new facilities for National Centre for Food Processing and Packaging.

Begin mathematical modelling of the operation of the spinning cone column fractionation system.

Establish microprocessor control research program.

Establish plastic film lamination system and apply to development of novel food packaging films to remove ethylene and oxygen and maintain sulphur dioxide levels in packages.

Begin study of performance of shipping containers and packaging in export shipments of meats.

Produce a model for product temperature distribution in refrigerated freight containers.

Establish pilot plant for isolation, by novel absorption-desorption technologies, of egg proteins.

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

Establish the Sensory Research Centre – Japan Project.

Measure the temporal basis of odour mixture perception in humans and animals.

Identify relationships between odour stimulation and glandular secretions in the nose.

Continue the isolation and identification of natural cooked-food flavours and identify the chemical basis of formation of these flavours.

Provide an investigative service to industry to identify off-flavours and taints in foods.

Develop prototypes of sensors applicable to food processing, biomedicine and detection of environmental pollution.

**Ensure the microbiological safety of foods, prevent microbial spoilage of foods, determine the functional properties of dietary fibre in nutrition, devise means to lower serum cholesterol in humans, and develop plant cell culture technology to produce food components. (11%)**

Establish relative behaviours of *Yersinia*, *Listeria* and *Aeromonas* in air and high CO<sub>2</sub> atmospheres.

Develop microbiological standards for modified atmosphere packages.

Complete studies on factors affecting growth of *Aspergillus flavus* and related organisms and the production of aflatoxins in Australian peanuts.

Complete survey of major spoilage and toxigenic fungi and significant mycotoxins in grains in Thailand and China.

Expand range of dietary fibres for which nutritional performance is documented.

Develop methods for selectively removing cholesterol from foods during processing.

Isolate lupin fibre, characterise it chemically and determine its fermentability *in vitro* and *in vivo*.

Scale up of plant cell culture technology to 1000 litre size.

**Transfer information and technology to consumers, the food industry and relevant Government bodies. (9%)**

Expand range of services provided by the only national facility for technology and information transfer to the meat processing industry.

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

**Appropriation Total Allocation (includes earned appropriation revenues): \$10,771,600**

**Sponsored Research:** \$ 6,700,400

**Total Budget:** \$17,472,000

The Division expects that 37% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 6.4 DIVISION OF HUMAN NUTRITION

**Objective**

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

**Strategy**

***To develop an understanding of those nutrition-related disorders that account for the greatest morbidity and mortality within the Australian community; to encourage and actively collaborate with the food and health care industries to produce novel foods and therapeutic agents; to define the factors that lead to optimal growth and development; to conduct national surveys of the patterns of food consumption; to develop techniques for increasing nutritional knowledge in the community.***

**Specific Objectives**  
(Percent Resources)

**Planned Outcomes**

**Develop nutritional strategies for the prevention of cardiovascular diseases (coronary heart disease and hypertension) which will include the development with industry of fat-modified and fibre-enriched foods. (11%)**

Test mixtures of edible oils for "cholesterol neutrality".

Compare new sources of fish oils and fish for optimising cardiovascular risk.

Establish benefits of new cereal products.

Establish cholesterol-lowering potential of new drugs versus optimal diet.

**Isolate, synthesize and test specific growth factors (IGF) for the treatment of disorders of catabolism and for their manufacture as cell culture ingredients. (23%)**

Test naturally occurring and synthetic peptides for biological efficacy in appropriate animal models.

Develop recombinant technology to synthesize substantial amounts of these peptides.

Expand commercialization of growth factors as cell culture ingredients.

**Improve the management of hypertension by defining the influence of nutrients on the development of hypertension, and identify new pharmacologically-active agents. (19%)**

Test combinations of interactive nutrients, sodium and specific fatty acids for anti-hypertensive effects.

Establish telemetry system for *in vivo* monitoring of cardiovascular haemodynamic response to blood pressure-lowering interventions.

**Monitor the nutritional and related health status of Australians and survey the psychosocial and behavioural determinants which give rise to patterns of eating and selection of food products. (10%)**

Undertake two major surveys of food and nutrient intakes as part of the Division's continuing surveillance of the Australian population.

Begin a long term study of the nutritional strategy and eating behaviour of the elderly.

Complete two nutrition education programs in specific community groups.

Start a major intervention study with antioxidants in precancerous disorders of women.

**Prevent, through dietary factors, formation of cancers, including some which are occupation-related. (13%)**

Complete development of specific techniques to provide an accurate assessment of mutagenic risk in humans.

Undertake two studies on the benefits of vitamins/antioxidants for preventing irradiation damage.

**Prevent sudden cardiac death (secondary to arrhythmia) and myocardial infarction by optimising dietary factors. (13%)**

Test further sources of plant, marine and animal fatty acids for their capacity to prevent cardiac arrhythmia.

Develop an experimental model to test the benefit of specific dietary fatty acids in preserving myocardial function during blood flow deprivation.

**Collaborate with food industry to develop appropriate fibre-rich products in order to maximise the health benefits of dietary fibre. (8%)**

Complete the development of methods for comprehensive analysis of cereal constituents.

Test the effects on nutritional potential of various processing techniques for grain products.

Test the individual constituents of several grains (oats, rice, barley) for their effects on cholesterol metabolism and bowel function.

**Reduce the development of obesity by demonstrating the nature of energy metabolism in those prone to overweight. (3%)**

Complete studies of energy metabolism in subjects with apparent differences in energy utilization.

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,332,000**

**Sponsored Research: \$1,395,900**

**Total Budget: \$5,728,100**

**Appropriation Capital: \$ 200,000**

The Division expects that 24% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **6.5 DIVISION OF TROPICAL ANIMAL PRODUCTION**

**Objective**

*To increase the efficiency of production of grazing livestock, particularly beef cattle, in tropical areas of Australia.*

**Strategy**

*To develop and apply new scientific principles and technologies for:*

- . *reducing or eliminating disease and parasite stress by developing safe, stable and environmentally–benign vaccines;*
- . *alleviating nutritional stress by more efficient utilisation of wet and dry season forages, using a variety of disciplines including microbiology and molecular biology; and*
- . *increasing reproduction and growth rate by the manipulation of metabolic and hormonal pathways and the genetic composition of animals.*

**Specific Objectives**  
(Percent Resources)

**Planned Outcomes**

**Produce effective sub-unit vaccines against ephemeral fever and other arboviruses. (11%)**

Express the G protein of bovine ephemeral fever virus in *E. coli* and another system.

Represent CSIRO on the Bluetongue Coordination Committee.

Mount a bluetongue surveillance program using light traps to collect vectors at 40 sites in Queensland and NSW.

**Produce non-living vaccines against ticks and tick toxins, babesiosis and anaplasmosis, and maintain chemical control of ticks. (32%)**

In collaboration with the commercial partner, continue field trials of a cattle tick vaccine based on the Bm86 antigen isolated from cattle tick.

Purify and sequence an alternative protective antigen from cattle tick.

Progress the purification of two further antigens by conducting two large-scale fractionation trials in cattle.

Begin evaluation of a Phase II *Babesia bovis* vaccine in large-scale pen and field trials.

Undertake pen trials of single and "cocktail" vaccines against *Anaplasma*.

Fully sequence the toxin of the Australian paralysis tick: produce a diagnostic probe, and produce and screen a putative immunogen.

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

**Produce vaccines against the larvae of the sheep blowfly and the adult stages of the buffalo fly. (11%)**

Establish a total life-cycle assay system for sheep blowfly, complete studies on pore sizes of peritrophic membranes, and partially purify a protective antigen.

Identify partially purified fractions of protective antigen from buffalo fly, initiate field trials using native antigen, assess larvae as an antigen source.

Establish cDNA and genomic libraries for sheep blowfly and buffalo fly, and screen the libraries with appropriate antibody.

**Develop advanced selection technology for beef cattle that takes into account resistance to environmental stresses. (4%)**

Using data produced to date in the ten-year (1984–1994) program of experiments on selection for weight gain, reproduction, feed intake and heat tolerance, quantitatively evaluate initial concepts of alternative selection strategies for tropical beef cattle with genetic simulation models.

**Develop molecular genetic techniques for improved livestock breeding. (7%)**

Characterize the DNA sequence for the Pompe's disease gene mutation as a basis for a test for carrier animals.

Screen new markers for the Booroola fertility gene in sheep, and 20 markers for the polled gene in cattle.

Develop a primary bovine gene map and continue work to establish 50 new gene locations.

**Exploit the phenomenon of hybrid vigour to produce cattle more suited to the tropics and sub-tropics than those currently available. (4%)**

Use embryo transfer to multiply the newly-imported Boran and Tuli cattle.

**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. (6%)**

Field test the value of the GnRF formulation that induces ovulation in post-partum cows.

Complete registration trials with the first-generation GnRF vaccine in cull cows, test improved formulations of the GnRF vaccine, including a solid vaccine implant, and determine the potential of a GnRF analogue that shows promise of controlled, reversible suppression of fertility.

Test prepubertal gonadal steroid immunisation for its ability to increase reproductive characteristics in both bulls and heifers.

**Manipulate the metabolic processes associated with weight change in cattle grazing pastures that vary markedly in quality and quantity. (12%)**

Analyse the receptor activity of the  $\beta$ -agonist clenbuterol, which is known to increase protein accretion.

Development a technique to determine the density of  $\alpha$  and  $\beta$ -catecholamine receptors.

Define the mechanisms of an  $\alpha_2$ -agonist known to reduce dry season weight loss with a view to developing a commercial application.

Test the efficacy in cattle of a new compound that does not affect metabolic rate but increases protein accretion, and conduct field tests of trenbolone acetate to reduce dry season weight loss.

**Develop techniques to achieve better reproduction and growth in northern cattle and sheep through dietary manipulation and improved use of forages. (11%)**

Complete the comparative evaluation of efficiency of rumen fermentation of cattle and buffaloes.

Begin search for a capability of lignin breakdown within the rumen microflora.

Test the effectiveness of acute supplementation in re-establishing oestrus cycling post-partum in underweight lactating cows.

Establish a system to evaluate the supplement quality and amount needed for economic growth of early-weaned calves on pastures of various qualities.

Evaluate the economic benefit of legumes in pastures in NW Queensland in terms of wool production, and (in pen trials) economics of supplementing Mitchell grass diets with *Acacia nilotica* leaf and pod.

Assist QDPI to transfer supplementary feeding technology to producers.

**Generalise and extend existing vaccine technologies and develop new methods of control, prevention and detection of parasitic diseases. (2%)**

Purify the protease antigen of *Babesia*, clone and characterise the 12D3 binding protein cDNA, and determine the subcellular location of 12D3, as steps towards establishing the relationship between function and protective antigenicity.

In the use of bovine ephemeral fever (BEF) virus as a model to develop applications of ribozymes as anti-viral agents, identify sequences of BEF RNA that can be targeted by ribozymes, construct appropriate ribozymes and test them *in vitro* for their ability to cleave BEF RNA.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 6,458,900**

**Sponsored Research:** \$ 3,547,100

**Total Budget:** \$10,006,000

The Division expects that 34% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 6.6 DIVISION OF WOOL TECHNOLOGY

<p style="text-align: center;"><b><u>Objective</u></b></p> <p><b><i>To increase worldwide demand for Australian wool, wool products, hides, skins and leather.</i></b></p> <p style="text-align: center;"><b><u>Strategy</u></b></p> <p><b><i>To develop new and innovative products and to enhance the appeal and performance of existing products. To apply new techniques and measurement systems to reduce costs of marketing, processing and manufacture and, where practicable, to promote their adoption in Australia.</i></b></p>
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<b><u>Specific Objectives (Percent Resources)</u></b>	<b><u>Planned Outcomes</u></b>
<b>Develop technology and other knowledge aimed at increasing consumer demand for products made from Australian wool. (38%)</b>	Enhance the bulk of wool knitting yarns by strain-release and differential contraction mechanisms.  Define yarn structures to alleviate weaving faults using fine yarns.  Identify the important textile properties that influence perception of fabric texture by consumers.  Demonstrate the superior comfort properties of wool fabrics and garments.  Demonstrate the influence of fabric finishing on the mechanical properties of wool fabrics.  Demonstrate the significance of fabric mechanical properties for garment manufacture and appearance.  Complete laboratory tests on newly-developed stainblocking agents.  Isolate experimental quantities of ortho and para cortical cells and determine distinguishing properties.  Complete evaluation of surface active agents and modified natural products for mothproofing.  Complete the isolation and purification of cysteine lyase from <i>T. bisselliella</i> . Identify alternative reductive systems in the digestive tract of wool-consuming larvae.  Develop and validate instrumentation for further objective appraisal of wool fabrics (wrinkling, abrasion, prickle, hairiness).  Apply jet printing technology to the colouration of yarn.
<b>Improve the efficiency of conversion of raw wool to end products. (37%)</b>	Complete feasibility study of new method of on-line conditioning of fabrics during finishing.  Determine if existing lubricants and additives have a significant effect on spinning performance independent of their effect on carding.  With the Australian Wool Corporation, complete a study of the effects of high-density pressing of exported wool on the efficiency of subsequent mechanical processing.

- Develop new or improved processes for the handling, marketing, preservation and conversion of hides and skins into leather products. (8%)**
- Design and build equipment for the use of cotton waste modified by surface active polyamines for the removal of chromium-containing dyes from effluent.
  - Determine the effect of several microbial enzymes on wool grease and wool scour effluents.
  - Develop a procedure for impregnating merino skins with polyacrylate polymers.
  - Develop protocols for the objective assessment of woolly sheep and lamb skins.
  - Complete a cost benefit analysis of the Siroskin process.
  - Develop a commercially acceptable tanning system based on the complexing of aluminium compounds.
- Develop and implement techniques to completely specify raw and semi-processed wool so as to enable the introduction of marketing wool by description (Sale by Description) and the prediction of processing performance. (14%)**
- Complete field trials of the Computer Aided Value System (CAVS) for wool marketing.
  - Review current and commercial test procedures for fibre diameter of raw wool and prepare a research plan for development of an improved test method.
  - Complete development of techniques for the objective measurement of visual characteristics of wool staples related to style and type.
- Develop new or improved textile filter media, filtration processes and related instrumentation for the benefit of Australian industries. (3%)**
- Develop a prototype image analysis instrument for the maintenance of quality in the production of foam-coated filter fabrics.
  - Extend the lifetime of power station fabric filters from the present 24,000 hours to 30,000 hours.
- Apply new techniques and measurement systems arising from research to reduce costs of marketing, processing and manufacture of Australian wool, hides, skin and leather. (3%)**
- Complete industry trials to relate fabric finishing procedures to garment performance.
  - Complete trials on low temperature dyeing with a commercial partner, and assist product introduction.
  - Complete commercialisation of a dyebath antisetting agent.
  - Complete trials on improved antipilling technology in association with the IWS.
  - Commence industrial trials of a new environmentally safe method for shrinkresisting wool slivers.
  - Complete commercial negotiations relating to the establishment in Australia of a wool grease refining plant based on CSIRO technology for producing pesticide-free lanolin.
  - Complete the pilot commercialisation of the FAST instruments (Fabric Assessment by Simple Testing).
  - Build and install in an Australian Mill a prototype strong flow biological reactor for treating wool scouring effluent.
  - Complete the design for the first CSIRO high-speed card in collaboration with a machinery manufacturer and an Australian producer.
  - Install prototype machine for removing coloured contaminants from scoured wool in an Australian Mill.

Complete initial commercial trials of a newly-developed instrument which enables carpetlaying conditions to be specified and subsequently checked *in situ*.

Transfer to industry a process using surface active polyamines in the low temperature dyeing of wool fabrics and for fabric preparation for printing.

Complete industry trials on aspects of commercial testing of staple length for particular wool types.

Conduct an industry workshop on specification of carding wools.

Complete industrial trials on the conversion of cattle hides to commercially acceptable wet-blue leather in 24 hours or less.

Establish a commercial use for waste hair from the Sirolime process.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 9,524,000**

**Sponsored Research:** \$13,265,700

**Total Budget:** \$28,561,000

**Appropriation Capital:** \$ 3,300,000

The Division expects that 60% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues), primarily from the Wool Research and Development Fund, based on estimates as at 16 May 1990.

## **7. INSTITUTE OF PLANT PRODUCTION AND PROCESSING**

### **Objective**

*To benefit Australia through research which improves and sustains the productivity and the profitability of industries based on field crops, pastures, horticulture and forests, and improves knowledge of Australia's soils, plants and insects.*

### **Strategy**

*The Institute's key strategies are to*

- . Give priority to research that either enhances exports or results in import replacement.*
- . Maintain a critical level of effort in areas of basic science and encourage and strengthen areas of generic science and technology, especially molecular biology.*
- . Improve product quality, specification, packaging and storage to meet market needs and preferences.*
- . Foster diversification by developing products with good market potential.*
- . Focus processing research on adding value in ways that will benefit Australia.*
- . Develop practices and systems which result in efficient sustainable production.*
- . Examine the impact of changing atmospheric composition and climate on the production of field crops, sown pastures, horticultural crops and forests.*
- . Develop practices that minimise use and effects of harmful chemicals and reduce contaminants in plant foods, animal feeds, wool and the environment.*
- . Restructure and revitalise CSIRO temperate and Mediterranean pasture research with a focused strategic input from CSIRO and an increased proportion of tactical research financed by industry.*
- . Undertake more systematic appraisal of research proposals and evaluate regularly the benefits accruing from research.*
- . Undertake national responsibilities for the National Herbaria, the Australian National Insect Collection, plant genetic resources, soil classification and bushfire 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.*

**Specific Activities**

- *Manage inter-Divisional land and water care program in collaboration with the Institute of Natural Resources and Environment.*
- *Manage bio-control program to develop non-chemical methods of pest and disease control with particular emphasis on reducing use of pesticides and examining the environmental impact of their use.*
- *Manage gene shears program and develop process to enhance the application of molecular biology skills.*
- *Develop research proposals to examine the potential impact of climate change on the production of field crops, shown pastures, horticultural crops and forests.*
- *Evaluate current decision support models for nitrogen and water balance with a view to developing generic software kernels.*
- *Develop collaborative proposals on ornamental and post-harvest horticulture.*
- *Develop inter-Divisional proposal to examine the fate of chemicals used in farming.*
- *Develop an inter-institutional program for the conduct of research and development aimed at declining fertility of cultivated soils and declining productivity of sown pastures.*
- *Develop inter-Divisional proposal on biodiversity and systematics.*
- *Further develop inter-Divisional program on acidification of soils.*
- *Develop project costing practices to reflect the true costs of research and participate in developing practices which separate employment conditions from funding sources.*

The Institute of Plant Production and Processing encompasses the following Divisions and Units.

**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  
 Biological Control Unit, Mexico  
 Biological Control Unit, South Africa  
 Screw-worm Fly Unit, New Guinea

**Division of Forestry and Forest Products**

Headquarters, Clayton, VIC  
 Highett Laboratories, Highett, VIC  
 Yarralumla, ACT  
 Queensland Forest Research Group, St Lucia, QLD  
 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  
 Wheat Research Unit, 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  
 Katherine Research Station, NT

The Institute Headquarters is at Canberra, ACT

## INSTITUTE OF PLANT PRODUCTION AND PROCESSING

SUMMARY OF RESOURCES 1990-91

(estimates as at 16 May 1990)

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
Entomology	111.6	288.0	12,486.0		12,486.0	8,000.00	20,486.0
Forestry and Forest Products	128.7	274.7	13,304.0	2,300.0	15,604.0	4,700.0	20,304.0
Horticulture	42.1	91.6	4,846.0		4,846.0	1,126.0	5,972.0
Plant Industry	165.7	422.9	19,092.0		19,092.0	7,834.0	26,926.0
Soils	81.3	170.0	9,049.0		9,049.0	1,350.0	10,399.0
Tropical Crops and Pastures	74.1	226.1	11,631.0		11,631.0	4,000.0	15,631.0
Institute Office	4.0	10.0	880.0		880.0		880.0
Other Institute <sup>c</sup>			3,342.0		3,342.0		3,342.0
Total	607.5	1,483.3	74,630.0	2,300.0	76,930.0	27,010.0	103,940.0

a Staff numbers, expressed in equivalent full time units, as at 23 May 1990 (site staff included against Entomology and Plant Industry).

b Annual and Capital Appropriation includes earned appropriation revenues.

c Includes \$0.580M administered on behalf of all Institutes (CABI)  
Includes \$1.572M administered on behalf of Divisions.

## 7.1 DIVISION OF ENTOMOLOGY

### **Objective**

***To devise ways of controlling insect and related pests of crops, crop products, livestock and humans, and to understand the role 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 identify biological control opportunities for weeds and pests, 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, and insect and plant pathogens. It also seeks to provide information on biodiversity and degradation in the natural environment through preparation and use of a physical and computer database of the Australian insect fauna and its distribution. The Division achieves its objectives partly through collaboration with industrial partners, universities, state and federal organisations and international and aid organisations, and partly by carrying out directly funded research in the national interest.*

### **Specific Objectives** (Percent Resources)

**Study insects and certain other arthropod pests of crop, pasture and plantation ecosystems and insects that damage trees, timber and building materials in order to improve our understanding of their biology, ecology, behaviour and, hence, potential control by natural enemies and other non-chemical methods. Develop management strategies that minimise the use of insecticides so as to reduce both the environmental impact and overall costs of control. (16%)**

**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. (15%)**

### **Planned Outcomes**

Introduce into quarantine and carry out specificity testing of potential biocontrol agents for cereal aphids, fruit piercing moths and pestiferous snails.

Start a program in WA to study the resistance mechanisms of pasture legumes to red-legged earth mites.

Study the population dynamics and levels of pyrethroid resistance of *Heliothis* (*Helicoverpa*) breeding on native plants in inland areas of New South Wales and Queensland as part of new initiatives.

Examine the efficacy of the fungus *Metarrhizium* and other possible biocontrol agents of termites as part of a broad initiative to find alternatives to organochlorines for termite control.

Continue development of strategies for biological control of skeleton weed, common heliotrope, nodding thistle, slender thistle, scotch and related thistles, soursoab and St John's wort.

Continue to develop strategies for biocontrol of weeds of conservation importance including mimosa, sida, Bitou bush and certain aquatic weeds.

Maintain the high security quarantine facility in Canberra as the primary quarantine for the introduction of pathogens or agents with special requirements.

Develop the Montpellier laboratory as a more versatile research base in Europe for initial testing and assessment of control agents for insect pests and weeds of European origin.

**Develop well-based, efficient pest and commodity management strategies for stored grain and similar products. (15%)**

Complete commercial agreements with industrial partners on Siroflo, retentive carriers for insecticides, transportable fluid bed grain driers and development of new fumigants.

Promulgate the information contained in the "Aeration Manual" and ensure major grain storage organisations in Australia are aware of how to use aeration optimally.

Complete commercial scale proving trials on the Sirofume phosphine fumigation process.

Carry out further trials to gather data on receipt of wheat at moistures higher than currently accepted safe limits.

Carry out proving trials on propane-burning and membrane systems for inert atmosphere generation in conjunction with our commercial partners.

Complete a predictive functional model of sorption/desorption of fumigants, including determination of the numerical values of controlling parameters.

**Develop environmentally sound technologies for pest control as adjuncts or alternatives to chemical pesticides, especially by means of behaviour-modifying chemicals and insect pathogens. (10%)**

Establish and monitor field experiments using candidate strains of *Metarhizium* to control scarabs in peanuts and potatoes.

In collaboration with Chinese scientists develop the use of dry media for rearing, inoculation of trays with liquid cultured entomopathogenic nematodes, and the use of freeze-dried bacteria.

Continue to assist our commercial partner to develop a successful nematode-based bioinsecticide.

Identify the major factors in soil affecting nematode abundance and develop strategies to improve longevity. Improve the field efficacy of inundatively released nematodes.

Determine the best strains of nematodes for control of banana weevil in NSW and Tonga and optimise application technology.

Identify the chemical, physical and behavioural factors which limit the effectiveness of pheromone control of codling moth in apple orchards and evaluate in the laboratory and field ways of overcoming these limitations.

**Document, describe and improve our knowledge of Australia's insect and mite fauna with special emphasis on those groups that are of economic, social, scientific, or environmental importance. (10%)**

Encourage conservation authorities to make greater use of insect data in environmental management through publicity and marketing.

Complete preliminary studies of insects on Australia's island territories and in the Tasmanian World Heritage area. Produce first report on insect diversity in rainforests in Cape York Peninsula.

Provide systematic information on insects useful in water quality assessment (Elmidae, Chironomidae) and native grasslands (Castniidae).

Complete rearrangement of the Australian National Insect Collection and establish a computer database of collection records aimed at showing, in particular, species distribution and diversity patterns.

Complete improved version and implement marketing of computer program for interactive identification of biological specimens.

Develop computer imaging in taxonomic illustrations.

Seek funding for and commence study on taxonomy on Australian heliothine moths.

Publish major studies on systematics of insect groups containing economically and environmentally important species (click beetles, dragonflies, ants, aphids, grasshoppers, tineids and weevils).

Publish a revised and expanded 'Insects of Australia' – a major international test.

**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. (12%)**

As part of the progress towards enhanced management of insects by developing and exploiting generic technologies for the transfer of genes or gene products into insect species, determine if the mobile P element or *hobo* systems can function in *Lucilia cuprina*, construct plasmid vectors to transfer foreign genes into the wild-type *Helicoverpa* baculovirus (HeNPV) genome, and isolate the spherulin gene and its promoter from a lepidopteran entomopox virus.

Isolate, characterise and exploit genes encoding proteinaceous insecticides or behaviour modifiers, or that contribute to insects' resistance to insecticides, and, in particular, identify toxin copy-DNA in a *Microbracon hebetor* copy-DNA library for cloning into the HeNPV, purify and characterise Esterase-3 and E<sub>m</sub> (insecticide resistance) proteins, and purify the mating receptivity inhibiting peptide of *Lucilia cuprina*. Survey the tissue and stage specific expression of juvenile hormone (JH111) and prepare cDNA libraries from appropriate tissues/stages.

Determine taxonomic relationships in entomopathogenic bacteria associated with nematodes.

Test the role of the DNA invertase in phase variation in the bacterium, *Xenorhabdus nematophilus* as part of the work towards development of effective bacterial insecticides.

**Develop strategies for the eradication or control of insects and related arthropod pests of livestock and man, that are either in Australia or threaten to enter the country. (16%)**

Evaluate genetic suppression techniques for control of sheep blowfly populations on the Furneaux group of islands. Develop management model to minimise insecticide usage in controlling flystrike in sheep.

Crop and redistribute exotic dung beetles in south eastern Australia to facilitate their establishment, enhance bush fly control and promote dung burial. Assess impact of dung beetles on bush fly abundance.

Commence with Division of Soils an evaluation of the importance of earthworms for sustainable agriculture.

Develop a suitable trap for control of buffalo fly breeding facility to enable genetic control of this pest in the event of it reaching Australia.

Collaborate with CAB International to produce a database of medical, agricultural and veterinary pests and the risks they pose if introduced to Commonwealth countries.

**Appropriation Total Allocation (includes earned appropriation revenues): \$12,486,000**

**Sponsored Research: \$ 8,000,000**

**Total Budget: \$20,486,000**

The Division expects that 39.7% of its total annual budget will be spent from external funds in 1990–91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **7.2 DIVISION OF FORESTRY AND FOREST PRODUCTS**

**Objectives**

***To benefit Australia by sustaining forests, improving yields and increasing the quality and value of forest products.***

**Strategy**

*The Division works closely with forest growers and forest-based industries in conducting research, primarily in Australia, to develop:*

- . Improved tree-breeding, silviculture and forest management.
- . Improved techniques for the control of fire and biological damage to forests.
- . Increased profitability through efficient use of wood resources and technologies for new products and processes.
- . Environmentally improved practices and processes.

**Specific Objectives**  
*(Percent Resources)*

**Develop strategies for high and sustainable yield and improving wood quality of *Pinus radiata* by understanding key biological processes especially concerning genetic manipulation, and nutrient and water availability in soils. (15%)**

**Planned Outcomes**

Further progress in the second phase of a major industry-sponsored project on the dynamics of organic matter and nitrogen between crop rotations of radiata pine. Test the validity and applicability of results to Gippsland region.

Pursue the new lead obtained from completed work that a better understanding of the process influencing the allocation of carbon to stem may lead to an index of early selection criteria.

Further progress in studies on (1) the effects of silvicultural treatments on fundamental wood properties and (2) quantitative description of the genetic parameters for wood and pulp traits.

Develop a Hybrid model and production functions for integrating a process based model and traditional regression models for improving the estimation of yield from plantations.

**Evaluate the multipurpose potential of Australia's tree flora and its genetic diversity and supply seed for research for national and international afforestation programs. (15%)**

Assess the utility of hypervariable probes from other organisms for identifying clones of *Pinus radiata*, and seek such probes in the pine itself. Plan project for linkage mapping in *Pinus radiata*.

Develop research projects for reforestation of tropical grasslands.

Collaborate with the Queensland Department of Forestry in the establishment of seed orchards of *Acacia mangium* and *Eucalyptus urophylla*.

Collate last two decades of research on essential oils in a book, and determine genetic parameters of oil yields in *Eucalyptus camaldulensis*.

**Describe key biological processes, such as microbial interactions, nutrient dynamics and stand development, relevant to sustained wood production in native forests. (14%)**

Complete the establishment phase of the current field testing program with an industrial partner and measure growth of trees inoculated with a range of mycorrhizal fungi. Initiate research on the histology and fine structure of responses of trees inoculated with compatible and incompatible fungal strains.

Further develop the means for the genetic manipulation of ectomycorrhizal fungi at the level of the nucleus, and initiate the development of a transformation system for manipulation of DNA fragments.

As part of the collaborative programme with the Department of Conservation and Lands, complete harvesting of wounded trees and measure the volume of defective wood resulting from treatments. Continue the study of fungal colonisation and relate to tree health and wood condition.

Complete a study of the coppicing capacity of selected East Gippsland eucalypt species.

**Develop strategies for intensive management of eucalypts in temperate regrowth forests and plantations, based on understanding of genetic diversity and ecophysiology, and stand development and forest operations. (15%)**

Plan and implement a major strategic trial aimed at nutritional management of eucalypts in plantations. Establish 80 ha of operational plantation on ex-agricultural land; continue intensive management of related plantation on native forest site. Continue writing up Esperance project.

The comparative frost tolerance of *E. Globulus*, *E. nitens* and their hybrids will be assessed and their field performance will be evaluated in Tasmania, Victoria and Western Australia during the winter of 1990.

An experimental eucalypt breeding arboretum will be established in Tasmania. This will contribute to ongoing evaluations of planting stock options for intensive management of seed production in commercial eucalypt species.

Studies on the heritability of insect defoliation in *E. nitens* and *E. regnans* will be strengthened through collaborative research with University of Tasmania.

**Develop production systems for high yielding plantations of sub-tropical eucalypts, especially *Eucalyptus grandis* based particularly on an understanding of the ecophysiology of the species. (6%)**

The detailed studies on the ecophysiology and productivity of *Eucalyptus grandis* plantation in Queensland will be completed and efforts concentrated on interpretation and writing up of results. Prepare final report for SHELL subject to the outcome of a proposal (in collaboration with TC&P) submitted to AMLRDC initiate the phase II of STAG project which will study the interaction between trees, grass and livestock production.

**Improve the prediction of bushfire behaviour in important fuel types – determine the damage done and provide an efficient system of extending fire danger information. (4%)**

Analyse and report on March 1990 experiments in regrowth forests. Plan and undertake further experiments in 1991.

Seek support from N.T. Bushfire authorities to extend and adjust the grassland fire spread models to open woodlands and forests with a grassy understorey.

Review methods of drought estimations and its relations to forest fuel moisture content, the behaviour of forest fires and the damage they do to forest crop.

Evaluate operational trials of fire spread models. Develop expert systems to assist fire fighters with operational decision making.

Complete joint studies with the environment research unit of work safe Australia on the physiological stresses of bushfire fighting.

**Improve the efficiency of the Australian timber and wood products industry. (15%)**

Improve technology for harvesting, grading and drying timber to obtain increased yields and maximise value adding from both regrowth and old growth resource.

Investigate the basic characteristics and properties of wood, with special reference to fast grown trees, in relation to its utilisation and performance.

Identify and develop processes for the utilisation of forest and mill residues in the manufacture of value added products.

Examine the cause and means of preventing wood degradation and establish techniques for the preservation of existing and future timber products.

**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. (15%)**

Determine the quality of specific forest resources for pulp and paper manufacture, particularly regrowth and plantation timbers.

Identify critical factors needed for the development of improved processes, taking into account the impact on the environment, for pulping wood and bleaching pulp for paper manufacture.

Develop improved adhesives and enhance adhesive performance for reconstituted wood products.

Respond to the research needs of the national research program under Commonwealth Pulp and Paper Industry Package.

Attract industrial collaboration for the production of regenerated cellulose.

Identify opportunities to extend the application of wood fibre/organic composites.

**Appropriation Total Allocation (includes earned appropriation revenues): \$15,604,000**

**Sponsored Research:** \$ 4,700,000

**Total Budget:** \$20,304,000

**Appropriation Capital:** \$ 2,300,000

The Division expects that 24.4% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **7.3 DIVISION OF HORTICULTURE**

***Objective***

*Improve crop quality, efficiency and sustainability of horticultural production on-farm, and improve product specification and postharvest 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 Resources)*

**Planned Outcomes**

**Develop superior new varieties of grapevines, citrus and other temperate crops and better crop management systems to enhance productivity and quality. (27%)**

Continue field establishment and evaluation of progeny arising from the grapevine and citrus breeding programs.  
Commence research to find alternatives to methyl bromide for control of insects, pests in dried fruit.  
Compare chitinase and glucanase activities in grapevine varieties differing in susceptibility to powdery and downy mildew.  
Commence assessment of vine performance under a range of sub-surface irrigation treatments.  
Conclude work on interactions between mycorrhizae and soil lime content in relation to citrus mineral nutrition.  
Commence production of inbred lines of melons.

**Develop novel methods to detect and control viral agents in horticultural species. (7%)**

Commence work on purification of viral agents present in grapevines infected with leafroll disease.  
Conduct infectivity tests with grapevine viroids.

**Establish reliable, objective methods of variety identification (5%)**

Establish DNA extraction and restriction digest conditions for grapevine material.  
Test synthetic oligonucleotides as fingerprinting probes.

**Develop techniques for inserting single gene characters into premium grape varieties. (11%)**

Use GUS reporter gene to measure frequency of infection and/or foreign gene integration and follow subsequent development of transformed cells.  
Prepare cDNA libraries and screen using antibodies and oligonucleotide probes for polyphenol oxidase.

**Ensure consistent cropping of selected subtropical and tropical fruit crops by development of improved management techniques varieties. (15%)**

Continue cashew hybridisation program.

Continue development of methods for rapid propagation of cashew.

Complete studies on the chemical induction of flowering in mango and control of tree size in the Katherine/Darwin region.

Continue research on the role of plant growth substances in regulating flowering in coffee.

Commence research on failure of flowering in pineapple.

Continue studies of pollination factors limiting yield in lychee and macadamia.

**Identify environmental and plant factors limiting productivity of horticultural crops. (10%)**

Identify the photosynthetic inhibitor in xylem sap.

Develop treatments to control growth and flowering of native ornamental species and improve their propagation.

Investigate the role of the cytoskeleton in controlling chloroplast division in higher plants.

**Identify factors controlling ripening, senescence and postharvest disorders of horticultural crops to enable development of improved postharvest storage procedures. (13%)**

Develop commercial packaging systems that allow control of gas composition and humidity in the internal atmosphere.

Advance prototypes of units that can provide high humidity in cool rooms to commercial application.

Commence investigation of postharvest disinfestation of quarantinable pests in exportable commodities by non-chemical means.

Continue to evaluate genetic contribution to the storability of vegetables and melons.

**Modify the ripening characteristics of commercial fruits by the introduction of chimaeric genes with promoters responsive to environmental signals. (12%)**

Isolate and characterise poly galacturonase genes from peach.

Construct chimaeric genes using tomato polygalacturonase gene.

Transform tomatoes with chimaeric genes and evaluate the phenotype of transformed lines.

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,846,000**

**Sponsored Research: \$1,126,000**

**Total Budget: \$5,972,000**

The Division expects that 19.7% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **7.4 DIVISION OF PLANT INDUSTRY**

***Objectives***

***To develop new opportunities and technologies for plant improvement and for management of agricultural production and processing in Australia, and to provide a basis for the more effective utilisation and management of the Australian flora and vegetation.***

***Strategy***

***The Division pursues its objectives through research in a broad range of basic and applied plant science, with emphasis on introduction of new technologies into agriculture and its associated production, processing and service industries. Research and development goals are furthered through close coordination and collaboration with other bodies servicing the Division's target industries and national interests.***

***Specific Objectives  
(Percent Resources)***

***Planned Outcomes***

**Understand and improve temperate Australian pastures. (10.7%)**

Complete studies on the amelioration of acid soils with phosphogypsum and gypsum at various soil phosphorus levels.

Identify medic species and their rhizobia for restoring soil fertility and vegetative cover in the marginal wheat lands of New South Wales.

Release for commercial use components of GRAZPLAN viz. METACCESS for graziers, cotton growers and for rangelands programs.

Complete the PVR registration and commercial release of the new phalaris cultivar, Holdfast, and the evaluation of prospects of breeding perennial legumes in *Lotus* and *Astragalus*.

**Determine the molecular basis of photosynthesis and its role in plant productivity. (9.9%)**

Characterise the damaging effect that ultraviolet B radiation has on Photosystem II and Rubisco in pea plants.

Define *cis*-acting sequences responsible for cell-specific expression of pyruvate Pi dikinase and NADP-malic enzyme in C<sub>4</sub> plants.

Define the mechanisms regulating the generation of CO<sub>2</sub> in bundle sheath cells of C<sub>4</sub> plants and the extent of CO<sub>2</sub> leakage from these cells.

Design and synthesise new inhibitors of enzymes of the amino acid biosynthetic pathway for use as potential herbicides.

**Determine the molecular basis of the interaction between environmental factors, hormones, and plant growth and development. (5.3%)**

Determine the DNA sequence requirements for the effects of gibberellin and abscisic acid on transcription.

Compare the structure and regulation of dehydrin production in dicots and monocots.

Utilise the *Lolium* floral bioassay to analyse the chemical nature of 'florigen'.

**Develop novel disease resistance mechanisms for crop and pasture species. (6.0%)**

Prepare enhanced constructions for optimum ribozyme gene expression *in vivo* and commence tests in transgenic plants.

Assay or field trial transgenic plants containing novel gene constructions which will confer resistance to potato leafroll virus. Clone and commence genome organisation studies of rice ragged stunt virus.

Generate mutants of functional plant luteovirus clones to characterise replication and transmission signals.

**Diversify and improve the adaptation of field-crops in southern Australia. (8.3%)**

Determine whether the unidentified growth inhibitor produced by roots in dry soil acts through regulating abscisic acid levels in leaves.

Evaluate accumulated data on direct CO<sub>2</sub> effects on plant respiration to assess whether apparent suppression is real.

Select high performance lines for release as the first Australian Linola cultivars.

Evaluate promising dual-purpose winter wheat breeding lines for potential release as cultivars.

**Increase the production of and efficiency of water and nitrogen use by cereals and grain and pasture legumes in the mediterranean climatic regions of Australia. (5.1%)**

Determine the influence of deep placement of gypsum on the water relations and growth of wheat and lupins growing on a duplex soil.

Determine the effects of a chemical desiccation technique on the translocation of carbon from the stem and leaves to the grain by weight balance and carbon labelling methods.

Quantify the fate of isotopic nitrogen in <sup>15</sup>N-labelled pasture legume materials and sheep excreta applied to a deep sand.

Model nitrate production and movement in sandy soils fertilised with urea, ammonium sulphate and diammonium phosphate.

**Develop economically viable and ecologically stable systems of cotton production for Australia. (8.0%)**

Release the *hydroLOGIC* irrigation management package following agreement with a commercial partner.

Complete a prototype of *entomoLOGIC* ready for field test.

Achieve commercial release and acceptance of five new cotton varieties.

Build a prototype management model for mites, incorporating sampling, population development, action thresholds and strategies for use of specific acaricides.

**Provide a basis for biological conservation, management and use of the Australian flora and vegetation. (9.2%)**

Complete a prototype of an interactive computer program – EUCLID – for identification of eucalypts.

Determine biological and phylogenetic relationships within species of Australian endemic wheatgrass *Australopyrum*.

Produce a catalogue of backcross barley breeding lines with known resistance genes to leaf scald and rust and convenient isozyme tags to these resistances.

Initiate commercial trials of production protocols for between 5 and 10 native ornamental species.

**Improve the market value of Australia's grain harvest and cereal products. (8.2%)**

Develop antibody-based test for dough strength in wheat; evaluate for breeding and receival use, simplify format and commercialise.

Evaluate field use of rapid test for organophosphate pesticide testing of grain; finalise simple format and commercialise.

Develop a screening test to identify wheat genotypes resistant to quality loss during high-temperature stress (in collaboration with Macquarie University).

Determine the molecular aspects that suit certain wheat starches for Japanese noodle production and identify novel genotypes as sources of such starch.

**Use molecular biology to manipulate plant genes. (9.3%)**

Determine in maize the developmental pattern of expression of the octopine synthase element binding factors.

Achieve expression in the germline of modified transposable elements in flax.

Produce 2,4-D resistant transgenic cotton plants.

Construct and test selectable markers with high levels of activity for use in cereal transformation.

**Use a variety of novel techniques to identify genes conferring useful traits and introduce these genes into important crop and pasture species. (9.3%)**

Introduce the introgressed rye CCN resistance into Australian cultivars of wheat.

Produce a genetic map linking isozymes, agronomic traits and DNA markers in *Triticum tauschii*.

Achieve significantly increased levels of expression of transgenic protein in leaves by targeting to the endoplasmic reticulum.

**Devise economically efficient and environmentally sustainable systems of crop and soil management. (10.7%)**

Develop Version 1 of a microcomputer-based decision-support system for tactical N-fertiliser application to dryland wheat.

Define new management practices to increase efficiency of use of industrially-fixed and biologically-fixed nitrogen.

Measure baseline productivity and microbial activity in field experiments on sustainable dryland cropping systems.

Evaluate the use of molecular biological methods for improving the acid soil tolerance of agricultural plant species.

**Appropriation Total Allocation (includes earned appropriation revenues): \$19,092,000**

**Sponsored Research:** \$ 7,834,000

**Total Budget:** \$26,926,000

The Division expects that 30.7% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 7.5 DIVISION OF SOILS

### **Objective**

***To contribute to the profitable and sustainable management of Australia's soil and land resource, by studying the distribution, properties and behaviour of soils in Australia and by encouraging the application of this knowledge including***

- identifying, maintaining, enhancing and promoting knowledge about soils for the long-term benefit of the Australian community;***
- conducting research into soil science and developing sound principles to apply soil science for the sustainable management of soils;***
- applying and encouraging the use of knowledge and techniques developed in soil science for the advancement of all areas of science, technology and industry.***

### **Strategy**

***The Division will:***

- undertake research to anticipate and manage soil problems of national significance within well focussed and targeted programs, which are re-evaluated each year.***
- ensure that research is relevant to national need, and that information is applied by improving formal and informal communications with clients, decision makers and the public.***
- obtain external funding for projects and, where appropriate, develop commercial opportunities which arise from research.***
- contribute to international developments in soil science by participating in scientific exchanges and publication.***
- maintain and distribute publicly accessible information about Australian soils.***
- actively participate in training soil scientists by involvement in lecturing, supervision of students and sponsorship of post-graduate students.***

### **Specific Objectives** ***(Percent Resources)***

**Develop methods to describe and manage the structure and structural stability of soils in order to minimise water and wind erosion, to enhance agricultural productivity, and to improve land management.**  
(25%)

**Improve soil management and facilitate interaction with users of research results by increasing knowledge of the properties, mineralogy, behaviour and distribution of Australian soils and disseminate this knowledge through models, databases, classification, mapping systems and research papers.** (24%)

### **Planned Outcomes**

Commence a detailed assessment of structure-based problems across south-east Australian wheat soils.

Develop methods for soil surface management to enhance infiltration of water and minimise soil erosion for seed bed conditions in the semi-arid tropics.

Develop a versatile physically-based water balance model for more critical assessment of consequences of erosion and structure decline and crop productivity.

Develop computer based soil image analysis of porosity to improve the description, quantification and display of soil properties relevant to land use planning and management.

Commence a program to evaluate physical and chemical changes to soil mineralogy during salinisation.

Extend the Waris database and GIS systems in Canberra and initiation of collaboration with the Western Australian Department of Agriculture.

Commence a major collaborative program with the Queensland Department of Primary Industries on use of remote sensing in erosion evaluation.

Complete tests of soil cementing agents which influence soil structure, crop performance and abrasion of tillage implements with the South Australian Institute of Technology.

Test new soil classification for Australia in collaboration with soil scientists and practitioners throughout Australia.

**Reduce losses from root diseases and enhance associations between plant roots and soil organisms to improve the productivity of crops, pastures and forests, and facilitate revegetation of degraded soils.**  
(20%)

Evaluate the role of mycorrhizal associations of Queensland cabinet timbers, define the importance of *Pythium* in seedling survival in nurseries and develop fungal innoculants for Australian seed bank species.

Test the use of bacteria to which tracer genes have been added as a means of improving biological control of "Take-all".

Commence a major project to evaluate the effect of native and introduced earthworms on soil structure and plant growth in South Australian pastures.

**Develop methods and strategies for the management of plant nutrition including the diagnosis and amelioration of nutrient deficiencies and toxicities.**  
(15%)

Commence a model of the nitrogen cycle.

Identify the role of soil microorganisms in nitrogen and carbon turnover by SEM and TEM techniques.

Commence testing of boron uptake within isogenic barley lines.

Assess nitrogen drawdown and iron deficiency in potting media for the nursery industry.

Identify soils prone to acidity and develop amelioration strategies matched to soil type.

Specify efficient irrigation systems for supplying water and nutrients to grapevines.

**Provide practical strategies for measuring, predicting and controlling the impact of agricultural, urban, mining and industrial land use management on soils and landscapes and rehabilitating degraded land.**  
(14%)

Complete plans for mine dump revegetation at Ranger Uranium Mines with special emphasis on soil microbial re-establishment.

Commence a national study of cadmium in vegetables.

Develop specific plans for minimising sediment and nutrient pollution of Mt Bold reservoir SA.

Develop rehabilitation systems at Rum Jungle and for managing sulphide wastes from gold mining.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 9,049,000**

**Sponsored Research: \$ 1,350,000**

**Total Budget: \$10,399,000**

The Division expects that 13.8% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 7.6 DIVISION OF TROPICAL CROPS AND PASTURES

**Objectives**

*To benefit the nation through research for the livestock and crop industries of northern Australia.*

***Strategy***

*The Division concentrates on developing new plants and technology that will improve the efficiency, sustainability and competitiveness of the pasture-based livestock industries and of the field crop industries of northern Australia. Project teams with a range of scientific skills are assembled to attack recognised problems in the pastoral, sugar and grain crop industries. Priorities are set in consultation with important stakeholders. The Division is seeking to increase the amount of research that is funded from external sources, and to improve its communications with client industries.*

**Specific Objectives**  
*(Percent Resource)*

**Planned Outcomes**

**Develop and test new and improved pasture legumes to improve the efficiency of cattle and sheep production. (31%)**

Intensify research on the improvement of *Stylosanthes* through staff recruitment and the use of molecular biology approaches.

Release a new variety of *Stylosanthes scabra* bred for resistance to anthracnose disease to the grazing industry.

Commence research on the adaptation and nutritive value of the grass *Bothriochloa pertusa*.

**Develop management systems for native grasslands and woodlands in northern Australia (including the introduction of exotic legumes and grasses) to maintain or enhance their productivity, and protect them from degradation. (24%)**

Complete economic analysis of band-seeding and other pasture establishment techniques.

Commence new research on land and water care for north Queensland.

Publish data from long-term research on nitrogen and carbon cycling in grass pastures.

**Moderate the degradation of dietary fibre and resolve toxicity problems in forage legumes using rumen biotechnology. (5%)**

Appoint new research staff (funded by an AMLRDC grant) to intensify research on the modification of rumen microorganisms to enhance fibre digestion.

**Improve and extend the range of tropical crop varieties. (9%)**

Complete a computer-based methodology for selecting new crops based on commercial prospects and preferred environments, yields and economic proposals.

Release a tropical soybean cultivar into commerce.

**Reduce the limitations to crop yield imposed by environmental and physiological factors. (10%)**

Develop and use simulation model for kenaf in the tropics to assess the feasibility of an industry in the Northern Territory.

Assess the role of root signals in reducing grain legume growth in dry soils.

**Develop and evaluate new farming systems for tropical Australia. (14%)**

Redeploy six staff members to join with colleagues at the Queensland Department of Primary Industries at Toowoomba in a joint farming systems research team.

Initiate new field research on cropping systems in SE Queensland.

**Assess land use options and crop production potential and develop decision support systems for Australian tropical/sub-tropical agriculture. (7%)**

Further develop agricultural resource information system technology for developing countries.

Complete a feasibility study for developing a management information system for sugar cane production based on mill areas.

**Appropriation Total Allocation (includes earned appropriation revenues): \$11,631,000**

**Sponsored Research: \$ 4,000,000**

**Total Budget: \$15,631,000**

The Division expects that 28.6% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **8. 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***

***Work in the Institute's Divisions will be structured to maintain a continuing effort in gaining new knowledge while at the same time allowing for the assembly of project teams from various disciplines to work on practical problems of immediate importance.***

***The Institute will liaise closely with other organisations working in this field to ensure that its activities are complementary and supportive.***

***The other key strategies for the Divisions of the Institute are to:***

- . promote and reward excellence in science and management by personal understanding of the quality, creativity and productivity of individuals and teams;***
- . assess and evaluate rigorously the benefits of current and proposed research;***
- . collaborate with those agencies and industries whose task is to formulate and implement management strategies for the various components of the Australian environment; and***
- . market our skills to users and promote our worth to governments.***

### ***Specific Activities***

***The operational units of their Institute are its five Divisions, one Centre and one Biometrics Unit. Specific outcomes for these operational units are listed in the following pages.***

***Specific Institute-wide activities include:***

- . formal establishment of the INRE Project Office to market and coordinate multi-Divisional and, in the case of marine science, multi-organisational contract task force projects (the Office will be self-funding).***
- . establishment and management of the government's pulp mill research program and monitoring effort***
- . commencement of two further inter-Divisional programs – coastal zone management and Antarctic studies***
- . further strengthening of international liaison by active participation in the Intergovernmental Oceanographic Commission, World Meteorological Organisation, the International Geosphere Biosphere Program and the Intergovernmental Panel on Climate Change***

***Specific Activities (continued)***

- increase INRE profile and contributions to policy issues through use of the mass and specialist media, presentations at public forums, involvement in and submissions to appropriate inquiries and commissions, and publication: In particular, the INRE Environmental Outlook document will be launched.
- achieve a 10% increase in resources by 1992, in part through seeking specific government sponsored research and in part by increased efforts in consulting
- complete initial phase of training program for all program managers and implement career development process for all staff
- review and streamline Divisional administrative support
- conduct a review of fisheries research and begin process of selecting a new Chief for the Division of Fisheries upon the retirement of the incumbent Chief.

The Institute encompasses the following Divisions and Units.

<b>Division of Atmospheric Research</b>	Headquarters and Melbourne Laboratories, Aspendale, Victoria
<b>Centre for Environmental Mechanics</b>	Headquarters and Canberra Laboratories, Canberra, ACT
<b>Division of Fisheries</b>	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
<b>Division of Oceanography</b>	Headquarters and CSIRO Marine Laboratories, Hobart, TAS CSIRO Marine Laboratories, Marmion, Perth, WA
<b>Division of Water Resources</b>	Headquarters and Perth Laboratories, Floreat Park, WA Black Mountain Laboratories, Canberra, ACT Waite Laboratories, Urrbrae, SA Griffith Laboratories, Griffith, NSW
<b>Division of Wildlife and Ecology</b>	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
<b>Biometrics Unit</b>	Headquarters, Canberra, ACT

The Institute Headquarters is at Canberra, ACT

**INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT****SUMMARY OF RESOURCES**

(estimates as at 16 May 1990)

Division	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Funds
			(\$'000)	(\$000s)	(\$'000)	(\$'000)	(\$'000)
Atmospheric Research	76.6	126.4	5,664.5	1,200.0	6,864.5	2,847.0	9,711.5
Fisheries	88.6	152.7	9,122.9	500.0	9,622.9	5,466.2	15,089.1
Oceanography	46.8	81.8	4,197.9		4,197.9	1,423.5	5,621.4
National Facility (ORV)	5.5	9.9	3,803.0		3,803.0		3,803.0
Water Resources	107.7	213.1	11,097.5		11,097.5	2,960.9	14,058.4
Wildlife and Ecology	90.1	206.6	11,352.3		11,352.3	2,733.1	14,085.4
Centre for Environmental Mechanics	16.4	27.8	1,648.9		1,648.9	569.4	2,218.3
Biometrics Unit	7.0	7.0	418.9		418.9		418.9
Institute Headquarters <sup>c</sup>	2.5	9.2	3,979.9		3,979.9		3,979.9
Floreat Park	3.8	21.0					
<b>Total</b>	<b>445.0</b>	<b>855.8</b>	<b>51,285.7</b>	<b>1,700.0</b>	<b>52,985.7</b>	<b>16,000.0</b>	<b>68,985.7</b>

a Staff numbers, expressed in equivalent full time units, as at 23 May 1990.

b Annual and Capital Appropriation includes earned appropriation revenues.

c Includes \$3,395,900 administered on behalf of Divisions.

## **8.1 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.***

### **Specific Objectives** ***(Percent Resources)***

**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. (17%)**

**Development of state-of-the-art computer models of global climate, and simulation of greenhouse-induced climate change using such models. (21%)**

**Assess regional extent and impact of future climate change caused by changing atmospheric composition. (11%)  
Develop a testable computer climate model for assessing the forecasting of drought, and**

### **Planned Outcomes**

A new laboratory for trace gas analyses of the isotopic composition of present-day CO<sub>2</sub> from a global sampling network.

Analysis of the historical changes (past 350 years) of air extracted from Antarctic ice cores will continue.

Global 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.

Scientific support for the Australian Baseline Air Pollution Station is ongoing.

Further development of 4-level and 9-level general circulation models.

Climate change simulations to provide preliminary results for evaluation of model performance as well as use in impact studies.

New methodology for analysis of climate change data. First reports to WA, NT and NSW and the second report to Victoria.

"Proof of concept" experiments concerning a testable drought forecasting scheme will continue.

**investigate the precipitation mechanisms of frontal and severe storm systems, with specific applications to catchment hydrology and precipitation enhancement. (14%)**

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.

Commencement of a second field experiment examining the properties of winter storms over S.E. Australia.

Completion of analysis of a previous experiment over Northern Australia.

Computer modelling studies of precipitation from severe storms are carried out, and are used to develop a new method of providing precipitation estimates.

**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. (17%)**

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.

Specific research on sea-breeze and terrain effects on the atmospheric flow near existing or planned power-station sites is well underway, with application to current problems in Victoria, New South Wales and Western Australia.

Completion of first year of a field study of rainwater acidity in the Latrobe Valley.

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 convective boundary layer complement this work, using a new CSIRO designed facility.

**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. (17%)**

New models and methods of analysis to improve commercial and research products from the Division's remote sensing facility.

First aircraft trials for a prototype satellite-borne atmospheric pressure sensor to be followed by a 'Phase A' study via Auspace.

Field and satellite studies of land surface temperatures applied to frost risk in wheat in W. Victoria will be carried out.

Simulations and measurement of sea surface temperature in conjunction with the launch of the ATSR ERS-1 satellite will be implemented.

An update of the satellite acquisition data system is complete and will be used for surface vegetation and cloud climatology studies to improve climate models.

Analysis of a field experiment on cloud base and optical properties using lidar. Upgrade of lidar system following successful field testing of lidar techniques for industrial plume spread monitoring.

**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).

**Appropriation Total Allocation (includes earned appropriation revenues): \$6,864,500**

**Sponsored Research:** \$2,847,000

**Total Budget:** \$9,711,500

**Appropriation Capital:** \$1,200,000

The Division expects that 30.45% of the total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## 8.2 DIVISION OF FISHERIES

**Objective**

*To maintain, develop and improve Australia's fisheries, with particular reference to the rational exploitation of the resource and the interests of the catching sector; to give support and advice to mariculture interests; and to anticipate problems in the marine environment, and in particular the coastal zone, likely to affect the fisheries.*

**Strategy**

*The Division will concentrate on problems of economic importance especially in the Australian Fishing Zone, by investigating the distribution, abundance and population dynamics of commercial and potentially commercial fisheries and studying the effects of fishing and environmental factors. The Division will give advice on marine fisheries to the Commonwealth fisheries management agency, and to the catching, and mariculture sectors of industry to meet their needs. The research effort on environmental problems will be maintained and increased if additional resources become available.*

**Specific Objectives**  
*(Percent Resources)*

**To commission FRV "Southern Surveyor" and resume the work at sea. (12%)**

**To improve the biological and mathematical basis for fisheries assessments and provide management advice for major fisheries. (50%)**

**Planned Outcomes**

FRV "Southern Surveyor" should be operational by September 1990.

Scientific advice to support the management of the Southern Bluefin Tuna (SBT) fishery.

Report on the reliability of length-based stock assessment, and development of improved methods of SBT stock assessment.

Report on SBT tagging data.

Development of an annual index of juvenile SBT abundance.

Publish assessments of multispecies fisheries in northern Australian water.

Measurements of responses of fish resources on the NW Shelf to an experimental management regime.

Development of a management regime for the Great Barrier Reef Marine Park Authority.

Provision of stock assessments for the northern prawn fishery.

Development of egg survey and acoustic methods with an acceptable level of accuracy to assess the slope and deepwater demersal fish resources in southeastern and western areas of the AZ.

In association with the Australian Fisheries Service (AFS) to advise on the development of an overall AFZ fishery information system (AFZIS) and to develop and expand the catch information sub-system of AFZIS.

**Conduct exploratory fishing surveys to assist in the development of new fisheries. (10%)**

Commencement of research vessel surveys of the demersal resources in the western deepwater and the fin-fish resources of the Gulf of Carpentaria and the Arafura Sea.

Continuation of work on the distribution of commercial concentrations of krill in Tasmanian waters in relation to oceanographic factors.

**Carry out research on mariculture to increase the efficiency of the industry and raise the level of profitability. (13%)**

Improvement in the nutritional value of microalgal feeds.

Phytoplankton handbook for the mariculture industry.

Further annual algal culture workshops for industry and commercial hatchery staff.

Close the life cycle of penaeid prawns under laboratory conditions.

Alternative feeds for larvae and juveniles and transfer the results to industry.

**Develop methods to improve the management, rehabilitation and protection of the marine environment with particular emphasis on the fisheries resources dependent on the coastal zone. (15%)**

Completion of the third year of a three year baseline study of seasonal and interannual variability in the habitats and species of Jervis Bay.

Continued seagrass research and development methods to restore depleted areas and extend existing meadows.

Completions of the studies and publications of results of the effect of toxic dinoflagellates on Tasmanian shellfish.

Identification and description of toxic dinoflagellate cysts introduced to Australian waters from foreign vessel ballast water discharge.

Report on ASEAN/US Coastal Management Program, AIDAB/IOC funded, on tropical toxic dinoflagellates.

**Appropriation Total Allocation (includes earned appropriation revenues): \$ 9,622,900**

**Sponsored Research: \$ 5,466,200**

**Total Budget: \$15,089,100**

**Appropriation Capital: \$ 500,000**

The Division expects that 36.50% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

### **8.3 DIVISION OF OCEANOGRAPHY**

**Objective**

***To improve:***

- (i) *the efficiency of all forms of Australian maritime activity dependent on oceanic knowledge;*
- (ii) *the rational management of the ocean and estuarine environment; and*
- (iii) *the quantitative understanding of those aspects of the interaction between the atmosphere and the regional oceans which relate to the variability and change of the Australian climate.*

**Strategy**

*The Division carries national responsibility for physical and chemical oceanography, including studies of the structure, composition and dynamical variability of regional water. Observations using satellites, ships, surface and subsurface moorings and fixed stations are combined with analysis, interpretation and numerical modelling. New techniques and instrumentation are developed and applied, and taken to commercialisation where appropriate. Projects are selected for their relevance to the objectives and evaluated for scientific importance and achievability. Relationship to the objectives of international climate research programs are also taken into account. Collaborations with agencies, universities and overseas research institutions are established wherever appropriate, and external sponsorship is actively pursued through specific government program initiatives, consultancies with government departments and private industry, through collaborative partnerships and contracts and through fees for expert services.*

*Information is transferred through scientific publications, specialist and popular reports, lectures and responsible interaction with the media. Divisional scientists maintain wide participation in national and international oceanographic coordination bodies and university affiliations and there is an active program of scientific visitors and scholars.*

*The Division operates the RV Franklin as a National facility to ensure a high level of quality control, user service, and a continual upgrading of the vessel's operating capability.*

**Specific Objectives  
(Percent Resources)**

**Characterise the structure and variability of the main dynamical features of open waters of the Australian region, including the basic processes of mixing and circulation. (18%)**

**Planned Outcomes**

Analyse data for publication from Leeuwin Current Interdisciplinary Experiment (LUCIE) cruise FR6/87, 9/87 and 3/88; publish model results; commence processing data from cruise FR13/89 (TECSAS) aimed at investigating the effects of the East Australian Current and its eddies on the waters of the temperate eastern continental shelf.

Complete study of currents, predicted off Sydney using coastal trapped wave (CTW) models; continue examination of the role of CTW's and local wind in the nutrient enrichment on the continental shelf near Sydney, using both in situ and remote sensing data; conduct numerical modelling of Bass Strait to determine the fate of CTW's incident on its western entrance.

Commence numerical modelling of Tasman-Coral Sea circulation.

Complete a physical oceanographic description of the waters of southern New Zealand from cruise FR7/89 data.

Complete a description of the New Ireland coastal undercurrent from cruise FR4/88 data.

Subject to funding, deploy moored current meter array in Vitiaz Strait, Papua New Guinea in conjunction with Louisiana State University.

**Investigate the thermal structure of regional oceans and their role in influencing interannual climate variability and longer-term climate change. (27%)**

Make direct measurement of surface heat fluxes in the western pacific using RV Franklin and publish results from the 1988 measurements.

Occupy 3500 subsurface temperature stations in the tropical Pacific and Indian Oceans, process and merge with 9000 stations provided by collaborating institutions.

Monitor thermal indices relevant to Australian climate variability and advise research community on the climate state of the tropical Pacific and Indian Ocean.

Install satellite transmission system for XBT data on CSIRO volunteer observing ships.

Study variability of major zonal currents in Indian Ocean.

Extend of XBTk network to mid latitudes for Greenhouse research program.

Recover and redeploy joint Australian/Japan current meter mooring of the Equator at 147 degrees East during FR7/90 and "Natsushima" cruise JAPACS91.

Deploy instruments on Aurora Australis and Southern Surveyor for the underway measurements of surface pH, fluorescence, temperature and salinity.

Conduct bathymetric and hydrographic survey neat Heard Island as first phase of program to determine feasibility of measuring global ocean temperatures using long-range acoustics.

Begin annual hydrographic measurements between Tasmania and Antarctica in conjunction with the Antarctic Division.

Develop algorithm for evaluating new density variable "neutral density" of a water sample, and install this algorithm in various laboratories around the world.

Develop inverse models of the ocean circulation based on the new coordinate frame of neutral surfaces, with the consistent inclusion of mixing processes.

Complete the model and publish the results of sea level rise caused by the thermal expansion of the ocean due to Greenhouse warming.

Represent Australia international and national climate change planning and implementation bodies, and expand relation with kindred agencies.

**Measure and characterise dissolved and particulate chemical constituents of marine waters and sediments, and interpret these data in relation to physical, chemical and biological processes and anthropogenic activities. (17%)**

Publish results of survey of Macquarie Harbour.

Analyse data from survey of waters of Port Davey, Tasmania to measure concentrations of trace metals, organic compounds and nutrients.

Publish results on the oceanography of the sub-tropical convergence zone around the south of New Zealand using data from cruise FR 7/89.

<b>Develop theoretical and numerical models of the oceanographic characteristics of Australia's continental shelves in order to provide information on currents, tides, and waves relevant to maritime industry and environmental needs. (14%)</b>	Assist the mariculture and fishing industries by providing nutritional information on marine microalgal feedstocks and polyunsaturated fatty acids in marine products.
	Determine whether the hydrocarbons in the sediments of d'Entrecasteaux Channel arise from pollutions or from natural oil seeps.
	Complete development of a density stratified three dimensional continental shelf circulation model.
	Investigate feasibility of combining remotely sensed sea surface data with simple dynamical models to obtain predictions of surface currents for application to defence and shipping industry.
	Actively promote use of new developments in surface current prediction to applications in search and rescue.
	Complete analysis of data collected in the South Australian Upwelling Zone and use that data for the adjustment, verification and future development of an existing upwelling prediction model.
	Further develop government and private "user industry" links and sponsorship.
	Seed funding from the Federal Govt Pulp Mills Research Program initiative announced in Dec 1989 to develop a comprehensive capability to predict the three dimensional movement and concentration of pulp mill effluent discharged into the ocean.
	Represent CSIRO on selected Government committees in relation to oceanic environmental issues.
	Provide continuing service to DASETT and other government agencies for specialist advice, and comment on environmental impact statements.
<b>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. (10%)</b>	Test prototype of new directional wave buoy, and finalise negotiations with industry for its manufacture.
	Pursue establishment of high bit-rate satellite reception facility in Hobart in conjunction with COSSA and Australian industry.
	Continue supply of satellite-derived sea surface temperature and vegetation index products to a range of government and private users.
	Using RV Franklin, conduct surface truth experiments for microwave instruments on ERS-1 satellite.
	Develop and test solid-state dissolved oxygen sensor; identify new chemical sensors for water sciences by way of in-house and collaborative development.
	Continue development of algorithms for processing of RV Franklin acoustic doppler profiler data.
<b>Operate the oceanographic research vessel Franklin as a national facility for the benefit of Australian oceanography generally and for the programs of the Division. (14%)</b>	Franklin will be operating in eastern and northern Australian water during this period.

**Appropriation Total Allocation (includes earned appropriation revenues): \$4,197,900**

**Sponsored Research: \$1,423,500**

**Total Budget: \$5,621,400**

The Division expects that 25.98% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **8.4 O.R.V. FRANKLIN (A NATIONAL FACILITY)**

### **Objective**

*Research time on the vessel is allocated to scientists from within and outside CSIRO by a Steering Committee on the basis of project proposals and external assessment by leading local or overseas scientists in the field. Steering Committee is appointed by the Minister for Science and Small Business and operates independently of CSIRO in accordance with the recommendation of the Australian Science and Technology Council (ASTEC) contained in its report 'Guidelines for the Operation of National Research Facilities'.*

### **Operations**

*During the fiscal year 1990/91, Franklin will operate in southern, eastern and northern Australian waters. Projects included in the program by the National Facility Steering Committee are:*

- . *Western Boundary closure of the Tropical South Pacific Circulation in the Coral Sea in winter, with focus on interactions at the reefal margin of the basin.*
- . *Bismarck Air–Sea Interaction and Circulation Study (BASICS).*
- . *Inorganic and Organic Carbon Cycles in Equatorial Waters.*
- . *Topographic Control of Shelf Circulation.*
- . *Mixing and Subduction (Bunyip).*
- . *Bass Strait Interdisciplinary Studies.*
- . *Southern Australian margin: cool–water carbonates and geological history.*
- . *Turbulence Measurements and Turbulent Scaling in the Antarctic Circumpolar Current.*
- . *Submarine Slope–failures of the continental margin of SE Australia.*
- . *Mapping of the East Australian Current, fronts and active upwelling areas by ship, buoy and ERS–1 Synthetic Aperture Radar.*
- . *Application and validation of Data from the ERS–1 Along Track Scanning Radiometer.*

CSIRO staff have been allocated 68% of project days on the vessel for 1990/91.

Total budget:	\$3,803,000
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## 8.5 DIVISION OF WATER RESOURCES

**Objective**

***To provide public agencies and the private sector with improved methods for the definition, use and management of Australia's water resources. Of particular importance is the maintenance of the quantity and quality of urban, rural and industrial water supplies.***

**Strategy**

***The Division will study the processes involved in the interactions between the atmosphere, plants, land and water, and translate these findings into practical techniques which will assist agencies in managing natural resources to meet community and environmental needs. We will consult with the water "industry" and develop collaborative research with user agencies. Our research is often multidisciplinary and concentrates on solving problems at a system level.***

**Specific Objectives**  
*(Percent Resources)*

**Planned Outcomes**

**Predict the hydrologic response of water resource catchments to changes in water and land management. (28%)**

Completion of first phase of procedures and computer software for the modelling of surface and groundwater interactions in the Perth metropolitan area.

Distribution of computer software and technology transfer of techniques for the identification of the distribution of soil moisture in hillslopes. Applications will include soil conservation, forestry operations and salinity amelioration in NSW and QLD.

Participation in an international inter-comparison program for the estimation of regional evaporation.

Completion and distribution of an extended version of the MicroBRIAN commercial software for image analysis.

**Develop, apply and transfer methods for predicting the sources, behaviour and yield of water, sediment and salt from the surface and subsurface over time periods appropriate to generally large areas. (12%)**

Determine the fate of irrigation tail water disposed of at Noora, especially if it is likely to return to the Murray River.

Application of hydrochemical and isotopic techniques for typing and determining the mixing of groundwaters and surface waters, especially in the Kerang Lakes region, and salt lake features in the Murray-Darling Basin.

Show whether or not radionuclides and mineral particle magnetics provide consistent evidence of sediment sources in large catchments, and determine the major controls on these sources.

Complete initial evaluation of soil modification on reducing percolation to water tables under ponded conditions and begin additional experiments on the most promising techniques.

Begin a major project on developing shallow sub-surface drainage for managing water tables without producing excessive amounts of saline groundwater.

**By ecological research promote environmentally safe management of surface waters. (14%)**

Complete field testing of herbicides for management of Alligator weed in damp pasture land.

Consolidate the aquatic plant consultancy group.

Complete the establishment of the artificial wetland system at Coffs Harbour and investigate the processes of phosphorus removal.

Determine the effect of water management on emergent understorey vegetation on natural wetlands and rivers.

Evaluate markets for and further development of equipment for measurement of biologically important water quality parameters.

Develop new methods for measuring odours to toxins produced by cyanobacteria.

**Develop, evaluate and apply decision support systems and other techniques of institutional, social, economic and environmental analysis to water resource problems. (11%)**

Complete the expert system developed for integrated catchment planning and development control in the Onkaparinga catchment, and effect technology transfer to user agencies, commencing with the Total Catchment Management Group for the Peel-Harvey estuary in Western Australia.

Complete an expert system for land management at Puckapunyal Army Base.

Develop a business plan for commercialisation of the Queensberry intelligent data base, and undertake consulting assignments utilising the Queensberry software.

Produce reports on (i) contribution of supply pressure controls to urban water demand management, (ii) relevance of social justice theory to the planning and conduct of community involvement in major water allocation decisions.

Continue development of the CSIRO-Curtin Centre for Applied Psychology.

Investigate new directions in information system and decision-support research in the areas of coastal management and waste management.

Derive or select a regional groundwater recharge-discharge model and develop data synthesis techniques for existing surface water models, to predict the impact on water resources of climate change.

**Measure and predict the movement of aqueous contaminants and salts with particular application to groundwater. (25%)**

Extend groundwater modelling expertise being developed in salinised catchments in higher rainfall areas in the SW of WA.

Use techniques developed by the Division to determine the extent of pollution of groundwater by petroleum fuels in underground storages over the Swan Coastal Plain aquifer.

Quantify sources of nutrients from a variety of land uses in the Darling Ranges, which are entering streams draining into the Swan River.

Provide validated techniques for measuring daily uptake of water by a range of vegetation types.

Complete development of surface geoelectric techniques for mapping groundwater pollution from point sources.

Complete assessment of the impact of point sources of nitrate on the Gamier limestone aquifer, and commence related work on quantifying nitrate release from feedlots in Queensland.

**Develop land and water use strategies in irrigated areas for the long term management of water tables to minimise salinisation, improve productivity and maintain acceptable water quality of rivers in the Murray Basin. (10%)**

Develop relationships for capillary rise from shallow water tables for different soil types; combine crop growth and water use models to simulate rotations and their effect on water table accessions; continue validation of a combined soil water flow and groundwater distribution model.

Release a prototype software model with supporting documentation to help develop understanding of the interaction between irrigation, soils crops, and water tables on rates of soil salinisation and its management.

Complete evaluation of soil amelioration techniques including gypsum enriched slots on crop yield and water balance; continue evaluation of the effect of lime enriched slots on the productivity of vines growing in acid soils.

**Appropriation Total Allocation (includes earned appropriation revenue): \$11,097,500**

**Sponsored Research: \$ 2,960,900**

**Total Budget: \$14,058,400**

The Division expects that 23.43% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **8.6 DIVISION OF WILDLIFE AND ECOLOGY**

**Objective**

*To develop a sound scientific basis for the conservation of Australia's biodiversity and for the management of Australia's wildlife, plant and land resources for economic and ecological sustainability, and to assist in providing that information to government agencies and other land managers.*

**Strategy**

*As Australia's largest natural environment research group, the Division operates throughout Australia in collaboration with Federal, State and Local Governments, industries and other agencies responsible for the management and conservation of Australia's wildlife and land resources. It also adopts an innovative approach to exploring the potential for utilizing the unique features of Australia's biota. Its overall approach is to develop multidisciplinary, integrated programs, using and developing modern ecological and biological techniques and theories.*

**Specific Objectives**  
(Percent Resources)

**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. (20%)**

**Planned Outcomes**

Completion of experiments on effects of grazing and burning on rangeland soil surface stability and soil nutrients.

First draft of expert system for the design and development of cost-effective strategies for restoration of overgrazed rangelands; initiate experiment on stability of perennial grasses.

First draft of a general herbage model.

Commencement of testing phase in development of the expert-system advisory package RAMS for sustainable management of grazing properties.

Completion of data analysis from the fauna survey of Uluru National Park.

Format of the Geographic Information System for the McDonnell Ranges tourism study.

Finalization of relocation of Deniliquin-based staff and families to Canberra.

Press articles on topical issues addressed in the "CSIRO Policy on Rangelands".

**To determine the ecological principles needed for conserving the biological diversity of Australia's tropical rainforests and savannas and for managing them for economic and ecological sustainability; and to assist government and other agencies to apply those principles. (16%)**

Completion of the fauna and flora survey of Stage 3 Kakadu National park for ANPWS.

Implementation of experimental treatments to assess the responses of tropical savannas to different fire regimes.

Completion of instrumentation at Site 2 in the collaborative experiment on cabinet-wood rainforest species.  
Report to CALM on rehabilitation of degraded land, using native plant species.

**Subject to current funding negotiations:**

- . conduct a fine-scale survey of fauna in the "Exploration Zone" of Kakadu National park;
- . develop a tropical rainforest information system;
- . commence a major research project on sustainable use of tropical rainforests in PNG.

Production of a position document on issues confronting management of tropical rain forests.

Initiation of collaborative research exchanges with French researchers studying tropical savannas in Africa.

**To provide government and other land managers with improved strategies and techniques, including novel and environmentally benign biological agents for controlling introduced or native vertebrate pests. (22%)**

Acquisition of funding necessary for development of a major group researching reduction of fertility as a means of controlling vertebrate pest, particularly rabbits, foxes (ANPWS, ESAC) and mice (ACIAR).

Commence project on control of cane toads, including assessment of biological agents.

Final report to Australian Wool Corporation on conventional techniques for control of rabbits.

Insertion of marker gene into myxoma virus.

A management information system for use in preventing mouse plagues.

A Management information system for use in managing an outbreak of an exotic disease of domestic animals.

CSIRO representation of the Vertebrate Pests Committee of SCA, and on the CONCOM-SCA Working Party on VHD disease of rabbits.

**To develop biological, ecological and genetic principles needed for conservation of the biodiversity of the Nation's fauna. (22%)**

Completion of experiments on water and energy metabolism for a range of vertebrates, and publication of papers.

Final report to ANPWS on the effects of introduced plants on Australian native species.

Continue research on dynamics of kangaroo populations.

Interim assessment of population status of fur seals of the southern coast of Australia.

Publication of "Aves, Volume 1" for Zoological Research.

Publication of project on epidemiology of arboviruses of humans in S.E. Australia.

Commercialize further research and development relating to lactation.

Completion of electronic data basing of mammal specimens held in the Australian Wildlife Collection, and continued curation and operation of the Collection.

Continued CSIRO focus for government initiatives on conservation of biodiversity, and CSIRO representation at CONCOM Standing Committee; at the Endangered Species Advisory Committee (ANPWS); on the Australian Government working party on biodiversity.

**To determine ecological principles needed for conserving the biological diversity of the Nation's temperate forests and woodlands and for managing them for economic and ecological sustainability, and to assist government and other land managers to apply those principles. (10%)**

Commence a major program of research resulting from reorientation and refocussing in 1989-90 of research relating to conservation of forest fauna and sustainable use of eucalypts in south-east Australia.

Reassess research on nutrients and plant allochemicals influencing the utilization of eucalypts by arboreal marsupials.

Report to ANPWS on reintroduction of small-mammal species at Heireston Prong, W.A.

Development and formalization of collaboration with W.A. Department of Agriculture and BRR for the project on optimising the pattern of native vegetation patches to meet conservation and salinity control objectives.

First classification of vegetation functional types for models of feedback effects of the vegetation cover of Australia on atmospheric composition and climate.

Subject to current funding negotiations, initiate research on the impacts of global climate change on the Nation's fauna and flora.

**To develop and transfer to user computer-based decision support systems to assist land managers and planners involved in the management of Australia's natural resources for economic and ecological sustainability. (10%)**

Conduct a range of consultancies for industries and government agencies involved in land-use management.

Commence collaborative research to develop a decision support system for land management in Cape York.

Subject to current funding negotiations:

- . commence research compilation of natural-resource accounts for the Murray-Darling Basin;
- . initiate development of a decision support system for coastal zone management.

**Appropriation Total Allocation (includes earned appropriation revenues): \$11,352,300**

**Sponsored Research: \$ 2,733,100**

**Total Budget \$14,085,400**

The Division expects that 22.24% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **8.7 CENTRE FOR ENVIRONMENTAL MECHANICS**

**Objective**

***To assist Federal and State agencies and industry to solve problems in hydrology, environmental quality, industrial processes and plant productivity by increasing our understanding of physical processes in the natural environment.***

**Strategy**

***Research focuses on perceived gaps in our scientific understanding required for effective management of hydrological, environmental and agricultural resources, and on the development of techniques, analyses, and instruments to expedite the practical application of our work. Results, developed in the context of the natural environment are applied where possible to related industrial processes and are disseminated via scientific publications, collaboration with State agencies, consulting and commercial licensing. The choice of problems is determined by their assessed solubility and by inputs from users in Federal and State agencies, and from industry and consulting firms.***

**Specific Objectives**  
(Percent Resources)

**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%)**

**Development an adequately verified theoretical description of wind 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%)**

**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**

**Planned Outcomes**

Development of techniques for characterizing soil topography and soil structure and for measuring the water content of wheat and mining materials.

Commencement of substantial horticulture and dryland cropping soil/plant management systems project.

Commencement of project on acid drainage waters from estuarine soils.

Development and test description of the movement of salt plumes in groundwater.

Completion of theoretical investigations of unsaturated flow around holes.

Commencement of investigation of the hydraulics of hill slope infiltration and down slope seepage.

Analysis of results of complex terrain meteorological studies funded by NERDDC and ECNSW.

Commencement of work on wind energy resource assessment for ECNSW.

Completion of field phase of collaborative climate study (Moga) and commencement of analysis toward surface layer parametrization for GCM's. Participation in BASICS project aboard R/V Franklin.

Continue externally funded collaborative project on soil evaporation and crop water use.

Test new fast response sensor for measuring atmospheric CO<sub>2</sub> fluxes.

Commence modelling of field crop responses to increased CO<sub>2</sub>.

Finalise investigations of physical factors influencing nitrogenous fertilizer efficiency in sugar cane and communicate first results to industry.

Perfection of new infra-red techniques for measuring fluxes of

**radiation climate of plant communities. (20%)**

**Provide an experimentally verified physical description of those physical processes in freshwater bodies which set the boundary conditions for biological processes affecting water quality and determine efficiency in irrigated agriculture. (10%)**

**Communicate results of Division's research to users in the community, industry and government agencies. (15%)**

**Greenhouse gas, methane, into the atmosphere.**

Model of stability and mixing in a billabong and test against observational data.

Continue theoretical and experimental investigations of physical determinants of algal growth and biological productivity.

Start investigations on the physical bases for the optimal design of saline water evaporation basins.

Complete TDR licensing agreement.

Strengthening of collaborative provision of practical assistance with instrumentation, and advice to other CSIRO Divisions.

**Appropriation Total Allocation (includes earned appropriation revenues): \$1,648,900**

**Sponsored Research: \$ 569,400**

**Total Budget: \$2,218,300**

The Division expects that 27.41% of its total annual budget will be spent from external funds in 1990-91 (comprising sponsored research funds and earned appropriation revenues) based on estimates as at 16 May 1990.

## **8.8 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 statistical consulting service.*
- . Train Divisional staff in basic statistical methods and in the use of statistical computer packages.*
- . Carry out biometrical research relevant to Divisional programs.*

**Specific Objectives**  
*(Percent Resources)*

**Planned Outcomes**

**Collaborate in Divisional research projects and provide a high quality statistical consulting service. (85%)**

Have staff located part time in each Division as required for consulting. Bring selected projects back to the Unit for statistical analysis and report the results.

**Train Divisional staff in basic statistical methods and in the use of statistical computer packages. (5%)**

Present short courses including: Introduction to GENSTAT5, Regression Modelling, Design and Analysis of Experiments, and Multivariate Analysis.

**Carry out biometrical research relevant to Divisional programs. (10%)**

Continue projects on Experimental Design, Generalized Linear Models, and Multivariate Analysis.

**Appropriation Total Allocation (includes earned appropriation revenues): \$418,900**

**Sponsored Research: \$Nil**

**Total Budget: \$418,900**

## **9. CORPORATE SERVICES DEPARTMENT**

### **Objectives**

***Coordinate the CSIRO budget process; provide management accounts to the Chief Executive and Executive Committee; produce the annual financial statements for CSIRO.***

***Develop a human resources strategy, and associated policies, to assist the Organisation attract, retain and develop high quality staff; provide professional human resource management advice to line managers.***

***Develop and maintain CSIRO's computer-based management, administrative, library and information systems, and provide a professional user education and support service Australia-wide.***

***Coordinate policies and standards for the financing, planning, design, construction, repair, maintenance and management of CSIRO's corporate property and accommodation.***

***Support the CSIRO library network and provide specialised information services on a cost recovery basis as far as is practicable.***

***Provide a corporate legal service.***

***Analyse and report on companies in which CSIRO has an interest.***

***Provide a focus for international relations in CSIRO.***

***Provide other 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 and effective scientific and industrial research. Its activities are directed towards the development of policies, the provision of advice and the coordination 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 operations of statutory authorities and business enterprises, and monitors and reports on the implementation of devolution and on adherence to corporate systems and policies.***

***The Department's work program and priorities are planned in close consultation with its key client groups: the Chief Executive, the Institutes and Divisions, and the Organisation's staff and their associations. In particular, its objectives are reviewed and ratified with the Chief Executive as part of the Department's planning. The Department reviews annually with the Institutes the nature, level of service and requirement for the services it delivers centrally.***

The Corporate Services Department is comprised of the Corporate Resources Branch, the Human Resources Branch, the Management Information Systems Branch, the Corporate Finance Unit, the Corporate Legal Service and the CSIRO International Relations Centre. 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.

**CORPORATE SERVICES DEPARTMENT****SUMMARY OF RESOURCES 1990-91**

(estimates as at 16 May 1990)

Branch/Unit	Prof Staff	Total <sup>a</sup> Staff	Approp Annual	Approp Capital	Approp <sup>b</sup> Total	Sponsored Research Funds	Total Annual
			(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)
Corporate Resources Branch	44.1	150.3	10,820.0	310.0	11,130.0	750.0	11,880.0
Human Resources Branch	12.8	46.1	3,490.0		3,490.0	490.0	3,980.0
Management Information Systems Branch	5.0	52.3	5,950.0		5,950.0		5,950.0
Corporate Finance	2.0	19.7	1,150.0		1,150.0		1,150.0
Corporate Legal Service		5.4	450.0		450.0		450.0
Centre for International Research Cooperation	3.0	5.0	340.0		340.0	600.0	940.0
Corporate Library and Information Service	1.0	3.0	230.0		230.0		230.0
Office of Director		2.7	230.0		230.0		230.0
<b>Total</b>	<b>67.9</b>	<b>284.5</b>	<b>22,670.0</b>	<b>310.0</b>	<b>22,980.0</b>	<b>1,840.0</b>	<b>24,820.0</b>

Note: Due to rounding, columns may not add exactly to totals.

a Staff numbers, expressed in equivalent full time units, as at 23 May 1990.

b Total Appropriation includes earned revenues.

## 9.1 FINANCES

	<p style="text-align: center;"><b><u>Objective</u></b></p> <p><b><i>Coordinate the CSIRO budget process; provide management accounts to the Chief Executive and Executive Committee; produce the annual financial statements for CSIRO.</i></b></p> <p style="text-align: center;"><b><u>Strategy</u></b></p> <p><b><i>Through closer consultation with Institutes and Divisions, the service provided by the Department supporting the Chief Executive's financial planning responsibility will continue to reflect recent trends in devolution and emphasise the responsibility of line managers.</i></b></p>
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Specific Objectives (Percent Resource)	Planned Outcomes
<b>Support financial planning for CSIRO by the Chief Executive and the Executive Committee and improve linkages between planning and budgetary processes. (15%)</b>	<p>In conjunction with the Institutes and other corporate groups, participate in the development by the Executive Committee of the Organisation's management plan with particular emphasis on financial planning aspects.</p> <p>Prepare management accounting reports for the Chief Executive on CSIRO's financial/budgetary position on a monthly basis.</p> <p>Convene discussions with Institutes and relevant corporate groups on enhancing the linkages between planning and budget processes and report to the Director in July 1990.</p>
<b>Prepare the Organisation's budget to meet research objectives and the Government's timetables for the Commonwealth Budget. (30%)</b>	<p>Develop and present the Organisation's 1990/91 budget for approval by the Executive Committee.</p> <p>Prepare the Organisation's Explanatory Notes for Parliament by August 1990.</p> <p>Compile and circulate information on the CSIRO budget 1990/91 to coincide with Government announcements on Budget night.</p> <p>Under the direction of the Executive Committee, consult on, develop and maintain internal and external timetables for the 1991/92–1993/94 triennium budget for presentation to Government by December 1990.</p> <p>Undertake corporate level negotiations in relation to the Organisation's overall budget including both specific internal components and external components.</p>
<b>Develop and maintain a corporate overview of sponsored research funding. (5%)</b>	<p>In consultation with Institutes, prepare reports on the level of and trends in CSIRO's external earnings for inclusion in the Chief Executive's monthly financial report.</p>
<b>Produce the annual financial statements for CSIRO. (30%)</b>	<p>Prepare a financial statement timetable by June 1990; complete signed financial statements by 30 September.</p> <p>Review expenditure and receipts for inclusion in the Chief Executive's monthly financial report.</p>

**Produce the financial management performance reports for the Executive Committee and Board. (5%)**

Prepare and circulate Divisional Management Accountability Checklists to Divisions.

Analyse responses and compile CSIRO Management Accountability Checklist by July 1990.

Report to the Executive Committee in July 1990 and the Board in August 1990.

**Specify effective and efficient accounting and reporting systems to support management decision-making. (5%)**

Examine feasibility of implementing full accrual accounting in CSIRO and report by October 1990.

**Provide reliable, accurate and informative data on the Organisation's research effort and the deployment of its human and financial resources. (10%)**

Compile distribution of research effort data for CSIRO using CSIRO, ABS and international classification schemes by October 1990.

Produce the CSIRO Data Book annually and the Personnel Statistics data book biannually in May and November.

Appropriation Total Allocation:	\$940,000
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Total Budget:	\$940,000
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## 9.2 PERSONNEL

**Objective**

***Develop a human resources strategy, and associated policies, to assist the Organisation attract, retain and develop high quality staff; provide professional human resource management advice to line managers.***

**Strategy**

***Changes in national industrial relations practices, such as award restructuring, are providing the catalyst to implement significant cultural changes in CSIRO in relation to the management of staff. Through a new human resources strategy developed in consultation with Institutes, Divisions and staff associations, the Organisation is seeking to introduce policies and practices which emphasise more effective career planning, staff development and reward systems based on performance and competence.***

**Specific Objectives**  
(Percent Resource)

**Planned Outcomes**

**Develop a Human Resource Strategy for CSIRO and place all human resource policies into a strategic framework. (15%)**

Prepare a Human Resources Strategic Plan by July 1990 for Board consideration in August 1990.

Specify by December 1990 additional enhancements to the CSIRO human resources MIS to meet the needs of effective career planning in the context of the HR Strategy.

Prepare CSIRO position papers on key award restructuring issues for the Executive Committee and the Industrial Relations Commission by July 1990.

**Develop policies, practices and implementation strategies to attract appropriate staff to CSIRO. (35%)**

Develop and promulgate guidelines on the implementation and operation of new Tenure and Redundancy Awards; report to the Executive Committee in July 1990.

Review future superannuation arrangements in CSIRO and present options to the Executive Committee by July 1990.

Introduce revised recruitment advertising arrangements.

Promote careers in science among young people in Australia.

**Develop policies, practices and implementation strategies to retain staff in CSIRO through suitable reward schemes, employment conditions and consultative processes. (30%)**

Implement by June 1991 flexible reward systems which encourage performance through incentives.

Arrange and conduct Consultative Council Meetings in October 1990 and April 1991; service Council sub-committees.

Implement a more effective and efficient grievance and appeals system by July 1990.

Develop a performance pay scheme by January 1991 and facilitate implementation on 1 July 1991.

Review the Bonus Scheme and facilitate implementation of any changes from July 1990.

Publish a "plain English" guide to employment practices and conditions for new staff by July 1990.

Monitor and report to the Executive Committee in December 1990 and June 1991 on Occupational Health and Safety and Equal Employment Opportunity matters, including the operation of work-based child care centres.

**Develop policies, practices and implementation strategies to assist line managers develop and deploy staff. (20%)**

Develop by July 1990 a career planning strategy for CSIRO which emphasises skills and knowledge (competencies) in addition to the more traditional qualifications and training for inclusion in the CSIRO Human Resources Strategy.

Review the corporate strategy for employee development and report to the Executive Committee by July 1990.

By June 1991, devolve a range of training and development activities to Divisions.

By December 1990, develop and implement procedures for measuring and evaluating training and development activities.

Modify the Performance Review and Development Scheme by January 1991 to be complementary to the Performance Pay Scheme and facilitate implementation on 1 July 1991.

Appropriation Total Allocation:	\$3,470,100
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Total Budget:	\$3,470,100
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### **9.3 MANAGEMENT INFORMATION SYSTEMS**

**Objective**

***Develop, and maintain CSIRO's computer-based management, administrative, library and information systems, and provide a professional user education and support service Australia-wide.***

**Strategy**

***Effective management information systems underly the Organisation's ability to plan, manage and report on its research effort. Management information systems will continue to be developed in consultation with Institutes, Divisions and corporate groups, utilising commercially available software packages where possible, to enhance these strategic activities and foster change in CSIRO.***

**Specific Objectives  
(Percent Resource)**

**Develop and maintain management information systems in a stable operational environment. (55%)**

**Provide and maintain a fast and efficient computing network for the transmission Australia-wide of voice and data, and in the future images. (15%)**

**Provide all users, including research staff, with responsive and professional hardware and software support services; actively communicate the capabilities available and the benefits to be derived from the creative use of information technology. (30%)**

**Planned Outcomes**

Up-grade administrative computing facilities by the implementation of an administrative mainframe environment managed by Fujitsu Australia Limited under a facilities management agreement.

Demonstrate by September 1990 a simplified path for senior managers to obtain integrated information from the management information systems.

Develop and implement software applications for micro-computer based systems which, by being independent of the hardware employed, will enable the use of existing Divisional research hardware in administrative applications.

Complete a communications network around Australia for administrative and research computing needs.

Coordinate all corporate network requirements for CSIRO, including additional networking for supercomputing, etc, and access/membership of the universities computer network.

Expand the range of hardware and communications platforms that can be supported in order to increase the opportunity for research managers to access the CSIRO management information systems.

Host user MIS conferences for each Institute by December 1990.

Increase user support and education and introduce an Institute account manager function from July 1990.

Appropriation Total Allocation:	\$4,912,600
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Total Budget:	\$4,912,600
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## **9.4 PROPERTY AND ACCOMMODATION**

**Objective**

*Coordinate policies and standards for the financing, planning, design, construction, repair, maintenance and management of CSIRO's corporate property and accommodation.*

**Strategy**

*Fundamental to the strategy is the concept that real property (ie land and buildings) is a corporate asset, to be developed and administered in the interests of and consistent with CSIRO's overall research objectives. The CSIRO estate comprises 177 sites and some 1800 buildings with a replacement value of \$1200 million. The property management strategy calls for continued rationalisation and concentration, increased refurbishment to extend operational life-times and effective repair and maintenance activity.*

**Specific Objectives**  
(Percent Resource)

**Planned Outcomes**

**Develop and advise on strategies and policies for the planning and management of CSIRO's property assets. (20%)**

In consultation with Institutes, develop the capital works programs within the Organisation's budgetary parameters.

Advise the CSIRO Board of progress regarding the implementation of the Property Management Strategy.

Implement and manage the approved Capital Investment Plan.

In consultation with Institutes, pursue concessional accommodation and/or capital development with States.

**Support Institutes and Divisions on property management matters through arranging technical and professional services associated with financing, design, construction, maintenance and security. (80%)**

Undertake valuations, negotiations, acquisitions, leasing and disposal activities.

Assist with the implementation of the Repairs and Maintenance (R&M) program and liaise with Divisions and Institutes to complete devolution of R&M financial operations by July 1990.

Coordinate and prepare planning studies for Clayton and Highett by June 1991.

Commence construction of the Black Mountain and North Ryde creches by July 1990 with completion planned for March 1991; finalise planning for the Clayton creche by December 1990.

Provide an energy management, security and R&M advisory service.

Appropriation Total Allocation:	\$1,060,000
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Total Budget:	\$1,060,000
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## **9.5 LIBRARY AND INFORMATION SERVICES**

**Objective**

***Support the CSIRO library network and provide specialised information services on a cost recovery basis as far as is practicable.***

**Strategy**

*CSIRO operates a network of 32 libraries which are supported by a computerised library management system and coordinated services (eg acquisitions, authority files, etc) to achieve cost effective performance. Journals of scientific research, monographs, magazines, films, videos and products of machine readable information are produced to enhance the Organisation's dissemination of scientific and technical information. Public access to technical information is facilitated through dial-in services.*

**Specific Objectives**  
*(Percent Resource)*

**Planned Outcomes**

**Advise the Chief Executive on options for increasing the effectiveness of existing information policies. (5%)**

Maintain liaison with organisations involved in the creation and dissemination of scientific and technical information.

Develop recommendations and report to the Chief Executive in August 1990.

**Provide advisory services to Institutes and Divisions in the use of print media, film and video and other communication technologies. (10%)**

Advise on the cost-effective use of external contractors for the provision of print, film, video and other communication media.

Provide high quality video production services at cost as required by Institutes and Divisions.

**Provide a publishing service to CSIRO to publish or co-publish scientific and technical information in various forms and to manage networks and services for specified target audiences. (30%)**

Publish on behalf of CSIRO, the Australian Academy of Science and the Standing Committee on Agriculture, 80 issues each year of the 12 Australian Journals of Scientific Research and the Australian Journal of Experimental Agriculture.

Publish, market and distribute 20–30 new scientific and technical monographs per year.

Operate the CSIRO Bookshop to market, process orders and distribute journals and CSIRO publications.

Compile, publish and distribute 14 issues per year of the research magazines Ecos, Rural Research and Industrial Research News.

**Coordinate the development and implementation of policies and standards within the CSIRO library network. (10%)**

In collaboration with Institutes and Divisions, review policies for CSIRO collections and report to the Executive Committee by December 1990.

Through the CSIRO Library Network Committee, assist in setting standards and guidelines for library services.

**Provide information services, including compiling and disseminating scientific and technical information to CSIRO and non-CSIRO users. (40%)**

Provide computerised on-line cataloguing, acquisitions and circulation services.

Provide reference and inter-library services to on-site users and to the CSIRO library network; participate in the Australian inter-library loan system.

Manage CSIRO serial subscriptions, including ordering and payment.

Operate an efficient exchange program for scientific and technical reference material.

Provide training support for CSIRO librarians, particularly in the use of the CLINES automated library system.

Maintain the CSIRO Index of published work.

Publish the 1990-91 Directory of CSIRO Research Programs by December 1990.

Compile scientific and technical databases; make these available online and through published products on a cost-recovery basis where appropriate; operate CSIRO AUSTRALIS and Search Party.

Maintain store of broadcast quality video images of CSIRO research and provide access for internal and external use.

Operate the CSIRO National Information Network to provide a first point of contact service in all States for scientific and technical information.

Provide translations of scientific and technical material at cost for CSIRO Divisions.

**Provide a library and information service at the CSIRO Limestone Avenue site.  
(5%)**

Produce the SCANFILE weekly abstract bulletin.

Appropriation Total Allocation:	\$6,760,600
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Total Budget:	\$6,760,600
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## 9.6 LEGAL SERVICES

**Objective**

***Provide a corporate legal service.***

**Strategy**

*The growing commercial orientation of CSIRO, and the increasingly litigious nature of Australian society, will require tighter management of legal issues, particularly in relations with outside parties, better education in basic law principles throughout the Organisation, better tools to help Divisions negotiate their own commercial arrangements and better back-up services to provide Divisions with answers to more complex legal questions.*

**Specific Objectives**  
*(Percent Resource)*

**Protect and improve CSIRO's legal position. (25%)**

Advise senior managers and negotiate on behalf of CSIRO, especially in commercial, litigation, administrative and compliance matters.

Review new legislation and developments in law.

Monitor the status of CSIRO's legal affairs.

Report regularly to the Chief Executive and formally to the Executive Committee annually (December).

**Assist with providing legislative cover that adequately provides for the Organisation's needs. (5%)**

Review present legislation associated with CSIRO, in particular the Science and Industry Research Act, and make recommendations to the Executive Committee on amendments no later than July 1991.

**Assist managers to improve handling of legal matters. (70%)**

Provide a legal advisory service to Institutes, Divisions and the units of the Corporate Centre.

Initiate a CSIRO legal handbook (loose-leaf, regular up-dates) by July 1990.

Run two "Legal Issues" seminars (September 1990, April 1991).

Develop other training services at cost in consultation with Institutes and Divisions.

**Appropriation Total Allocation:** \$178,500

**Total Budget:** \$178,500

## 9.7 COMPANY ANALYSIS

**Objective**

*Analyse and report on companies in which CSIRO has an interest.*

**Strategy**

*The increasing commercial orientation of CSIRO activities requires the Organisation to improve its capacity to provide sound commercial advice to staff members who become involved in commercial operations. Both Sirotech and the Corporate Services Department have a role in this activity. The strategy will be to emphasise the positive role CSIRO staff can play in enhancing the performance of companies and to reduce the risk to CSIRO arising from poor commercial performance of companies in which the Organisation has an interest.*

**Specific Objectives**  
(Percent Resource)

**Enhance company performance and minimise risk to CSIRO in relation to companies in which CSIRO has equity interest or board members by supporting CSIRO company board members with a professional financial analysis and advisory service. (100%)**

**Planned Outcomes**

In consultation with Sirotech and Institutes, develop and maintain a listing of companies with CSIRO equity interest showing guarantees provided by CSIRO and maintain a record of CSIRO staff on company boards or office holders in companies – target: July 1990.

Maintain a registry of legal documentation associated with equity holdings and CSIRO representation on boards.

Develop a procedure for managing CSIRO's equity holdings by September 1990.

Provide advisory services to CSIRO representatives on boards covering financial and legal responsibilities.

By July 1990, develop a framework for analysing and reporting prior to board meetings on company performance and financial positions with particular emphasis on performance in relation to industry standards, rate of return issues, assets, equity and potential for dividend return.

Report on financial aspects to the CSIRO Board in December 1990, report on legal aspects regularly to the Chief Executive and formally to the Executive Committee and the Board annually (September).

Appropriation Total Allocation:	\$250,000
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Total Budget:	\$250,000
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## **9.8 INTERNATIONAL RELATIONS**

***Objective***

***Provide a focus for international relations in CSIRO.***

***Strategy***

*International cooperation in scientific and industrial research can be fostered through developing interactions, and maintaining networks, with government departments, foreign legations and overseas research agencies. By extending the existing network, and developing and promoting services for Institutes and Divisions, international relations can be improved and cooperation increased.*

**Specific Objectives**  
*(Percent Resource)*

**Support CSIRO's corporate and statutory responsibilities in relation to international matters. (75%)**

**Planned Outcomes**

Provide advice to the Chief Executive on international relations matters and support the development of corporate policy on international relations.

Foster CSIRO's contributions to international scientific collaboration and technical cooperation.

Increase the awareness of the public, industry and overseas bodies to CSIRO's international activities; produce the Biennial Report on CSIRO's international activities for the period July 1988 to June 1990 by November 1990.

Represent CSIRO at appropriate meetings and conferences (including Australian representation on the Commonwealth Science Council in October 1990).

Facilitate visits of overseas delegations to CSIRO.

**Provide services to Institutes and Divisions on international matters. (25%)**

Manage and develop opportunities for training programs and attachments for overseas trainees.

Provide advice on current policy on international matters and its impact on CSIRO's operations.

Assist in identifying opportunities for overseas consulting and project work.

Produce an international relations newsletter quarterly.

<b>Appropriation Total Allocation:</b>	\$318,200
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<b>Total Budget:</b>	\$318,200
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## 9.9 CENTRAL SERVICES

**Objective**

***Provide other support and advisory services to CSIRO best delivered centrally.***

**Strategy**

*Central services are provided by the Corporate Services Department to take advantage of economies of scale or where an identified need exists at a corporate level. Services are provided in close consultation with Institutes and Divisions to ensure that economies are real and services needed.*

**Specific Objectives**  
(Percent Resource)

**Planned Outcomes**

**Support the Chief Executive and Directors on corporate-level commercialisation policy issues. (5%)**

Support the Chief Executive in the development and coordination of corporate commercialisation policies and provide a central point of contact for liaison within CSIRO and with industry and other Government agencies.

Interface with Sirotech and brief the Chief Executive and other CSIRO board members for monthly Sirotech Board meetings and on Sirotech activities generally.

Arrange preparation, publication and distribution of material covering the protection of commercially confidential information and CSIRO's policy on equity investments and charge-out rates for R&D by July 1990.

Develop and provide procurement policy and procedural advice to Institutes, Divisions and suppliers.

Review the implementation of the Australian Government Credit card and make recommendations about future use throughout CSIRO.

**Develop and assist in the implementation of effective corporate policy and procedures on procurement of goods and services. (5%)**

Arrange and manage major contracts, corporate contracts and pricing agreements.

**Provide assistance with the negotiation and coordination of major contracts. (5%)**

Produce and issue a revision of the current CSIRO Financial Directions by July 1990.

**Facilitate the implementation of an effective risk management program in CSIRO. (5%)**

Convene a Risk Management Working Party to develop concepts for consideration.

Report on options to the Executive Committee.

Promulgate new policy and procedures throughout the Organisation by August 1990.

**Provide an efficient payroll service for CSIRO staff, provide other services, including a superannuation processing and advisory service and archives, and provide efficient and effective administrative support at CSIRO Headquarters. (75%)**

Integrate new superannuation arrangements into the functions of the Corporate Payroll Office by August 1990.

Provide administrative services at CSIRO Headquarters.

Operate the CSIRO Archives.

**Appropriation Total Allocation:** \$3,436,600

**Total Budget:** \$3,436,600

## **10. SIROTECH LIMITED**

Sirotech Limited is a company wholly owned by CSIRO and limited by guarantee. Its main income is derived through work done for CSIRO. Its role is defined below.

### **Objective**

***To create new opportunities for business and increased competitiveness in Australian industry based on new or improved technologies from CSIRO and to generate funds for CSIRO by facilitating transfer of its research results.***

### **Strategies**

*Sirotech will carry out this objective by continuing to provide a service to CSIRO through a team of competent professionals, well trained and experienced in the role of technology transfer. Sirotech's advice will help CSIRO structure its commercial relationships with Australian industry in such a way as to facilitate commercial success and in addition to ensure that CSIRO obtains fair market value for contributions it makes to these business opportunities. The skills available within Sirotech ensure that a full spectrum of commercial arrangements can be embarked upon, and embrace patents, intellectual property, legal, financial and general commercial skills.*

### **Services Offered**

- . *Commercial and professional evaluation and advice, in relation to intellectual property, particularly patents;*
- . *Creation and maintenance of the CSIRO patent portfolio and other CSIRO intellectual property;*
- . *Creation and maintenance of CSIRO Agreements and intellectual property data bases;*
- . *Identify industry research needs through increased Division-level contact;*
- . *Market assessment of research results to ascertain commercial viability;*
- . *Maintenance of market and company data base;*
- . *Location and evaluation of commercial partners;*
- . *Negotiation of agreements;*
- . *Advice on financial/legal implications of technology transfer arrangements;*
- . *Management of joint ventures on behalf of CSIRO;*
- . *Licence audit and collections;*
- . *Assist in defining commercial objectives for improved project management; and*
- . *Help commercialise identified areas of CSIRO research by most appropriate means.*

### **Financial:**

New CSIRO Contract and Royalty Income:	\$16,000,000
Running Costs:	\$ 3,800,000

# Australian Science, Australia's Future

## ► 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.

