SCIENCE AND TECHNOLOGY STATEMENT 1987–88

MAY 1988

DEPARTMENT OF INDUSTRY, TECHNOLOGY AND COMMERCE

Department of Industry, Technology and Commerce

SCIENCE AND TECHNOLOGY STATEMENT 1987-88

A statement on the Commonwealth Government sector prepared by the Department of Industry, Technology and Commerce on the basis of information provided by agencies of the Commonwealth Government.

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PREFACE

The 1987-88 Science and Technology Statement provides evidence of the Government's continuing commitment to the support of Australia's scientific and technological activities, particularly research and development. This support is now even more critical to Australia's
economic health.

The rapid deterioration in our terms of trade over recent years has exposed a number of long-standing weaknesses in Australia's economic infrastructure. Our industrial and social structure was based on the naive assumption that to continue being one of the world's richest countries, we need only continue producing raw materials from our abundant natural resources, and these materials would continue to demand premium prices on the world market. Not enough consideration was paid to the development of internationally competitive manufacturing and services industries - these were only tools to be supported in the domestic market to help maintain high levels of employment.

We have had a rude awakening.

With our primary products in agriculture and mining earning less revenue as prices and demand fall, and with our balance of trade in technology-based products falling increasingly behind, we must redirect our efforts towards developing strong, export-oriented manufacturing and services industries. These industries must be able to compete in a global market-place, and hence must be internationally competitive in all facets of development, production, marketing and delivery.

The Government has adopted a broad range of measures to achieve this. A primary aim of our policy is to improve Australia's economic and technological linkages with the world economy. Recent developments in world stockmarkets have shown that it is essential to build a very firm base for the revitalisation of existing industries and the development of new industries. Science and technology are at the core of this base, whose essential components include a strong R&D effort in industry, government and higher education, effective technology transfer to Australia, and an appropriately trained workforce.

In the R&D field, our efforts have been in two phases. The Government's first priority was to increase the performance of R&D by business enterprises. Without such activity, companies are not only unable to develop new, potentially significant ideas, but they are seriously impaired in their capacity to improve on existing products and processes, or adopt innovations from other countries.

The introduction of the 150% tax incentive scheme for industry R&D, the establishment of the Management and Investment Companies Licensing Scheme, and the creation of the Grants for Industry Research and Development Scheme, have been significant features in improving the innovatory capacity of Australian companies. Part of the schemes' success may be seen in the dramatic increase in business enterprise R&D expenditure over the last five years.

Our second priority has been to ensure that Australia's substantial public investment in government and higher education R&D is managed efficiently, and is more attuned to the country's economic and social well-being. Accordingly, the Government recently instituted a number of measures to achieve these aims.

Two of Australia's most significant Government research organisations are CSIRO and the Australian Nuclear Science and Technology Organisation (ANSTO, formerly the Australian Atomic Energy Commission). CSIRO has been substantially reorganised following several reviews. As described in last year's Science and Technology Statement, the Government reaffirmed that CSIRO's major role is to carry out world-class research of strategic, long-term importance to Australia. However, a number of changes in CSIRO's institute and management structures have been initiated to allow for a more effective use of resources, to expand interactions between CSIRO, industry and higher education, and to encourage better transfer of research results to Australian industry.

Following its recent formation, ANSTO's research will be directed away from the nuclear fuel cycle and towards other peaceful and socially beneficial uses of related technologies. Like CSIRO, it will also have a greater orientation towards potential economic gains from its research.

In the higher education sector, the Government is establishing an Australian Research Council (ARC). The ARC will advise on research priorities and ensure a greater concentration of effort within the higher education research sector, where despite some excellent work by individuals, much of our effort has been fragmented. The ARC will seek to ensure that an adequate national effort is maintained in basic science, as well as aiming to enhance the level of scientific interaction between higher education, industry and government. We must ensure that we maintain our well-established capabilities in scientific research as a major springboard for the discoveries on which future generations will depend.

All these elements will encourage a greater integration of Australia's research efforts. They will increase the potential for effective transfer of the results of our costly research activity to the creation and maintenance of competitive, export-oriented industries which can contribute to Australia's economic and social well-being.

The Government is particularly concerned with correcting problems within the infrastructure of Australian industries. A key element is the contribution of the Australian workforce to the development of advanced industries. We need an educated, flexible workforce, with a good understanding of the science and engineering disciplines, and able to contribute fully to the dynamic, advanced industries of the future.

We must all recognise that a secondary or tertiary education of five or ten or twenty years ago is no longer sufficient to ensure stable employment for life. The world is changing rapidly, and with it the demand for specific skills. We cannot predict with any certainty what the future demand for particular skills will be, but we can be quite confident that science, technology and engineering will play a considerable role in determining the skills required. Flexibility of attitude and a good basic understanding of these areas will increase significantly our opportunities to learn the new skills required. To this end, the Government intends to improve Australia's poor record in retention rates at secondary school, is reviewing the funding of the higher education sector, and is increasing the number of places available for students in tertiary education, particularly in science and engineering courses.

Australia still faces difficult times, but the problems are not insurmountable. We need to develop a more productive culture aware of scientific discovery and technological development, open to innovation and alert to opportunity. There is no reason why we cannot improve the social and economic life of all Australians, but effort and changes in attitude are required. Wider recognition of the potential of scientific research, the challenge of technological change, and the necessity for a more innovative outlook in industry will be essential.

John Button Barry O Jones

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DEVELOPMENT OF THE STATEMENT

This is the ninth annual Statement providing detailed information about expenditure by the Commonwealth Government in support of science and technology (S&T).

It should be emphasised that the Science and Technology Statement is only one among a number of sources of information on Commonwealth Government involvement in scientific and technological matters. The Department of Industry, Technology and Commerce is continuing to develop other elements of a larger package of source material for policy makers, policy analysts and advisers, and others concerned with science and technology.

There is a consistent effort to maintain compatibility with international practice, particularly in relation to the terminology and definitions adopted by OECD and UNESCO. One persistent point of confusion to some has been the common usage of "science and technology" as being synonymous with the natural sciences and engineering (NSE), whereas in international usage it extends to the social sciences and humanities (SSH).

The Science and Technology Statement is an evolving document and suggestions are welcome as to how it should change in the future. Any such suggestions should be directed to:

The Director
Science and Technology Indicators
Science and Technology Policy Branch
Department of Industry, Technology and Commerce
GPO Box 9839
CANBERRA
ACT 2600

A number of tables presented in previous editions of the Statement are no longer included. Readers with a need for this information are invited to write to the address above.

The Department of Industry, Technology and Commerce acknowledges the close co-operation of other Commonwealth agencies and the work of their staff in the prompt provision of information for this Statement. DITAC officers principally responsible for preparing this edition were Diane Nash, Stephen Reye, David Fayle, Ian McMahon and Kevin Bryant.

ACCURACY AND ROUNDING CONVENTION

With few exceptions, clearly indicated in the relevant tables, all numerical data represent actual expenditures in millions of Australian dollars. Entries have been rounded to the next $million, $0.1m, or $0.01m, according to the level of aggregation of the tables. It should be recognised, however, that the data are often less accurate than implied. This is because - although most large items are checked against the relevant Budget appropriations or other financial statements - the disaggregation and itemisation required by the Statement entails some estimation by the responding agencies. Some discrepancies between quoted totals and actual sums of components listed in tables are due to rounding.

CHAPTER 1

BROAD DEVELOPMENTS OF THE PAST YEAR

In the past year the Government has initiated a number of reforms within several large Government R&D organisations and support schemes. These reforms are aimed primarily at increasing the efficiency of the use of resources and promoting the capability of Australia's extensive government-funded R&D programs to make a greater contribution to Australia's social and economic well-being and international competitiveness. These reforms complement earlier measures such as the introduction of the Management and Investment Companies Scheme and the 150% tax concession for industry R&D, which were designed to improve industry competitiveness by increasing the R&D performance of Australian business enterprises.

1.1 Reorganisation of CSIRO

In July, 1987, the Chairman of CSIRO, the Hon Neville Wran QC, announced a major reorganisation of CSIRO. This reorganisation, which follows a review by the Australian Science and Technology Council (ASTEC) and a study by McKinsey and Company, aims to place greater emphasis on the link between scientific research and its economic and social benefits to Australia.

The main role of CSIRO will continue to be the performance of long-term strategic research which is of potential benefit to Australia and which is beyond the capabilities of individual Australian companies or agencies. To carry out this role effectively, it is essential that CSIRO scientists remain at the forefront of international developments in science and technology. However, to enable the full contribution to economic growth and social well-being of this research to be realised, these research results must be effectively transferred to Australian industry and other users .

In the restructure, the existing 41 divisions, presently grouped into five institutes, will be reorganised into 32 divisions in six institutes. The proposed new institutes are:

. Institute of Information and Communication Technologies

. Institute of Industrial Technologies

. Institute of Minerals, Energy and Construction

. Institute of Animal Production and Processing

. Institute of Plant Production and Processing

. Institute of Natural Resources and Environment.

Other facets of the reorganisation are that:

. the new divisions and institutes will be more closely allied to industry and community groups

. there will be tighter monitoring of CSIRO's research to maximise its economic or social value to the Australian community, while maintaining scientific excellence

. the divisions and institutes will perform more of their own administrative work, and line management will be strengthened by giving chiefs of divisons and directors of institutes greater authority and greater accountability for their decisions and efficient use of resources

. a vigorous program of management training will be instituted

. the corporate centre will be streamlined.

These changes are designed to ensure that CSIRO plays a major role in the development of Australia's manufacturing and technological capacity. (Further details of CSIRO's research is given in pages 117 to 132.)

1.2 Formation of Australian Nuclear Science and Technology Organisation (ANSTO)

The Australian Nuclear Science and Technology Organisation (ANSTO) was formed in April 1987, replacing the Australian Atomic Energy Commission (AAEC). ANSTO was created to provide a new direction for nuclear science and technology in Australia. Its research focus is shifted away from work on the nuclear fuel cycle, in particular power generation, and towards other peaceful and socially beneficial uses of related nuclear technologies.

In particular, ANSTO will concentrate on radiation and radioisotope applications in the medical, industrial, agricultural and scientific fields. It will have a greater orientation towards potential economic gains from its research than its predecessor. The legislation creating ANSTO expressly prohibits the organisation from undertaking any research into the design or production of nuclear weapons or other nuclear explosive devices. (Further details of ANSTO's research is given in page 112.)

1.3 Higher Education Sector

As part of the Government's concern with improving the direction and effectiveness of publicly-funded research, ASTEC has reviewed R&D in the higher education sector (see its report "Improving the Research Performance of Australian Universities and Other Higher Education Institutions").

Following consideration of ASTEC's review, the Government has announced that it will establish an Australian Research Council (ARC) to advise on research priorities and to ensure a greater concentration of effort within higher education research.

The ARC will provide advice on national priorities for higher education research and on the coordination of the national research effort. Its recommendations will include measures to:

. support both fundamental research and research which will directly contribute to national economic and social development

. enhance the training of research personnel

. improve the interaction between the higher education research sector and industry and other government research sectors.

The immediate priorities of the ARC are:

. to concentrate and coordinate existing research schemes. The ARC will be responsible for advising on funds presently allocated to the Australian Research Grants Scheme, the National Research Fellowships and Queen Elizabeth II Fellowships Schemes, the Marine Science and Technology Grants Scheme, the Commonwealth Postgraduate Awards Scheme, Grants to Learned Academies, and (in cooperation with CTEC) Grants for Special Research Centres and Key Centres of Teaching and Research.

. to make those research funds, currently provided to higher education institutions as general recurrent funds, more competitive. Enhanced competitiveness will ensure that the most able researchers and the most promising projects are adequately supported.

The Government will also provide, for the first time, a pool of research funds to be distributed to technological institutions in the advanced education sector which have the capacity for high-level research in areas of strategic importance to Australia.

As part of its general program of improving Australia's skills and workforce capabilities, the Commonwealth (through the Employment, Education and Training portfolio) has established among its priorities an increase in tertiary education participation, and an increase in enrolments in science/technology courses and other courses of direct relevance to future economic requirements. The Government has announced that it will review future funding directions for the higher education sector in detail. In addition, the Government has approved funding for an additional intake of 3500-4000 young school leavers in 1988, and is seeking to encourage greater industry involvement in the funding of higher education and in defining objectives. These efforts should go some way towards improving Australia's poor record of participation in higher education, compared to many of our major trading partners, and help provide the skilled workforce needed for Australia to become a more technologically-oriented country.

1.4 Partnerships in Development Agreements

Transnational companies have the capacity to play a large part in the processes of technology transfer to Australia and improving the export competitiveness of Australian industry. The Government sees that very substantial opportunities can be opened up by promoting appropriate investment by these companies in Australia.

A new category, "Partnership for Development Agreement", has been created as an adjunct to the Offsets Program. Transnational companies which wish to invest in Australia are encouraged to enter into such agreements with Commonwealth and State civil offsets authorities. Under these Agreements, the companies aim to achieve mutually agreed product development and export/import ratios, such as R&D as 5 per cent of turnover and a 50 per cent export/import ratio within seven years. The product development and competitive export activity can be undertaken within the participating company or Australian-owned firms. However the overseas owned corporation must clearly facilitate the activity. Transnational companies which enter into these agreements are exempted from other applications of the Offsets Program.

1.5 New Venture Capital Developments

The availability of adequate finance is one of the key constraints to the development of new, technology-based industries necessary for the future generation of wealth and employment in Australia. In 1984 the Government established the Management and Investment Companies Scheme to catalyse the development of an adequate venture capital market in Australia. The success of this initiative may be seen in the rapid growth of this market in Australia.

However, there still appears to be problems in attracting sufficient funds at the seed/start-up end of the venture capital market. This area is particularly important in the development of high technology industries.

In order to encourage international investment in this field, the Government has announced that companies with offsets obligations may discharge these obligations by investment in approved venture capital funds in Australia. In return for the investment (for a minimum of five years), the companies receive a three times multiplier, plus an offsets credit for any exports which the investment later produces. The funds managers must invest in the seed/start-up end of the venture capital market.

1.6 Information Industries Strategy

The Commonwealth Government has announced an Information Industries Strategy to help treble the size of Australia's high technology computers and communication industries within the next decade. At present Australia has a trade gap of $4000 million in the information industries, and on current trends this is forecast to rise to $10,000 million by the early 1990s, becoming the largest contributor to Australia's trade deficit.

The Strategy contains a set of initiatives relating to education and training, international markets and technological issues, offsets and product development and regulatory matters. These initiatives aim to encourage the rapid growth of the information industies within Australia, and encourage their export orientation. Among the initiatives are:

. to increase substantially intakes into undergraduate courses in electronics engineering, computer science and other relevant disciplines

. implement communications equipment and software export strategies, and develop strategies for computer hardware and information and communications services

. establish a regional technology development program to promote cooperative R&D efforts in order to encourage regional specialisation in particular goods and services

. increase participation in cooperative and collaborative agreements such as the US International Partnership for the Commercialisation of Technology (INPACT) and government-industry R&D programs

. utilise the offsets program to encourage full participation of transnational corporations, particularly by achieving agreed levels of performance in terms of exports and R&D

. establish communications technology as a generic technology within the Grants for Industry Research and Development (GIRD) Scheme

. establish a National Procurement Development Program which, inter alia, would assist the development and trialling of information industries products to meet government purchasing requirements.

CHAPTER 2

RECENT TRENDS IN COMMONWEALTH FUNDED S&T 2.1

2.1 Summary

Table 1 and Figure 1 present broad summaries of the information presented in this section, with references to tables presenting further dissections. The Table refers to the total of the Budget sector (net expenditure) and the Non-Budget sector and thus represents Commonwealth "own funds". Budget sector figures are net of recoveries and comprise expenditures from appropriations specifically identified for R&D, estimated expenditures on R&D from other appropriations, and, in the case of Research Trust Funds, the R&D expenditures from the Trust funds which can be attributed on a pro-rata basis to an appropriation. Commonwealth non-Budget sector figures represent the R&D funded by Commonwealth bodies from their own funds (other than direct appropriations). These consist mainly of trading revenues of government enterprises, disposals of plant, sales of publications, and residuals of appropriations retained from previous years.

To discuss trends in expenditure in terms of the levels of activity being supported, the expenditures should ideally be expressed at constant price levels, and adjustments should be made to remove the effects of any expenditure changes which did not influence the level of real activity. This is discussed further in Appendix D under the heading "Estimation of trends in real terms". The price indices used to obtain the constant price estimates in Table 1 (broad trends) and Table 10 (socio-economic objective aggregates) are presented in Table 19 of that Appendix. Figure 1 also summarises this constant price information and the same indices are applied to derive the real growth rates in various socio-economic objectives as outlined later in Chapter 3. All other expenditures throughout the document are at current prices.

Projected Commonwealth direct expenditure of $1179m on R&D for 1987-88 shows almost no increase relative to the 1986-87 total of $1178.5m (Table 1.1). This represents a real decrease of about 5.9%.

Over the period 1978-79 to 1987-88 the average real growth rate in all R&D expenditure directly funded by the Commonwealth was 1.6% per annum.

In addition to **direct** Commonwealth support for R&D, there are additional costs incurred through the research component of teaching-and-research expenditures in the higher education sector (see A9.7, p.93), and through revenue foregone by the Commonwealth via both the 150% tax concession scheme for industrial R&D and the 100% tax deduction available for equity subscriptions in Management Investment Companies (MICs). The cost of assistance under the Bounty (Computers) Act 1984, may also be considered as R&D support. Estimates for these additional costs are given in a footnote to Table 1.1 and used to derive approximate costs for all Commonwealth support for R&D. These totals should be regarded as indicative only.

When these factors are added, the approximate cost of all Commonwealth support for R&D in 1987-88 is estimated to be about $1840m (Table 1.1, Part A), an increase of 4.4% over 1986-87. In real terms, this represents a decrease of approximately 1.7% in support compared with 1986-87. However, R&D support in 1987-88 is projected to be 4.8% greater in real terms than in 1985-86. In other words, a real increase in Commonwealth R&D support has accompanied the change in emphasis away from direct funding towards tax incentives for industrial R&D.

The costs of revenue foregone under the 150% tax concession scheme for industrial R&D are shown on p.6 in a footnote to Table 1.1. It should be noted that the additional expenditure which the scheme stimulates in industry occurs before the revenue is foregone. A separate set of estimates of the effective support for R&D at the time of performance is given in a footnote to Table 9 (pp 25-26).

Table 1.1: Summary of trends in Commonwealth Government support for R&D, 1982-83 to projected 1987-88.

($ million)	R & D					
	82-83	83-84	84-85	85-86	86-87	Proj 87-88
PART A: Approximate cost of all Commonwealth support for R&D (including tax incentives and bounty for industrial R&D and the estimated research components of higher education teaching-plus-research expenditure *):						
$m current	1206	1271	1420	1570	1763	1840
% of total Commonwealth outlays	2.471	2.252	2.228	2.245	2.354	2.355
% of GDP	0.709	0.661	0.661	0.654	0.667	0.633
at constant 1986-87 prices ($m):	1554	1539	1621	1679	1763	1727
PART B: Commonwealth sector direct expenditure * (from Commonwealth sources): **including** Commonwealth Business and Financial Enterprises:						
$m current	896	941	1012	1107	1179	1179
% of total Commonwealth outlays	1.835	1.667	1.589	1.583	1.574	1.508
% of GDP	0.527	0.489	0.471	0.461	0.446	0.405
at constant 1986-87 prices ($m):	1143	1133	1149	1179	1179	1109
PART C: Commonwealth sector direct expenditure * (from Commonwealth sources): **excluding** Commonwealth Business and Financial Enterprises *#:*						
$m current	849	890	960	1044	1114	1125
% of total Commonwealth outlays	1.741	1.576	1.506	1.494	1.487	1.439
% of GDP	0.500	0.463	0.447	0.435	0.421	0.387
at constant 1986-87 prices ($m):	1084	1071	1089	1112	1114	1059

* Direct R&D expenditure does not contain estimates for the research components of higher education sector teaching-and-research expenditure (see A9.7, p 101), nor does it include revenue foregone due to tax incentives for industrial R&D. Estimates of the total cost of Commonwealth support for R&D include these components ($m current prices):

Estimated R&D Component of General University Funding:	310	330	406	430	460	490
Estimated Costs of Relevant Industrial R&D Tax Incentives:				20	105	150
Assistance under the Bounty (Computers) Act 1984			1.5	13.2	19.4	20.9

Note that the estimated costs of the tax incentive scheme are allocated to the year in which revenue is foregone rather than the year in which the R&D was performed.

Table 1.2: Summary of trends in Commonwealth Government support for S&T, 1982-83 to projected 1987-88.

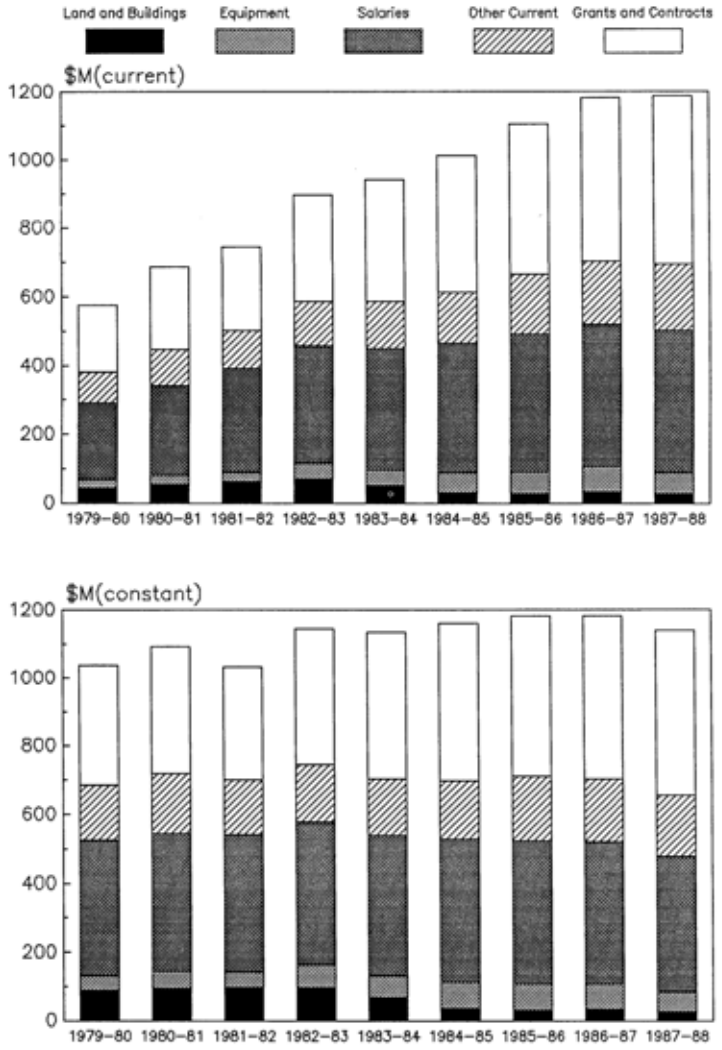
	S&T (including R&D)					
	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Commonwealth sector direct expenditure on S&T (from Commonwealth sources): **including** Commonwealth Business and Financial Enterprises:						
$m current	1609	1719	1883	2069	2240	2162
% of total Commonwealth outlays	3.298	3.046	2.955	2.959	2.990	2.766
% of GDP	0.947	0.894	0.877	0.861	0.846	0.743
excluding Commonwealth Business and Financial Enterprises #:						
$m current	1462	1567	1698	1887	2034	1978
% of total Commonwealth outlays	2.996	2.776	2.665	2.699	2.716	2.531
% of GDP	0.860	0.815	0.791	0.786	0.768	0.680
Total Commonwealth outlays ($m)	48793	56432	63714	69918	74899	78146 &
GDP ($m)	169921	192276	214735	240136	264400	290688

& Estimate based on Budget predictions.

The Commonwealth business enterprises excluded are Telecom, Australia Post, Overseas Telecommunications Commission, the Snowy Mountains Engineering Corporation, and AUSSAT Pty Ltd; financial enterprises excluded are the Reserve Bank and the Commonwealth Bank.

Note: Table 3 presents a breakdown of intramural expenditure by ministry and agency with major R&D performance. Table 4 presents a similar breakdown of extramural payments by ministry and major granting program. Tables 5 and 6 show the amounts of extramural payments (grants in Table 5 and contracts in Table 6) going to particular sectors.

Fig. 1. Commonwealth Funds Expended on R&D by Type of Expenditure.



2.2 S&T Expenditure by Ministry

Table 2 is a presentation of aggregate Commonwealth funds expended on S&T by ministry. Further dissections are provided in Tables 3 and 4.

The main trends evident in data presented by ministry in Table 2 may be compared with trends in aggregate expenditures directed towards particular socio-economic objective categories as used in the Australian Bureau of Statistics R&D survey. Further explanation is given in Appendix D. Fig 2 below is a visual display of the data for direct Commonwealth funding presented in Table 2, for 1986-87.

Table 2 also includes the estimates for additional costs incurred by the Commonwealth for R&D support, details of which are given in Table 1.

Fig. 2 Commonwealth Funding of R&D by Ministry, 1986-87.

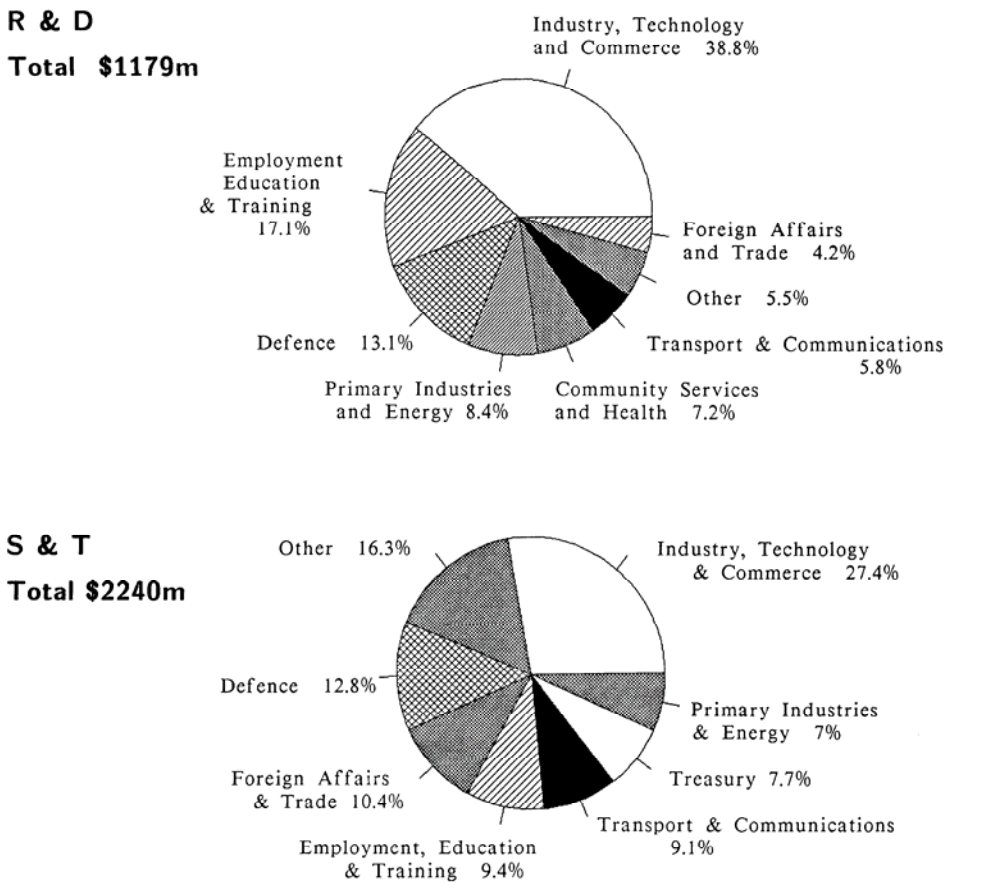


Table 2: Commonwealth Government funds expended on R&D by ministry with prime responsibility for planning the expenditure*

($ million)	R& D					
	82-83	83-84	84-85	85-86	86-87	Proj 87-88
1) Commonwealth sector direct expenditure (excluding Commonwealth business enterprises)						
Aboriginal Affairs	0.66	0.52	0.65	0.53	0.73	0.74
Administrative Services	3.68	3.65	4.11	3.73	3.73	4.18
Arts, Sport, the Environment, Tourism and Territories	24.71	25.00	27.96	29.91	36.49	37.48
Attorney-General's	4.06	4.56	5.98	6.11	5.70	5.93
Community Services and Health	50.12	60.38	70.51	76.35	85.07	87.63
Defence	114.43	121.21	132.99	139.07	153.61	148.22
Employment, Education and Training	137.58	154.25	171.01	192.21	201.72	208.73
Finance	-	-	-	-	-	
Foreign Affairs and Trade	30.25	32.62	40.27	40.14	49.89	37.66
Immigration, Local Government and Ethnic Affairs	0.62	0.25	0.41	0.47	0.70	0.71
Industrial Relations	0.01	0.00	0.26	1.27	1.36	0.95
Industry, Technology and Commerce	419.51	420.54	419.18	459.69	458.22	461.06
Primary Industries and Energy	50.47	54.96	72.02	78.62	95.96	109.32
Prime Minister and Cabinet	0.06	0.07	0.06	0.09	0.35	1.23
Social Security	0.59	0.68	0.68	0.64	0.73	0.78
Transport and Communications	5.83	5.95	5.95	6.68	8.78	9.80
Treasury	6.34	4.57	6.96	8.14	10.88	10.20
Veterans' Affairs	0.40	0.37	0.42	0.63	0.70	0.70
Total Commonwealth sector direct expenditure (excluding business enterprises)	849	890	960	1044	1114	1125

(Table 2 continued)

($ million)	R& D					
	82-83	83-84	84-85	85-86	86-87	Proj 87-88
2) Expenditure of Commonwealth business enterprises (see Table 1 footnote)						
Transport and Communications	44.07	44.20	46.94	57.75	59.90	50.48
Treasury	2.10	7.14	5.89	4.74	4.19	3.74
Total Commonwealth business enterprises	46.17	51.34	52.83	62.49	64.09	54.22
Total Commonwealth sector direct expenditure (including business enterprises)	896	941	1012	1107	1179	1179

* Every program or organisation surveyed has been classified to the Ministry currently responsible for it. As a consequence, the data prior to 1987-88 do not reflect the actual portfolios. Previous S&T Statements should be consulted for such data. See Tables 3 and 4 for more detailed dissections of expenditure by ministry.

Other major Commonwealth support for R&D includes (in $million):

General University Funding:	310	330	406	430	460	490
Estimated Costs of Relevant Industrial R&D Tax Incentives:	-	-	-	20	105	150
Assistance under the Bounty (Computers) Act 1984	-	-	1.5	13.2	19.4	20.9

Note that the estimated costs of the tax incentive scheme are allocated to the year in which revenue is foregone rather than the year in which the R&D was performed.

2.3 Overview of Major R&D agencies and granting programs

Tables 3 and 4 show intramural R&D expenditure within Commonwealth bodies (Table 3), with the larger agencies separately identified, and extramural payments (Table 4) with major R&D granting programs shown. For data prior to 1985-86 see the 1986-87 Science and Technology Statement.

Table 3: Intramural Commonwealth expenditure on R&D by ministry, showing agencies with major R&D performance.

($ million)	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Aboriginal Affairs	**0.47**	**0.17**	**0.06**	**0.05**	**0.51**	**0.52**
Administrative Services	**3.56**	**3.51**	**3.96**	**3.57**	**3.73**	**4.18**
Arts, Sport, Environment, Tourism & Territories	**23.88**	**23.93**	**26.50**	**28.33**	**33.83**	**35.09**
Supervising Scientist	5.67	4.26	4.40	4.28	5.85	5.81
Attorney General's	**3.60**	**4.27**	**5.52**	**5.75**	**5.52**	**5.75**
Community Services and Health	**15.76**	**17.71**	**18.36**	**20.16**	**21.79**	**21.15**
Australian Radiation Laboratory	2.78	2.41	2.58	2.96	2.80	3.05
National Acoustics Laboratory	1.88	2.87	1.78	2.22	2.40	2.59
Commonwealth Serum Lab	5.00	5.50	6.22	7.22	8.89	8.89
Defence	**113.38**	**120.30**	**131.88**	**137.99**	**152.64**	**147.22**
DSTO	n.a.	n.a.	n.a.	137.99	152.33	146.66
Employment, Education & Training	**2.86**	**2.99**	**3.48**	**3.79**	**4.56**	**3.33**
Foreign Affairs and Trade	**0.00**	**0.00**	**0.00**	**0.00**	**1.89**	**2.00**
Immigration, Local Government & Ethnic Affairs	**0.29**	**0.09**	**0.18**	**0.24**	**0.35**	**0.35**
Industrial Relations	0.00	0.00	0.00	0.00	0.10	0.10
Industry, Technology and Commerce	**365.99**	**355.59**	**357.72**	**391.26**	**398.70**	**406.88**
ANSTO	30.51	24.53	28.02	29.89	30.58	34.45
Australian Institute of Marine Science	6.54	7.02	7.50	7.77	8.91	10.21
National Building Technology Centre	0.86	1.02	1.18	1.92	2.56	2.75
CSIRO	326.56	321.11	318.82	349.78	354.34	357.20

($ million)	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Primary Industries and Energy	**18.45**	**18.56**	**26.49**	**29.10**	**30.99**	**32.32**
Australian Bureau of Agricultural and Resource Economics	1.31	1.43	1.70	1.51	1.60	1.71
Bureau of Mineral Resources	16.56	16.29	23.98	26.76	29.35	30.57
Prime Minister and Cabinet	**0.00**	**0.00**	**0.00**	**0.00**	**0.29**	**0.35**
Social Security	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Transport and Communications	**45.97**	**46.08**	**48.79**	**58.06**	**62.76**	**53.78**
Telecom Australia	41.70	40.50	43.08	51.00	53.70	44.10
Bureau of Transport and Communications Economics	2.20	2.18	2.33	2.44	2.58	2.59
Treasury	**6.44**	**8.90**	**9.63**	**9.92**	**10.71**	**10.24**
Australian Bureau of Statistics	6.08	4.33	6.68	7.83	9.74	9.75
Veterans' Affairs	**0.40**	**0.37**	**0.42**	**0.63**	**0.70**	**0.70**
Total:	**601.0**	**602.5**	**633.1**	**688.9**	**729.13**	**723.38**

NOTE: The table does not purport to show the total amount of expenditure for the agencies identified. Non-Commonwealth funds are excluded (see Ministry tables - Appendix A), as are R&D contracted out and grant payments (see Table 4).

Table 4: Extramural Commonwealth expenditure on R&D by ministry, showing agencies with major R&D performance.

($ million)

	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Aboriginal Affairs	**0.19**	**0.35**	**0.59**	**0.48**	**0.22**	**0.22**
Administrative Services	**0.12**	**0.15**	**0.15**	**0.16**	**0.01**	**0.00**
Arts, Sport, Environment, Tourism & Territories	**0.84**	**1.06**	**1.36**	**1.59**	**2.63**	**2.39**
Great Barrier Reef Marine Park Authority	0.03	0.12	0.08	1.04	0.79	0.66
Attorney General's	**0.47**	**0.29**	**0.48**	**0.37**	**0.18**	**0.17**
Community Services and Health	**34.35**	**42.67**	**52.15**	**56.19**	**63.28**	**66.48**
NH&MRC	29.56	37.98	44.18	51.24	58.95	64.36
Defence	**1.05**	**0.91**	**1.12**	**1.08**	**0.96**	**1.00**
Employment, Education & Training	**134.72**	**151.27**	**167.53**	**188.42**	**197.17**	**205.42**
Grants to universities	94.00	104.00	114.00	126.00	126.00	135.00
Special research centres	5.90	5.70	5.70	6.00	6.30	6.70
ARC grants	20.86	23.28	26.83	29.48	35.45	35.61
Post-graduate awards	11.16	14.60	15.41	17.57	18.94	19.84
NRF-QEII & QEII fellowships	0.92	1.17	2.15	4.04	1.32	1.46
National research fellowships	0.00	0.19	1.47	3.84	4.77	4.95
Foreign Affairs and Trade	**30.25**	**32.62**	**40.27**	**40.14**	**48.00**	**35.66**
ACIAR	0.96	4.75	8.62	8.60	9.22	9.73
AIDAB	21.47	19.49	22.37	22.29	38.76	25.90
Immigration, Local Government & Ethnic Affairs	**0.33**	**0.17**	**0.23**	**0.23**	**0.36**	**0.36**
Industrial Relations	**0.01**	**0.00**	**0.26**	**1.27**	**1.25**	**0.85**

Table 4 (continued)

($ million)	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Industry, Technology and Commerce	**53.52**	**64.95**	**61.46**	**68.43**	**59.52**	**54.18**
Automotive Industry R&D Grants	0.00	0.00	0.00	4.00	2.50	3.70
CSIRO	1.18	1.49	1.90	1.52	2.31	2.70
AIRDIS#	47.88	57.80	54.39	51.95	34.40	13.63
GIRD Scheme*	0.00	0.00	0.00	0.00	11.25	25.63
Primary Industries and Energy	**32.01**	**36.40**	**45.53**	**49.53**	**64.83**	**76.76**
Larger Rural Industry R&D Funds						
- Barley	0.30	0.34	0.85	0.80	1.67	1.77
- Fishing Industry	0.66	1.68	3.86	4.02	3.87	4.73
- Wheat	3.20	2.05	5.32	4.25	5.14	6.77
- Special	0.00	0.00	0.00	0.00	0.77	1.87
AWC - Wool R&D Fund	7.85	9.22	11.11	7.68	12.49	16.24
AMLRDC	0.00	0.00	0.00	11.18	14.90	14.20
Energy Research Trust Fund	11.69	13.72	12.29	12.46	12.51	11.81
Water Research	1.34	0.63	0.21	0.70	2.74	5.32
Prime Minister and Cabinet	**0.06**	**0.07**	**0.06**	**0.09**	**0.06**	**0.89**
Social Security	**0.59**	**0.68**	**0.68**	**0.64**	**0.73**	**0.78**
Transport and Communications	**3.93**	**4.07**	**4.10**	**6.37**	**5.91**	**6.51**
OTC	0.59	0.44	0.65	2.04	2.04	2.26
Telecom Australia	0.90	1.31	1.26	1.70	1.95	2.25
Treasury	**2.00**	**2.81**	**3.23**	**2.96**	**3.57**	**3.61**
Reserve Bank - Rural Credits	1.72	2.51	2.68	2.61	3.10	3.40
Veterans' Affairs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total:	**294.4**	**338.5**	**379.2**	**417.9**	**448.65**	**455.30**

*Estimates of the total cost of Commonwealth support for R&D also include these components ($m current prices):

	82-83	83-84	84-85	85-86	86-87	87-88
Estimated R&D Component of General University Funding:	310	330	406	430	460	490
Estimated Costs of Relevant Industrial R&D Tax Incentives:	-	-	-	20	105	150
Assistance under the Bounty (Computers) Act 1984	-	-	1.5	13.2	19.4	20.9

Note that the estimated costs of the tax incentive scheme are allocated to the year in which revenue is foregone rather than the year in which the R&D was performed.

AIRDIS has largely been replaced by the 150% tax concession for industrial R&D. The GIRD scheme assists those companies which cannot benefit from the tax concession.

2.4 Destination of extramural R&D Funding

Extramural expenditure consists of grants and contracts. These categories are defined in Appendix D. Table 5 is a summary of the amounts of Commonwealth grants for R&D purposes by sector of recipient. Table 6 is a similar summary of contracts. Some other major items of support are provided as a footnote to Table 6.

Table 5: Commonwealth R&D grants by recipient sector, 1982-83 to projected 1987-88 ($ million)

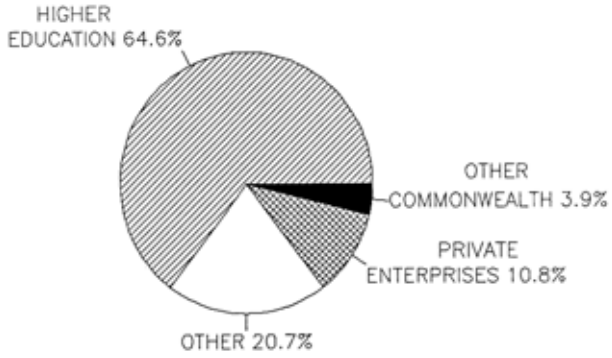
	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Private Enterprise						
N	54.6	67.6	63.7	64.4	51.8	44.4
S	0.0	0.1	0.0	0.2	0.1	0.1
N+S	54.6	67.7	63.8	64.6	51.9	44.5
Commonwealth Agencies						
N	11.5	12.6	15.7	11.2	13.1	15.8
S	0.1	0.0	0.1	0.0	0.4	0.3
N+S	11.6	12.6	15.9	11.2	13.4	16.1
Higher Education						
N	116.2	131.5	151.3	185.1	205.8	219.0
S	35.6	39.3	43.0	45.7	46.0	46.7
N+S	151.8	170.8	194.2	230.8	251.7	265.7
Other Bodies*						
N	49.7	55.2	64.9	52.0	76.0	73.9
S	8.9	10.6	13.0	12.7	12.5	11.2
N+S	58.6	65.8	77.9	64.7	88.5	85.1
Total (Direct Commonwealth funding all grants)	276.6	317.0	351.7	371.3	405.6	411.4

* Includes unclassified. Note that this will include some grants going to the private enterprise sector.

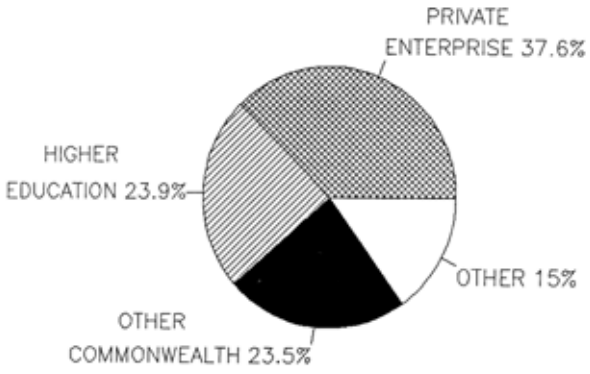
N Natural sciences and engineering

S Social sciences and humanities

Fig. 3. Destination of Commonwealth Extramural Expenditure.



GRANTS



CONTRACTS

Table 6: Commonwealth R&D contracts by recipient sector, 1982-83 to projected 1987-88

($ million)	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Private Enterprise						
N	2.3	1.6	1.8	5.8	13.2	12.4
S	0.6	0.5	0.9	2.0	3.3	1.1
N+S	2.9	2.1	2.8	7.9	16.5	13.5
Commonwealth Agencies						
N	3.9	5.4	8.8	13.7	10.0	11.1
S	0.1	0.1	0.1	0.3	0.3	0.3
N+S	4.0	5.6	8.9	14.0	10.3	11.4
Higher Education						
N	6.4	7.7	9.6	14.9	8.9	9.8
S	1.1	1.3	1.5	1.2	1.6	1.7
N+S	7.4	9.0	11.2	16.0	10.5	11.5
Other Bodies*						
N	3.3	4.5	4.3	6.7	4.5	5.2
S	0.2	0.2	0.4	2.3	2.0	2.0
N+S	3.6	4.7	4.6	9.0	6.6	7.2
Total (Direct Commonwealth funding all contracts)	17.9	21.5	27.5	47.0	43.9	43.6

* Includes unclassified. Note that this will include some contracts going to private enterprises.

N Natural sciences and engineering; S Social sciences and humanities

Estimates of the total cost of Commonwealth support for R&D also include these components ($m current prices):

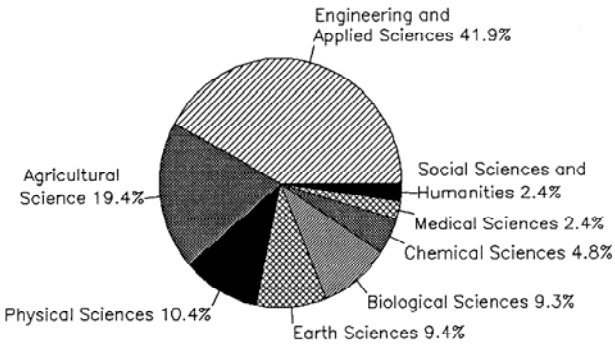
	82-83	83-84	84-85	85-86	86-87	87-88
Estimated R&D Component of General University Funding:	310	330	406	430	460	490
Estimated Costs of Relevant Industrial R&D Tax Incentives:	-	-	-	20	105	150
Assistance under the Bounty (Computers) Act 1984	-	-	1.5	13.2	19.4	20.9

Note that the estimated costs of the tax incentive scheme are allocated to the year in which revenue is foregone rather than the year in which the R&D was performed.

2.5 Commonwealth R&D performance by field of science

From time to time requests have been made for Science and Technology Statement data to be disaggregated by discipline or field of science. If precise figures are sought, this presents difficulties of many kinds which could be satisfactorily resolved only by a full-scale R&D survey. As an experiment an ad hoc system of classification was derived for the Science and Technology Statements in 1985-86 and 1986-87. We have now discontinued this. See the publication "Measures of Science and Innovation" (Australian Science and Technology Indicators Report) or Australian Bureau of Statistics R&D survey bulletins. These present data on field of science based on the national R&D surveys. Figure 4 shows the distribution of Commonwealth performance of R&D by major field of science in 1984-85 (excluding public business enterprises).

Fig 4. Commonwealth R&D performance by field of science



2.6 Commonwealth Contribution to Gross Domestic Expenditure on R&D (GERD)

Table 7, based on the Australian national surveys of R&D performers in all sectors, shows the contribution of each sector to funding GERD. The surveys have shown that Commonwealth Government support for R&D activities rose steadily between 1978-79 and 1985-86 in real terms. When the general government sector as a whole is considered (i.e., Commonwealth plus States), the picture is similar to that presented by Commonwealth funding alone.

The relative share of business enterprise funding of GERD fell slightly between 1976-77 and 1978-79. This reduced the business enterprise share of funding of the gross domestic expenditure on R&D (GERD) from 22% to 21% but was followed by a slight increase over the period 1978-79 to 1981-82 and a much larger increase over the period 1981-82 to 1985-86. The rapid increase in the percentage of GERD funded by the business sector over this latter period resulted in this percentage rising to 31% and the portion of Government funding of GERD falling from 62% to 54%. State Government funding of R&D as a percentage of GERD has undergone a small steady decrease since 1978-79.

Fig 5. Gross Expenditure on R&D by Sector of Funding 1985-86
($ million)

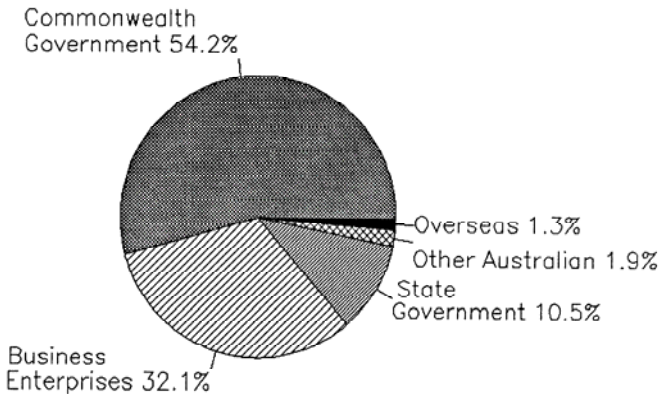


Table 7: Commonwealth Government and other sector funding contributions to Australia's gross domestic expenditure on R&D (GERD): 1976-77 to 1985-86

($ million)

Sector of Funding	1976-77	1978-79	1981-82	1984-85	1985-86
Commonwealth Government	541	666	976	1377	1494
State Government	114	140	185	269	288
Sub-total General Government	654	806	1161	1646	1781
Business Enterprise	195	217	353	660	859
Other Australian	10	18	32	59	52
Overseas	14	13	16	26	36
Total GERD	873	1054	1562	2391	2728
Commonwealth Government funding as % GERD (%)	62	63	62	58	55
State Government funding as % GERD (%)	13	13	12	11	11
Business Enterprise funding as % GERD (%)	22	21	23	28	31

Note: Tables 7 and 8 are based on national R&D surveys and include the imputed research component of higher education teaching-and-research expenditures (see A.10.2).

Sources : see page 23.

Table 8: Sectoral Performance of Gross Domestic Expenditure on R&D (GERD) : 1976-77 to 1985-86

($ million)

Sector of Performance	1976-77	1978-79	1981-82	1984-85	1985-86	1986-87
Commonwealth Government	290	321	515	670	727	na
State Government	126	149	200	289	317	na
Sub-total General Government	416	470	715	959	1044	na
Business Enterprise	203	246	374	721	905	1082
Higher Education	244	326	452	668	732	na
Private non-profit	11	13	21	44	47	na
Total GERD	873	1054	1562	2391	2728	na
General Government Performance as % GERD	48	45	46	40	38	na
Business Enterprise (including Public) Performance as % GERD	23	23	24	30	33	na
Higher Education Performance as % GERD	28	31	29	28	27	na

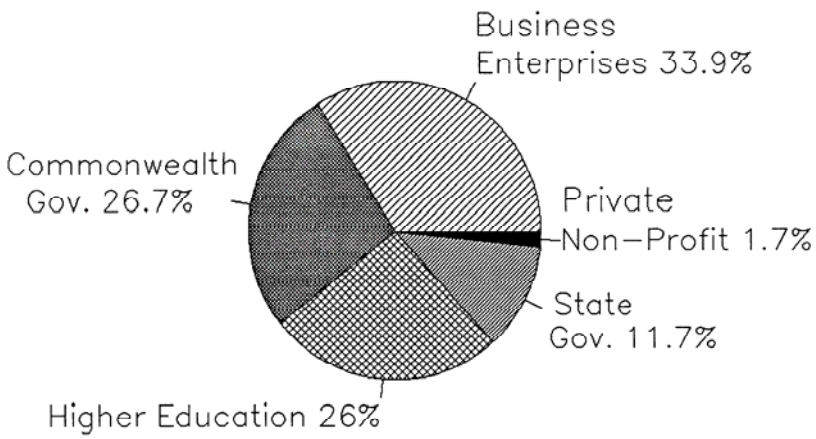
Sources: Data for Tables 7 and 8 are based on:

. Project SCORE 1968-69, 1973-74, 1976-77, 1978-79

. ABS Research and Experimental Development (Australia) Catalogues:

- 8104.0, Business Enterprises, 1981-82 (1 March 1984)
- 8104.0, Business Enterprises, 1984-85 (5 December 1986)
- 8105.0, Business Enterprises, 1986-87, Preliminary (18 April 1988)
- 8109.0, General Government Organisations, 1981-82 (27 January, 1984)
- 8111.0, Higher Education Organisations, 1981 (6 October 1983)
- 8112.0, All Sector Summary, 1981-82 (3 April 1984)
- 8112.0, All Sector Summary, 1984-85 (2 June 1987)
- 8122.0, All Sector Summary (Inter Year Survey) 1985-86 (30 June 1987)

Fig 6. Gross Expenditure on R&D by Sector of Performance 1985-86
($ million)



CHAPTER 3

R&D TRENDS AND DEVELOPMENTS BY SOCIO-ECONOMIC OBJECTIVE

3.1 Presentation of Trends

In this Chapter both long- and short-term trends of expenditure by socio-economic objective are given. These are derived using a consistent smoothing technique so that all data are utilised. The trends shown are on an annual average basis. Bearing in mind the cautions below, the long-term trends may be taken as indicative of the implicit policies of successive governments over the nine-year period shown. The short-term (three-year) trend is more indicative of recent shifts in priorities.

For a variety of reasons the trend data for the socio-economic objectives need to be considered with some caution. CSIRO, for example, has in recent years made a number of changes to its classification system which may have resulted in minor discontinuities between successive years in some categories. Where possible the data are adjusted to minimise problems of this kind which have come to notice, but the tight publication schedule for the Statement sometimes means such revisions cannot be made prior to going to press. The data in this chapter contains one such probable anomaly in the last three years for the category "urban and regional planning". Another area where some changes in classification have occurred is in the distinction between the objectives "general advancement of knowledge" and "earth, ocean, atmosphere and space".

Apart from reporting anomalies, there is a "lumpiness" introduced into expenditure time series by large capital expenditures for major facilities which may sometimes be regarded as a distortion superimposed on a more consistent pattern of current expenditure support. In the case of agriculture, for example, the large capital expenditure on construction of the Australian Animal Health Laboratory (AAHL) in the period up to 1982-83 has confused the trend picture (see Figure 8, page 29).

Footnotes to Tables 9 and 10 indicate levels of indirect support for R&D provided through channels including the general funding of universities (i.e. funding which is not specific to research) and the 150% tax concession scheme for R&D in industry. In the case of the latter scheme the data given indicate the government-funded proportion of the estimated levels of additional R&D which the tax scheme has stimulated in industry. A separate set of estimates of the costs of the revenue foregone (which generally occur the year after the R&D expenditure in industry) have been provided in a footnote to Table 1.1 (page 6) and elsewhere in this Statement.

3.2 Recent Developments

Under most objective headings there is a presentation of relevant items which have come to notice. Sometimes these are highlights of research completed over the past year; sometimes they are developments of other kinds (policy initiatives, problems etc.) which have had, or which are likely to have implications for research directed towards the particular objective.

3.3 Summary Data

Table 9 shows Commonwealth R&D expenditures at current prices directed towards the various socio-economic objective categories. Table 10 presents the same data as Table 9, but in real terms (constant 86-87 dollars). Figure 7 shows constant dollar trends for four of the largest categories of socio-economic objective.

Table 9: Total Commonwealth Government expenditure on R&D by socio-economic objective. Current Prices

Objective Category	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
				($m)					
National security									
Defence	85.4	98.1	103.4	114.4	121.2	133.0	139.1	153.6	148.2
Economic development									
.Agriculture	91.8	109.0	120.6	128.8	115.1	133.7	144.9	166.6	176.7
.Other P.I.	14.5	14.8	17.4	19.7	26.1	25.1	25.8	28.4	30.9
.Mining	13.4	17.4	23.1	20.5	22.4	22.5	22.9	25.8	26.7
.Manufacturing*	77.4	101.0	86.9	114.3	113.2	128.4	157.6	136.3	130.0
.Construction	7.7	7.6	7.7	8.3	8.2	10.3	14.3	14.3	14.4
.Energy	33.7	42.2	52.5	69.2	67.4	63.6	59.5	55.7	58.0
.Transport	5.0	4.6	3.5	5.7	5.6	5.6	6.6	6.5	6.8
.Communications	28.5	37.6	40.3	47.3	46.8	50.1	59.3	65.4	56.2
.Econom Services nei	14.8	17.7	17.4	18.2	22.8	30.5	21.3	17.8	13.4
Sub-total	286.88	351.98	369.42	432.0	427.6	469.9	512.2	515.0	511.9
Community services									
.Urban and regional planning	1.8	1.4	1.8	2.9	2.6	2.6	0.1	1.5	1.4
.Environment	20.0	20.4	24.8	36.6	31.8	30.9	28.8	21.6	22.1
.Health	30.3	35.8	45.0	55.4	66.1	78.6	88.3	100.3	104.6
.Education	3.2	4.0	3.7	2.6	3.0	3.5	3.2	2.6	3.2
.Welfare	1.2	1.8	2.0	3.3	2.0	2.7	3.7	4.8	4.5
.Community services nei	15.0	18.3	23.4	34.3	37.9	46.8	47.1	57.3	45.1
Sub-total	71.5	81.6	100.9	135.2	143.5	165.2	171.1	188.9	181.7
Advancement of knowledge									
.Earth, ocean, atmosphere and space	32.4	42.3	46.0	61.7	68.2	63.2	67.3	95.4	101.5
.General advancement of knowledge#	100.1	112.7	125.9	152.1	180.5	181.0	217.0	225.0	235.9
Sub-total	132.5	154.9	171.9	213.8	248.7	244.2	284.3	320.4	337.4
Total	576.3	686.56	745.58	895.5	940.9	1012.3	1106.8	1178.5	1179.2

Notes

- Before 1981-82, there were differing superannuation arrangements applying to certain statutory authorities (especially CSIRO and AAEC) with the effect that superannuation payments were not included in the expenditure for such authorities. In this table notional increases have been applied to data for 1978-79, 1979-80 and 1980-81 for trend comparision purposes. (See Science and Technology Statement 1984-85 for data without such notional increases).

- R&D funded by the Minister for Education for the purpose of producing qualified researchers or for supporting normal academic activities has been included in "General advancement of knowledge". Only research mainly directed towards education processes or education administration has been included in the "Education" objective.

- Other major Commonwealth support for R&D includes (in $million):

	82-83	83-84	84-85	85-86	86-87	87-88
General University Funding:	310	330	406	430	460	490
Estimated Support from Relevant Industrial R&D Tax Incentives:	-	-	-	150	180	210
Assistance under the Bounty (Computers) Act 1984	-	-	1.5	13.2	19.4	20.9

Note that the estimated support from the tax incentives is tabled against the year in which the R&D is performed rather than the year in which revenue is foregone. For estimates based on the tax revenue year see page 6.

* Since 1985-86 the major instrument of Commonwealth R&D support for manufacturing has been the 150% tax concession scheme. The estimated cost of this incentive is given in the note above. The apparent decline in support for manufacturing shown in the table is due to the winding down of the former direct grant scheme (AIRDIS). As the estimates above show, the decline in direct funding is more than offset by support through the tax incentives. A relatively small component of the revenue foregone through the tax incentive scheme supports objectives other than manufacturing.

\# The major component of 'General University Funding' (GUF) in the table above assists general advancement of knowledge. The health objective also receives substantial support through GUF. The balance is spread among the other objectives.

Table 10: Total Commonwealth Government expenditure on R&D by socio-economic objective. Constant (1986-87) Prices

Objective Category	79-80	80-81	81-82	($m) 82-83	83-84	84-85	85-86	86-87	Proj. 87-88
National security									
.Defence	152.4	155.4	141.9	144.6	145.3	152.3	148.7	153.6	140.3
Economic development									
.Agriculture	151.6	159.8	155.2	166.0	138.0	151.3	153.9	166.6	165.7
.Other P. I.	24.9	22.7	23.5	24.9	31.6	28.3	27.4	28.4	29.2
.Mining	23.9	27.7	32.0	25.8	26.8	25.5	24.4	25.8	25.2
.Manufacturing*	140.9	162.1	121.0	147.9	137.6	145.9	168.0	136.3	121.1
.Construction	13.6	12.0	10.5	10.4	9.7	11.6	15.2	14.3	13.7
.Energy	60.4	67.1	73.0	87.8	80.8	72.6	63.5	55.7	54.7
.Transport	9.0	7.5	5.0	7.2	6.7	6.3	7.0	6.5	6.4
.Communications	50.6	60.8	56.8	60.2	56.3	56.8	63.4	65.4	52.1
.Economic Services nei	26.5	28.3	23.9	22.7	27.7	34.5	22.6	17.8	12.7
Sub-total	501.4	548.0	500.9	552.9	515.2	533.0	545.5	515.0	480.8
Community Services									
.Urban and regional planning	3.2	2.2	2.4	3.8	3.1	2.9	0.1	1.5	1.4
Environment	35.8	32.5	34.5	46.3	37.9	34.9	30.5	21.6	21.5
Health	54.1	56.3	62.6	70.2	79.3	88.5	93.6	100.3	98.1
Education	5.7	6.2	5.1	3.2	3.6	3.9	3.4	2.6	3.0
Welfare	2.1	2.7	2.8	4.1	2.3	3.0	3.9	4.8	4.3
Community services nei	26.8	29.3	33.4	44.6	46.0	53.4	50.2	57.3	42.7
Sub-total	127.7	129.2	140.9	172.1	172.2	186.5	181.7	188.9	171.0
Advancement of knowledge									
.Earth, Ocean and atmosphere	58.3	67.6	64.7	79.8	83.4	72.7	74.2	95.4	95.0
General advancement of knowledge#	177.5	175.8	176.3	193.7	217.1	204.6	228.5	225.0	222.5
Sub-total	235.8	243.4	241.1	273.5	300.5	277.3	302.7	320.4	317.5
Total	1017.7	1076.6	1024.8	1143.2	1133.2	1149.2	1178.6	1178.5	1109.3

Notes

- See Table 17 and comments (Appendix D.8) for explanation of the constant price estimates.

- Before 1981-82, there were differing superannuation arrangements applying to certain statutory authorities (especially CSIRO and AAEC) with the effect that superannuation payments were not included in the expenditure for such authorities. In this table notional increases have been applied to data for 1978-79, 1979-80 and 1980-81 for trend comparision purposes. (See Science and Technology Statement 1984-85 for data without such notional increases).

- R&D funded by the Minister for Education for the purpose of producing qualified researchers or for supporting normal academic activities has been included in "General advancement of knowledge". Only research mainly directed towards education processes or education administration has been included in the "Education" objective.

- Other major Commonwealth support for R&D includes (in 1986-87 $million):

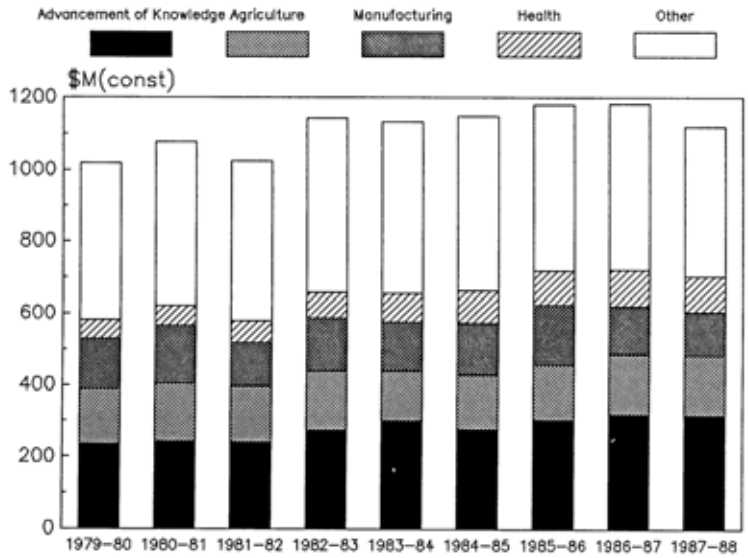
	82-83	83-84	84-85	85-86	86-87	87-88
General University Funding: Estimated Support from Relevant	411	406	470	465	460	458
Industrial R&D Tax Incentives:	-	-	-	175	180	200
Assistance under the Bounty (Computers) Act 1984	-	-	1.7	14.2	19.4	19.5

Note that the estimated support from the tax incentives is tabled against the year in which the R&D is performed rather than the year in which revenue is foregone.

* See footnotes on p.26

See footnotes on p.26

Fig 7. Commonwealth Expenditure on R&D by Socio-economic Objective.



3.4 **DEFENCE** ($148.2m projected for 1987-88)

Major Programs

All R&D under this heading is the responsibility of the Department of Defence.

Growth Trends

- Long-term trend (1978-79 to projected 1987-88): -0.4% pa
- Short-term trend (1985-86 to projected 1987-88): -2.9% pa

Recent developments

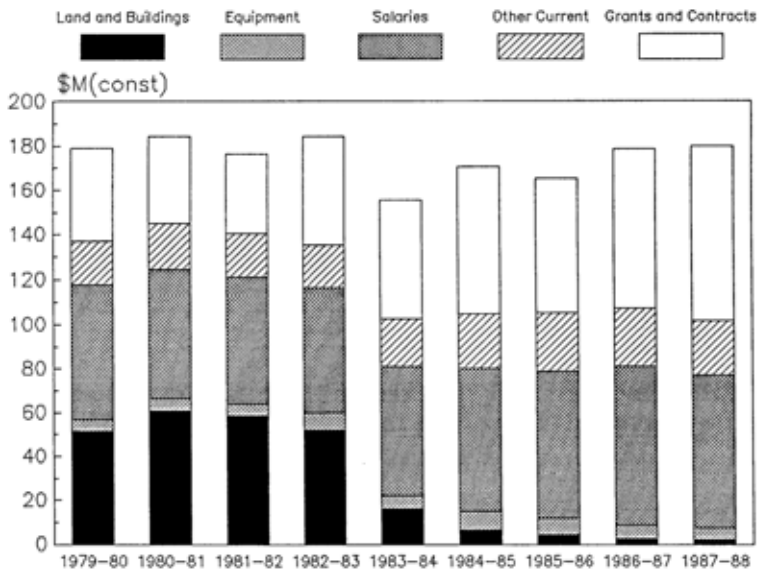
Current projects of significance include the NULKA system for ship defence, DSTO support for the Australian over-the-horizon-radar network, the laser airborne depth sounder (LADS), and the KARIWARA buoyant fibre slimline acoustic towed array.

3.5 **AGRICULTURE** ($176.7m projected for 1987-88)

Major programs

CSIRO accounts for about 67% of R&D expenditure under this heading with programs administered by the Department of Primary Industries and Energy accounting for most of the rest (eg Rural Research Trust Funds about 9%, the Australian Wool Corporation 9%, the Australian Meat and Livestock R&D Corporation 8%).

Fig. 8 Commonwealth R&D Expenditure on Agriculture by Type of Expenditure



Growth trends

- long-term trend (1978-79 to projected 1987-88): -3.4% pa
- short-term trend (1984-85 to projected 1986-87): +1.6% pa

Recent developments

- The Division of Wildlife and Rangelands Research has been developing RANGEPACK, a microcomputer-based advisory system for pastoral land management. There has been extensive collaboration with government agricultural agencies and the agricultural industry generally. The system is designed to improve the level of information available to the grazier and to aid in the management of Australia's extensive arid and semi-arid rangelands.

- A computer model that describes the likely establishment and progress of an outbreak of foot and mouth disease within a feral pig population has been developed by the CSIRO Division of Wildlife and Rangelands Research. An outbreak of the disease would cost Australia $6 billion dollars during the first year, even if the outbreak is immediately contained. The model has revealed that there are significant gaps in current knowledge about the behaviour of feral pigs in relation to foot and mouth disease outbreak and spread which are important in disease prevention and eradication.

- The CSIRO Division of Entomology has continued to improve techniques for integrated pest management to lessen the need for potentially harmful pesticides in the Australian environment. A program has been developed to clone a powerful insect toxin gene from entomophagous nematodes into a virus specific to the Heliothis bollworm, a serious pest of cotton. The virus is known as a Heliothis nuclear polyhedtosis virus and in its natural form, causes only low mortality in the Heliothis bollworm. With the inclusion of the toxic gene the virus will greatly increase its efficacy and speed of action in killing the larvae. This research points to the feasibility of producing a whole range of species-specific biocides that will supplement or replace traditional chemical insecticides in Australian agriculture.

- Two new cotton varieties, SIOKRA and SICALA have been bred at the CSIRO Division of Plant Industry's Cotton Research Unit at Narrabri and will be planted to about 70 per cent of the Australian cotton growing area in 1987-88. The combination of early maturing and high yielding characteristics of SIOKRA, and the superior lint quality of SICALA, are anticipated to add $45 million to the value of the Australian cotton crop in the current year alone.

- The Division of Plant Industry, in conjunction with Australian Fertilizers Limited (AFL), has developed a portable on-farm test kit which will enable farmers to test their subterranean clover pastures and wheat crops for deficiencies for the nutrients phosphorus and nitrogen. The product has been marketed by AFL as the Greenleaf Farm Lab and orders for 800 kits were placed in the first month of production. Substantial benefits are expected to derive from more accurate and timely fertilizer management of pastures and wheat, the products of which, excluding dairy products, return about $10 billion to the Australian economy each year.

- A noticeable increase in rabbit numbers has led to the recently formed virus ecology group in CSIRO Division of Wildlife and Rangelands Research beginning *work* on enhancing the effectiveness of myxomatosis. Wild strains of the myxoma virus have been found to be weak and act to immunise the rabbit against the more lethal strains. One of the first aims of the group has been to develop an antibody test kit which will tell the farmer the optimal time for release of new strains. In the longer term, genetic engineering Of the myxoma virus is envisaged, either to increase its efficiency or to incorporate a bacterial toxin in the genome.

- The CSIRO Division of Tropical Crops and Pastures has developed two new varieties in the modest but expanding Australian mungbean industry. The first, Shantung, has a high seed quality and an improved resistance to powdery mildew, which makes it particularly suitable in humid situations. The second, Satin, has

improved tolerance to conditions that cause weather damage to the grain such as those conditions found on the Darling Downs. Both varieties are being multiplied by the Australian Mungbean Association for release to growers and to boost the export oriented trade.

. The Australian Animal Health Laboratory's new diagnostic test for foot and mouth disease, specifically developed to eliminate the need to use live virus, has proved successful in field trials in Thailand. Carried out in collaboration with Thai authorities, the trials have proved the test to be more reliable for direct diagnosis of field samples than existing tests (80% vs 25% correct). Both tests gave 100% accuracy when field samples were first cultured for 24-48 hours.

. The CSIRO Division of Animal Health, in association with the University of Sydney and the CSIRO Division of Molecular Biology, has developed a new vaccine against sheep footrot using genetic engineering techniques. The research has involved the transfer of antigen genes of the causative organism, which is very difficult to grow in artificial culture, to a less fastidious host bacterium where satisfactory expression of the antigen gene could be obtained. A prototype vaccine was successfully tested in the field and an agreement to develop it commercially was signed by CSIRO and the University with two industry partners.

. Scientists in the CSIRO Division of Tropical Animal Science have demonstrated that pregnancy in cattle can be prevented by immunisation against the physiological hormone, Luteinising Hormone Releasing Hormone. The technique can be reversed and could be of value for delaying pregnancy in underweight heifers in conditions such as those found in northern Australia. The Division of Animal Production has been studying the use of the procedure in sheep, as an alternative to castrating ram lambs.

. The CSIRO Division of Tropical Animal Science has developed a simple, inexpensive and non-destructive test for determining the sex of cattle embryos. The test is based on a colour reaction of a sex-linked enzyme. The most sophisticated equipment required is a light microscope. It is expected to find an important place in the selection of embryos for implantation in surrogate cows in the cattle breeding industry.

3.6 OTHER PRIMARY INDUSTRIES ($30.9m projected for 1987-88)

Major programs

About 78% of R&D here is accounted for by CSIRO. Programs administered by the Department of Primary Industries and Energy account for most of the balance.

Growth trends

- long-term trend (1978-79 to projected 1987-88): +2.9% pa
- short-term trend (1985-86 to projected 1987-88): -2.9% pa

Recent developments

. The CSIRO Division of Fisheries Research has developed a novel way of studying scallops using an underwater TV camera mounted on a commercial dredge. This has made it possible to not only determine the physical and biological features of individual scallop beds, but also to observe the operation of the dredge and reaction of the scallops to dredging. This approach should greatly assist in explaining the puzzling variability of catches between scallop beds.

- The CSIRO Division of Forest Research has made significant advances in the development of a process-based model to describe and predict the growth of forests. The model is particularly significant in the examination of tree growth during major climatic changes such as global warming of between 1.5 and 4.5 degrees, expected to occur in the next 30-50 years. There are no other methods currently available that forecast the consequence of such climatic changes on forest growth.

- The CSIRO Division of Forest Research has combined information on the genetics and breeding systems of tree species of major economic importance with strategies of a wide range of alternative breeding species in order to improve the management and breeding capacity of forest plantations. Conclusions from this research have been embodied in breeding plans for a variety of forest managers in Australia and in other countries. Some of the plantations where this work will have significant value include the widely grown conifers such as radiata pine, the black wattle Acacia mearnsii which has been introduced to an extensive area of China as a new crop, and Eucalyptus globulus - of great interest in Australia and other countries as raw material for high-grade paper.

- In March 1987, the CSIRO Division of Horticultural Rresearch released the world's largest black seedless table grape. As it was grown in commercial quantities for the first time it was exported successfully to Singapore and Hong Kong. The significance of this variety is that it can be grown to an average berry diameter of 21.5 millimetres (well above the export standard of 16 millimetres) without the application of chemicals. The Division has now produced seven new varieties from its breeding program for the Australian environment.

3.7 MINING ($26.7m projected for 1987-88)

Major programs

CSIRO accounts for about 53% of R&D expenditure directed towards this objective. The Bureau of Mineral Resources, Geology and Geophysics (BMR) accounts for 44%.

Growth trends

- Long-term trend (1978-79 to projected 1987-88): -0.9% pa

- Short-term trend (1985-86 to projected 1987-88): +1.6% pa

Recent developments

- Scientists in the CSIRO's Division of Soils have refined methods of X-ray spectroscopy to analyse soil minerals for nutrients important in agricultural production. The methods have been found to be generally applicable and have been adopted by the mining industry as internationally accepted contractual standards for iron ores. The Division is currently working with the Australian Standards Association and the mining industry to develop and produce standards for analysing coal ashes and mineral sands.

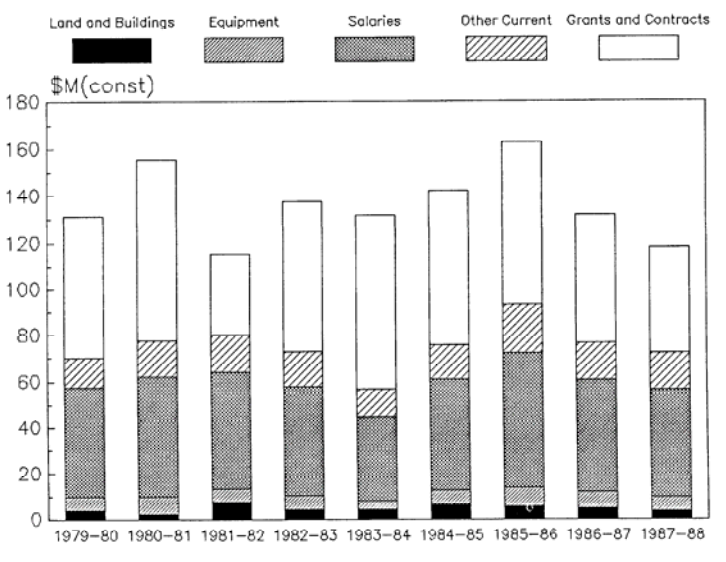
- A Task Force has been established by the CSIRO Institute of Energy and Earth Resources for a major multi-million dollar agreement with an AMIRA sponsored consortium of companies to use advanced mineral exploration techniques to enhance the industry's capability to find the next 'generation' of gold discoveries. Whilst the project is to concentrate on Western Australia initially, the techniques will be applicable to other areas in the Australasian region.

3.8 MANUFACTURING ($130.0m projected for 1987-88)

Major programs

For R&D expenditure reported for this objective, Grants for Industry Research and Development Scheme accounts for 20%, commitments under the Australian Industry Research and Development Incentives Scheme accounts for 11%, CSIRO for 61%, with most of the remainder being accounted for by other DITAC programs. Note the footnote on p.26 regarding the 150% industrial R&D tax concession scheme, now the major instrument for Commonwealth support of manufacturing R&D.

Fig 9. Commonwealth R&D Expenditure on Manufacturing by Type of Expenditure



Growth trends

- long-term trend (1978-79 to projected 1987-88): -0.8% pa;

- short-term trend (1985-86 to projected 1987-88): -15.1% pa

Recent developments

. A semi-commercial reverse osmosis plant based on research by the CSIRO Division of Food Research has been used by a Melbourne dairy processor to produce milk concentrate. Some 700,OOOL of product was frozen and exported to South East Asia, and 100,OOOL used to manufacture high-protein, reduced-fat milk products for the local market. The possibility of significant economic benefits from lower transport costs of concentrated milk will be studied following the installation of a second plant in a Victorian country dairy factory.

. Following years of research on biomaterials for implantable prosthetic devices, the CSIRO Division of Molecular Biology has filed an international patent jointly with an industry collaborator on a surface etching technique for hydrogels. Treatment renders the gels suitable for colonisation by endothclial cells. Patents are also in preparation on research developments for blood vessel prosthesis.

. CSIRO researchers from the Division of Radiophysics have collaborated with Austek Microsystems Pty Ltd in the design of a new microchip that represents both a major advance in technology and an important opportunity for Australian

. industry. The chip uses very large scale integration technology and is designed to carry out a mathematical procedure known as fast Fourier transforms. The VLSI/FFT chip is five times faster than its known competitors and is a low cost alternative to current methods of FFT analysis. The FFT method has immediate application in specialist fields such as searching for patterns in large volumes of complex information in communications and computer-based voice recognition. It is so fast that it is expected to revolutionize electronic equipment in a wide range of fields - from laboratory and engineering machinery to mining and telecommunications and remote sensing.

. The CSIRO Divisions of Applied Physics and Materials Science and Technology are at the forefront in new materials research and their applications in research on the so-called 'high temperature' superconductors. The new materials are ceramics rather than metals, using both common and 'rare earth' metals that carry electrical current without resistance, at temperatures as high as 180 degrees K. The discovery of these materials is a major breakthrough because it means that the much cheaper liquid nitrogen, rather than expensive liquid helium, can be used as a coolant to produce superconductivity. The new materials have potential applications over a wide spectrum of electrical engineering such as cheaper power transmission, electronics - such as high speed links between computer components and enhancing the speed performance of microchips, and medical technology - leading to cheaper magnetic imaging devices.

. In the CSIRO Division of Materials Science and Technology, research in structural ceramics has included new powder treatment methods for the fabrication of ultra-high strength oxide ceramics, transformation toughening of non-oxide ceramics, ceramic fabrication of novel composites based on silicon nitride and silicon carbide, and development of advanced refractories with excellent thermal shock and spalling resistance properties. Major commercial collaboration on three projects is being negotiated.

. The South Australian Timber Corporation has invested $22 million in a plant at Mt Gambier, SA to produce SCRIMBER, the reconsolidated wood product invented by the CSIRO Division of Chemical and Wood Technology and developed in conjunction with Repco Ltd. The design of the plant which will utilize pone thinnings to produce the structural beams, has been completed and contracts let for supply of major equipment items. The plant will have an initial capacity on a three shift basis, of 30,000 cubic metres per year, increasing to 45,000 cubic metres in the third year following commission - expected towards the end of 1988.

. The filtration group of the CSIRO Division of Textile Physics has completed a study of precharging in filter baghouses in collaboration with Mt Isa Mines Ltd. The precharging technology has been demonstrated to increase the capacity of existing filters by 20% and will be used in the filtration of the major gas effluents from the lead smelt at Mt Isa Mines. The application of the technology is being examined at the Eraring power station in collaboration with the Electricity Commission of NSW.

. The CSIRO Division of Manufacturing Technology's new premises were opened at the beginning 1987 by the CSIRO Chairman, Mr Neville Wran. The new building has been constructed on the CSIRO site at Preston to house the Advanced Manufacturing Centre Ltd (previously known as the Victorian CAD/CAM Centre Ltd), a joint company of CSIRO and the Victorian Government. Space in the building has also been leased to the Australian Design Council and a new joint venture company, The Preston Group Pty Ltd. The latter company has been formed to commercialize the Division of Manufacturing Technology's research in complex manufacturing systems. CSIRO will be the major equity partner in the company. The significance of these groupings of organisations on the Preston site will provide a powerful service to the manufacturing industry.

. Research in the CSIRO Division of Protein Chemistry has led to a process of substantially reducing the matting and felting of wool during the processing and tanning of woolly sheepskins. The problem is a serious one because it places severe limits not only on the methods of processing but on suitable raw materials. The process, registered as Siroskin, will lead to considerable savings in time and money for the Australian woolskin processing industry because it allows more efficient processing methods as well as expanding the range of woolskins that can be readily processed.

. Scientists at the CSIRO Division of Textile Industry have developed a completely integrated technological and economic package call SIROSCOUR, for scouring Australian wools. The package includes process design and computer programs enabling detailed scouring costings to be calculated. SIROSCOUR has been licensed to the engineering firm Process Design and Fabrication Pty Ltd in Melbourne. The company already has orders for an installation in Australia.

. The CSIRO Division of Textile Physics has now finalized the transfer of its 'ATLAS' technology for the pre-sale measurement of wool staple length and strength. The ATLAS program was funded from Wool Research Trust Funds and orders for 18 of the units, costing $200,000 have been placed by Australian Wool Testing Authority Ltd with the manufacturers, Kel Aerospace Pty Ltd. It is anticipated that double this number will be required to test annually the entire Australian wool clip.

. The CSIRO Division of Textile Physics has been taking an active role in assessing the technical feasibility of sale of greasy wool by description, a major industry goal. Aspects of this research, funded from Wool Research Trust Funds, have included the use of an image-analysis system for the objective measurement of 'style' and 'type' in greasy wool and the application of 'expert systems' technology for wool valuation. The latter project is being conducted in association with SIROMATH Pty Ltd, the Australian Wool Corporation and the CSIRO Division of Information Technology.

. Ten new collaborative research agreements in industrial chemistry have been signed between the CSIRO Division of Applied Organic Chemistry and industry in line with the Division's strategy to support Australian-based chemical and polymer industries to develop internationally competitive products and technologies. The new agreements will significantly augment the Division's external funding. The projects cover polyamide adhesives, surface treatment of polymers for biological or other end-use compatibility, optimised urea conversion, synthesis of fine chemicals and enhanced activity of chemicals in biological fluids.

3.9 CONSTRUCTION ($14.4m projected for 1987-88)

Major programs

CSIRO accounts for about 75% of R&D expenditure under this heading and the National Building Technology Centre for 21%.

Growth trends

- Long-term trend (1978-79 to projected 1987-88): +2.4% pa;

  Short-term trend (1985-86 to projected 1987-88): -5.1% pa

Recent Developments

. A new Australian Building Research Grants Scheme has been established to provide assistance for high priority building research projects. Funds will be provided for the Scheme by the Commonwealth on the basis that matching funds are contributed from non-Commonwealth sources. The Building Research and Development Advisory Committee has been re-formed with broader terms of reference, enabling it to advise on all aspects of the organisation, funding, coordination and transfer to users of the results of building research. The Committee's membership has been widened to provide adequate coverage of community, industry and other groups concerned with the building research effort.

. The CSIRO Division of Building Research has developed a computer program, THINFEAS, that allows a complete lifecycle costing of any building. The program which has already been sold to industry, covers all aspects of maintenance operation and ultimately demolition, as well as initial construction.

. The CSIRO Division of Building Research has been responsible for the instrumentation and measurement of a major field study, named 'Operation Wildlife', on the distribution of smoke in high rise buildings. The project became possible because of the expected demolition of a 25 storey building in Melbourne. The investigation provided valuable information on the effectiveness of smoke lobbies around lifts and stairwells, a contentious subject in fire engineering. The experiment also pointed to the fact that field experiments with cold smoke are not a reliable guide to the performance of 'real' hot smoke generated from combustion.

. The CSIRO Division of Geomechanics has joined with the Norwegian Geological Institute and Woodside Petroleum to investigate the foundation stability and engineering design of offshore petroleum platforms. The platforms in regions of the Australian Continental shelf experience difficult and unique geological conditions. The technology being developed will give the Australian industry a valuable design expertise.

3.10 ENERGY ($58.0m projected for 1987-88)

Major programs

CSIRO accounts for 37% of the research expenditure on energy, but other major activities are supported by ANSTO (22%), the National Energy Research Development and Demonstration Program (15%) and BMR (20%).

Growth trends

- Long-term trend (1978-79 to projected 1987-88): -0.6% pa;

- Short-term trends (1985-86 to projected 1987-88): -7.2% pa

Recent developments

. The CSIRO Divisions of Fossil Fuels and Energy chemistry have joined with BHP under NERDDP sponsorship to further develop the technology for the direct conversion of natural gas to products suitable for the production of liquid transport fuels. Progress over the year on the project has been significant in terms of both conversion rate and product selectivity. The prospects for a viable commercial process are under development.

. The CSIRO Division of Mineral Physics and Mineralogy has completed negotiations with several companies to extend its research on microbially

enhanced oil recovery (MEOR) to field trials in oil reservoirs. The work was originally carried out in the Baas Becking Geobiological Laboratory under grants from the NERDDP. Research has isolated several microorganisms that produce surfactants under oxygen-free conditions; under laboratory conditions oil recovery was increased by up to 20% by reduction of the surface tension between reservoir fluids.

3.11 TRANSPORT ($6.8m estimated for 1987-88)

Major programs

R&D activities contributing to this objective are accounted for by the Bureau of Transport and Communications Economics (39%) and other elements of the Department of Transport and Communications (57%).

Growth trends

-Long-term trend (1978-79 to estimated 1987-88): -2.1% pa

-Short-term trend (1985-86 to estimated 1987-88): -4.4% pa

3.12 COMMUNICATIONS ($56.2m projected for 1987-88)

Major programs

The R&D activities of Telecom (82%) account for most of this objective. An important contribution is also made by the Overseas Telecommunications Commission (5%). It is worth noting that over 97% of the R&D funds in this sector derive from revenues generated by Commonwealth owned Business Enterprises.

Growth trends

- Long-term trend (1978-79 to projected 1987-88): -0.6% pa;
- Short-term trend (1985-86 to projected 1987-88): -10.0% pa

Recent developments

. Telecom Australia has established a $5 million annual fund to finance innovative research and development of communications products. The Product Development Fund is aimed at increasing exports of Australian communications products as well as boosting development of the local market.

. In April 1986, the Canberra Laboratory of the CSIRO Division of Information Technology was established as the Centre for Spatial Information Systems. The Centre has provided a focus for activities in information systems, image processing and computer graphics. Through the Centre, the Division was affiliated with the new ANU Centre for Information Science Research.

. The Computer Networking Group of the CSIRO Division of Information Technology has completed an extensive review of the current academic and research computer networking in Australia. Consequently, blueprints have been developed for progression to the emerging international standards for Open Systems Interconnection developed by the International Organisation for Standardization and the International Telegraph and Telephone Consultative Committee.

3.13 OTHER ECONOMIC SERVICES ($13.4m projected for 1987-88)

Major Programs

CSIRO provides 23% of R&D expenditure under this heading. Other supporting agencies include the Reserve Bank (2%), Australian Bureau of Statistics (38%), Bureau of Industry Economics (7%), and the Department of Employment, Education and Training.

Growth trends

- Long-term trend (1978-79 to projected 1987-88): -6.5% pa;

- Short-term trend (1985-86 to projected 1987-88): -25.0% pa

Recent developments

. The Reserve Bank of Australia will soon issue the first of a new generation of banknotes. The notes, which were developed in a project between the Reserve Bank and CSIRO, include an anti-counterfeiting image which sets a new world standard in anti-forgery techniques. This technology has the potential to generate considerable export revenue for Australia.

3.14 URBAN AND REGIONAL DEVELOPMENT ($1.4m projected for 1987-88)

Major programs

CSIRO accounts for about 80% of R&D expenditure under this heading. ABS (9%) and the Department of Arts, Sport, the Environment, Tourism and Territories cover the remainder.

Growth trends (See note in Section 3.1, p. 24)

- Long-term trend (1978-79 to projected 1987-88): -16.9% pa;

- Short-term trend (1985-86 to projected 1987-88): not estimated

3.15 ENVIRONMENT ($22.1m projected for 1987-88)

Major programs

CSIRO conducts 43% of the activities directed to this objective. Other agencies include the Office of the Supervising Scientist for the Alligators Rivers Region (28%), and ANSTO (24%). The balance is given by activities under the Arts, Sport, the Environment, Tourism and Territories portfolio.

Growth Trends

- Long-term trend (1978-79 to projected 1987-88): -6.8% pa;

- Short-term trend (1985-86 to projected 1987-88): -16.0% pa

Recent developments

. The Commonwealth and Northern Territory governments will spend an initial $225 000 in the Northern Territory under the National Rainforest Conservation Program. The work will include a distribution study, mapping and vegetation surveys of the Territory's monsoon forests, and the results will be used to classify rainforest communities and determine management needs. New South Wales, Victoria and Western Australia also participate in the Program.

. The CSIRO Division of Wildlife and Rangelands Research has developed a comprehensive pattern detection and analysis package for VAX - VMS minicomputers and MS - DOS microcomputers as a result of a comprehensive environmental data analysis research. The package, being developed for Australian and overseas markets by a commercial partner, will be instrumental in assisting in upgrading of land and water management, as well as in other situations where interpretation of relationships between sets of data is required.

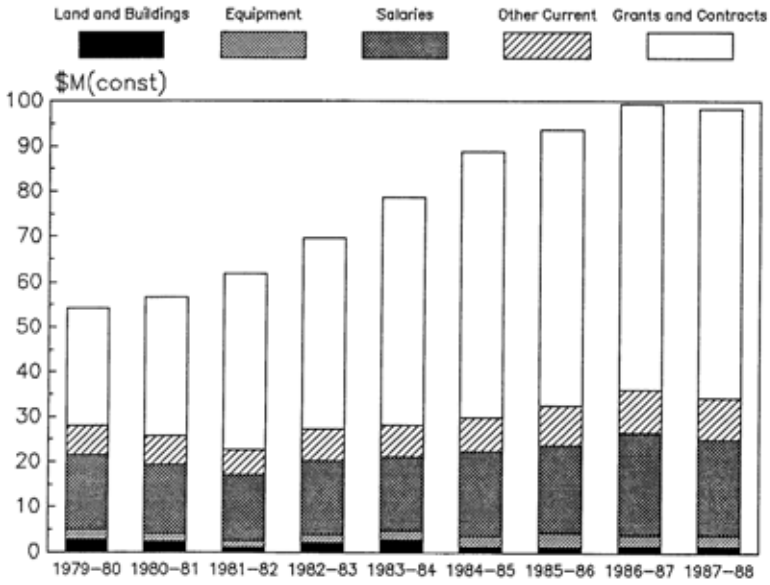
. Work by scientists at the CSIRO Centre for Irrigation and Freshwater Research on the use of artificial wetlands for improving the quality of wastewaters has advanced further by the establishment of pilot schemes with the support of local municipal authorities. The technique is based on the maintenance of good hydraulic flow through the root zone of aquatic plants growing in a gravel substrate. This results in more efficient nutrient removal and lower costs than conventional methods.

3.16 HEALTH ($104.6m projected for 1987-88)

Major programs

The National Health and Medical Research Council grants program (62%) provides the major support for health R&D. Various elements of the Department of Community Services and Health provide most of the balance, while the Commonwealth Serum Laboratories (9%), CSIRO (8%) and ANSTO (6%) also contribute to this objective.

Fig 10. Commonwealth R&D Expenditure on Health by Type of Expenditure



Growth trends

- Long-term trend (1978-79 to projected 1987-88): +9.3% pa;
- Short-term trend (1985-86 to projected 1987-88): +2.4% pa;

3.17 EDUCATION ($3.2m estimated for 1987-88)

Major programs

A variety of programs undertaken within the Department of Employment, Education and Training contribute the major part (83%) of R&D directed to understanding, improving or evaluating the education process. (Note that Commonwealth Tertiary Education Commission funds for research in the tertiary education sector, and post-graduate awards, are classed as being directed towards 'general advancement of knowledge'.)

Growth trends

-Long-term trend (1978-79 to estimated 1987-88): -9.2%pa

-Short-term trend (1985-86 to estimated 1987-88): -6.1%pa

3.18 WELFARE ($4.5m projected for 1987-88)

Major programs

Major elements include the Departments of Community Services and Health (14%), Social Security (17%); Immigration, Local Government and Ethnic Affairs (12%), and the Australian Bureau of Statistics (57%).

Growth trends

- Long-term trend (1978-79 to projected 1987-88): +8.6% pa;

- Short-term trend (1985-86 to projected 1987-88): +5.0% pa

3.19 OTHER COMMUNITY SERVICES ($45.1m estimated for 1987-88)

Major Programs

This objective consists mainly (83%) of overseas development assistance; 69% of the R&D support is provided by the Australian International Development Assistance Bureau and 31% by the Australian Centre for International Agricultural Research. Other R&D is supported by the Law Reform Commission (6%), other activities of the Department of the Attorney General (6%), the Australian Institute of Criminology and ABS.

Growth Trends

-Long-term trend (1978-79 to estimated 1987-88): +8.5%pa

-Short-term trend (1985-86 to estimated 1987-88): -7.9%pa

3.20 EARTH, OCEAN, ATMOSPHERE and SPACE ($98.3m projected for 1987-88)

Major programs

R&D activities towards this objective are undertaken or supported by CSIRO (41%); the Antarctic Division of the Department of Arts, Sport, the Environment, Tourism and Territories (28%); the Australian Institute of Marine Science (11%); BMR (7%); the Bureau of Meteorology (3%); minor contributions are provided by the Water Division of the Department of Primary Industries and Energy, and ANSTO.

Growth Trends

- Long-term trend (1978-79 to projected 1987-88): +5.1% pa;

-Short-term trend (1985-86 to projected 1987-88): +13.3% pa

Recent developments

Earth Sciences

. The Australian Seismological Centre was opened in Canberra in September 1986. The Centre, established within the Bureau of Mineral Resources, Geology and Geophysics, is used to monitor earthquakes and study their effects, and to detect and identify seismic waves originating from underground nuclear explosions. The latter function will further the development of an adequate global seismographic network, which is a major component in the establishment of verification procedures required for a Comprehensive Test Ban Treaty for nuclear weapons.

. 1986-87 saw the first full year of the Advanced Very High Resolution Radiometer (AVHRR) Service provided by the CSIRO Division of Atmospheric Research's Remote Sensing Facility. The facility includes a Satellite Tracking Antenna and an Image Processing Workstation; both were developed by CSIRO. The AVHRR Service is a commercial spin-off of the research and development associated with the Remote Sensing Facility and the imagery acquired by the Division from NOAA and CMS satellites and as such, is processed to suit the customer's needs. Recent examples of these services using AVHRR, are daily supplies of sea surface temperature data to the fishing industry, the development and supply of vegetation dryness indices to the Country Fire Authority of Victoria for bushfire risk assessment and the supply of data for geological exploration to the mining industry.

Oceanography

. The seasonal Leeuwin Current off Western Australia has been the subject of an intensive 18 month interdisciplinary study involving the CSIRO Division of Oceanography and several other institutions. The current is unusual and of particular importance because it is the only current on the eastern side of an ocean that carries tropical water poleward, resulting in a significantly less fertile marine habitat than other oceanic eastern boundaries. The pattern of this current as it flows southward past Western Australia, swinging eastward across the Great Australian Bight, is known to influence the spawning and migrations of a number of commercially important marine species to Australia, such as the western rock lobster and the southern bluefin tuna. Research in understanding the Leeuwin current, the processes governing its seasonal flow and its role in the life cycle of a number of fisheries, has entailed the use of a number of facilities including the CSIRO oceanographic research vessel, the RV 'Franklin', moored instruments, drifting buoys and satellite imagery.

Atmosphere

. The Bureau of Meteorology Research Centre (BMRC) in collaboration with Monash University and a number of other Australian and international institutions conducted the Australian Monsoon Experiment (AMEX) during October and November 1986 and January and February 1987. The major objectives were to study the two-way relationships between tropical thunderstorms and the wet-season atmospheric circulation, and to examine specific phenomena called North Australian Cloud Lines and their effects on northern Australia. Concurrent with AMEX and complementary to it, two United States experiments: the Stratosphere Troposphere Exchange Project (STEP); and the Equatorial Mesoscale Experiment (EMEX), were held over the same area.

In addition to this the People's Republic of China participated in AMEX by deploying an oceanographic vessel in the central Gulf of Carpentaria.

A remarkable diversity of weather events was observed during the experimental period and all participants regarded the outcome as a success.

. In early 1987, scientists from the CSIRO Division of Atmospheric Research and the CSIRO F-27 aircraft participated in an experiment in Northern Australia, the Equatorial Mesoscale Experiment (EMEX). The experiment was coordinated by a number of US Universities and the National Oceanic and Atmospheric Administration. The main aim of EMEX was to improve our understanding of the heating of the tropical atmosphere due to convection associated with monsoons. Practical benefits resulting from understanding the water budgets of these systems will include improved modelling of precipitation in the tropics and parameterization schemes for convection in the tropics. New models will assist scientists to study global atmospheric phenomena, such as the EL Nino/Southern Oscillation, the phenomena of heat being stored in tropical oceans and believed to originate in the western equatorial Pacific.

. During 1987 the Bureau of Meteorology further developed the Australian Region version of the Man Computer Interactive Data Acquisition System (McIDAS), which was originally developed at the Space Science and Engineering Centre of the University of Wisconsin in the early 1970s for deriving cloud drift winds from geosynchronous satellite imagery. The present Australian Region McIDAS (ARM) is the result of eleven years of collaborative research effort and staff exchange between the Bureau of Meteorology and the University of Wisconsin. The uses of ARM are many and varied, including; video looping to show the time evolution of weather systems; rainfall estimation from satellite or radar imagery; display of numerical analysis and forecast fields and derived products.

. A number of activities in the CSIRO Division of Atmospheric Research in the field of Global Atmospheric Change received prominence in 1986-87 when several issues of concern for the environment were canvassed publicly. One of these issues was the growing evidence of damage to the Earth's ozone layer - most notably by the discovery of a dramatic seasonal depression of ozone levels over Antarctica, now known as the Antarctic ozone hole.

The second issue that received widespread attention was the greenhouse effect: the problem that rising trace gas levels in the global atmosphere were expected to lead to a warming of the atmosphere and hence climatic changes, as well as rising sea levels. Past and current research in the Division places it in an excellent position to tackle this particular issue in terms of its direct impact on Australia.

Space

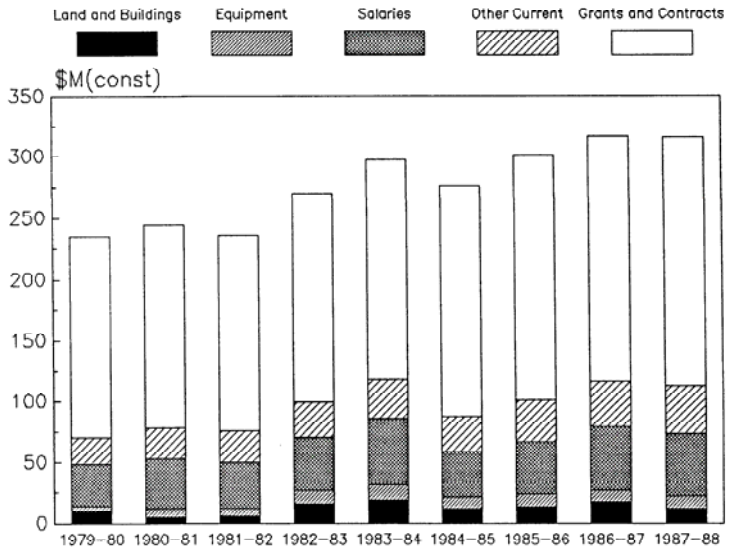
. The Australia Telescope, a Bicentennial project, reached a major milestone when the first antenna was handed over to CSIRO in May 1987. The Telescope is to eventually comprise an array of mobile radio telescope antennas simulating a giant telescope 300km in diameter. It will be centred on Culgoora, near Narrabri, with a further antenna at Siding Spring, near Coonabarabran, and links to the Parkes 64 metre radiotelescope. The antenna was constructed by Evans Deakin Industries Pty Ltd, based on specifications and research performed by the CSIRO Division of Radiophysics in conjunction with its consulting engineers MacDonald Wagner Pty Ltd. The Division will operate the Telescope as a national facility. The Telescope, which can be linked to other radiotelescopes around the world, will be able to map the universe in unprecedented detail.

3.22 GENERAL ADVANCEMENT OF KNOWLEDGE ($238.5m projected for 1987-88)

Major programs

R&D activities under this heading are supported through grants to universities (57%), the Australian Research Grants Scheme (15%), Commonwealth Postgraduate Research Awards (8%), Commonwealth Special Research Centres (3%), CSIRO (10%), and ANSTO (2%).

Fig 11. Commonwealth R&D Expenditure on Total Advancement of Knowledge (General; and Earth, Ocean, Atmosphere and Space by Type of Expenditure)



Growth trends

- Long-term growth (1978-79 to projected 1987-88): +3.8% pa;
- Short-term growth (1985-86 to projected 1987-88): -1.4% pa

CHAPTER 4

INTERNATIONAL COMPARISONS AND TRENDS[1]

4.1 Total resources devoted to R&D

It is of considerable interest to compare Australia's level and distribution of R&D effort with that of other countries. The OECD Science and Technology Indicators Unit regularly publishes such analyses of its member countries' R&D efforts. Figure 12 and Table 11 show some details of R&D expenditure of OECD countries, for the latest year for which data are available, grouped according to gross expenditure on R&D (GERD). Data are given both by source of funding ("who pays for it?") and by sector of performance ("who does it?").

Table 11 shows that all the large R&D performing countries are also highly R&D intensive, and perform the greater part of their R&D in the business enterprise sector. In the medium R&D performer group, Sweden and Switzerland appear very similar to the large R&D performers in their level of R&D intensity, and the performance (and funding) by the business enterprise sector.

Australia's R&D effort is remarkable in its distribution of funding and performance. While Australia's level of government support for R&D is comparable to that of most other countries, the level of business enterprise funding is very low. This is despite a significant increase in business enterprise R&D since 1981-82. On the most recent data available, the relative level of business enterprise funding of R&D (ie as a percentage of GDP) is lower only in New Zealand, Ireland, Iceland, Spain, Portugal and Greece.

In comparing GERD as a percentage of GDP among OECD countries, Australia's position prior to 1973 was close to the median, but between 1973 and 1976 our position deteriorated. This was a result of a sharp decline in business enterprise sector R&D in Australia, a decline in strong contrast with the stabilisation or increase in privately funded business enterprise R&D which occurred over the years prior to 1976 in almost all other OECD countries. After a stable level between 1976 and 1981, business sector R&D expenditure has increased markedly.

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(1) International comparisons are subject to a number of caveats arising from differences in R&D survey practice in the various countries. The proposed standard OECD practice is set out in the "Frascati Manual: The Measurement of Scientific and Technical Activities", OECD Paris 1980, but most member countries differ from the proposed standard in some areas. Readers should refer to the publications of the OECD Science and Technology Indicators Unit for details. Sources for this section were:

. Recent Results - Selected S&T Indicators OECD, Paris, September 1986

. OECD Science and Technology Indicators, Resources Devoted to R&D, OECD, Paris 1985

. Unpublished OECD sources

. ABS sources for Australian data are given in footnote (1) to p. 47 (business R&D data and revised historical series for Australian GDP) and at the foot of Table 8 (p. 22). See also Chapter 2 and corresponding appendix tables in "Measures of Science and Innovation - Australian Science and Technology Indicators Report 1987", November 1987; but note that some of these data need to be updated from the ABS sources given in the footnote to p. 47.

Table 11: Comparisons between OECD nations - gross domestic expenditure on R&D (GERD) as % GDP (latest available year)

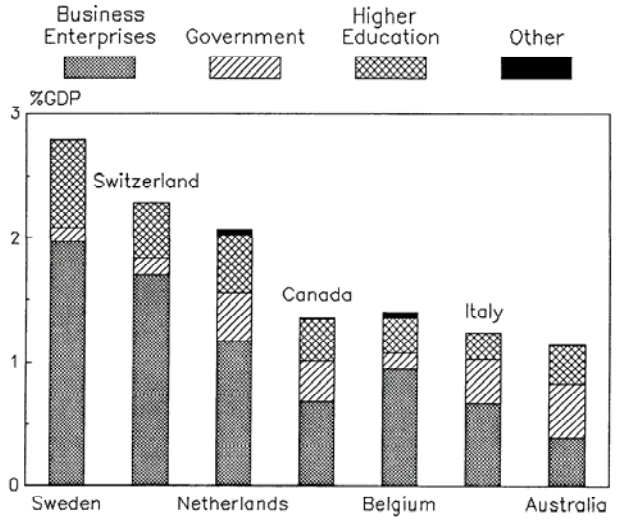
Country	GERD/ GDP(%)	R&D in Sector* as % GDP: Source of Funds* BE	Govt Civil	Govt Defence	Performance* BE	Govt	HE
Large R&D Performers							
USA (1986)	2.88	1.39	0.56	0.89	2.07	0.34	0.39
Japan (1985)	2.81	1.93	0.57	0.02	1.88	0.26	0.57
Germany (1985)	2.66	1.62	0.87	0.14	1.92	0.33	0.40
(Group Median)	2.66	1.39	0.57	0.46	1.88	0.34	0.39
UK (1985)	2.33	1.07	0.33	0.68	1.47	0.46	0.32
France (1985)	2.31	0.96	0.76	0.46	1.36	0.59	0.35
Medium R&D Performers							
Sweden (1985)##	2.79	1.75	0.66	0.30	1.97	0.12	0.69
Switzerland (1983)	2.28	1.76	0.45	0.06	1.70	0.14	0.45
Netherlands (1986)	2.07	1.03	0.90	0.03	1.17	0.39	0.47
(Group Median, without Australia)	1.74	0.96	0.66	0.06	1.06	0.24	0.39
Belgium (1979)	1.40	0.89	0.42	0.00	0.95	0.13	0.28
Canada (1986)	1.36	0.57	0.62	0.04	0.69	0.33	0.33
Italy (1985)	1.26	0.51	0.63	0.08	0.67	0.36	0.21
AUSTRALIA(1985-86)	1.16	0.36	0.70	0.06	0.38	0.44	0.32
Small R&D Performers							
Norway (1986)	1.67	0.82	0.73	0.06	1.01	0.28	0.38
Finland (1983)	1.32	0.73	0.55	0.01	0.75	0.28	0.28
Denmark (1985)	1.25	0.61	0.58	0.00	0.69	0.25	0.31
Austria (1981)	1.17	0.59	0.55	0.00	0.65	0.11	0.38
New Zealand (1983)	0.95	0.18	0.77	0.01	0.21	0.57	0.14
(Group Median)	0.87	0.28	0.52	0.01	0.32	0.25	0.17
Ireland (1985)	0.80	0.36	0.37	0.00	0.41	0.24	0.14
Iceland (1983)	0.74	0.23	0.49	0.00	0.13	0.38	0.20
Spain (1983)	0.44	0.22	0.20	0.01	0.23	0.13	0.08
Portugal (1984)	0.40	0.12	0.25	0.00	0.12	0.17	0.10
Greece (1984)	0.32	0.08	0.23	0.01	0.08	0.17	0.06
Australian Trends							
Australia(1968-69)	1.33	0.47	0.66	0.15	0.47	0.53	0.31
Australia(1973-74)	1.21	0.39	0.67	0.12	0.42	0.50	0.32
Australia(1976-77)	1.02	0.22	0.67	0.10	0.23	0.48	0.29
Australia(1978-79)	1.00	0.20	0.69	0.08	0.23	0.44	0.32
Australia(1981-82)	1.00	0.23	0.68	0.07	0.24	0.46	0.31
Australia(1984-85)	1.13	0.31	0.71	0.07	0.34	0.45	0.33
Australia(1985-86)	1.16	0.36	0.70	0.06	0.38	0.44	0.32
Australia(1986-87)	na	0.39	na	na	0.42	na	na

* In OECD data the Business Enterprise sector includes both private and public business enterprises. The General Government sector includes federal and provincial or State governments and their agencies excluding public business enterprises. "Government" as a source of funds includes the "Own funds" of public universities. Note that there are sectors other than those shown, so that the totals are less than the % GERD/GDP.

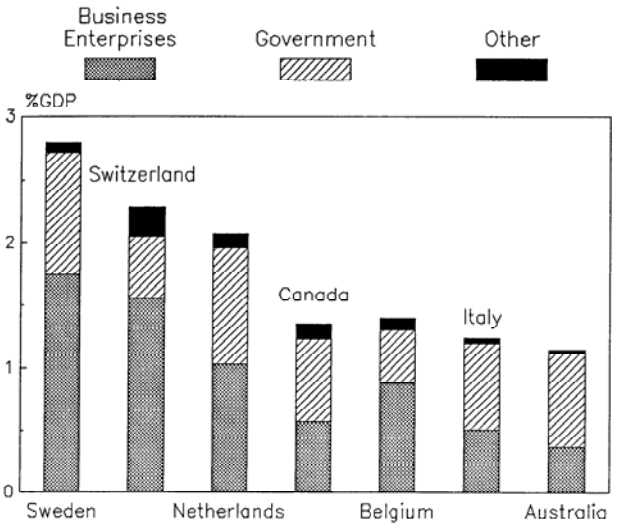
Excludes social sciences and humanities.

Fig 12. R&D performance by selected OECD countries

a) Sector of performance



b) Source of funds



4.2 Resources devoted to business enterprise R&D

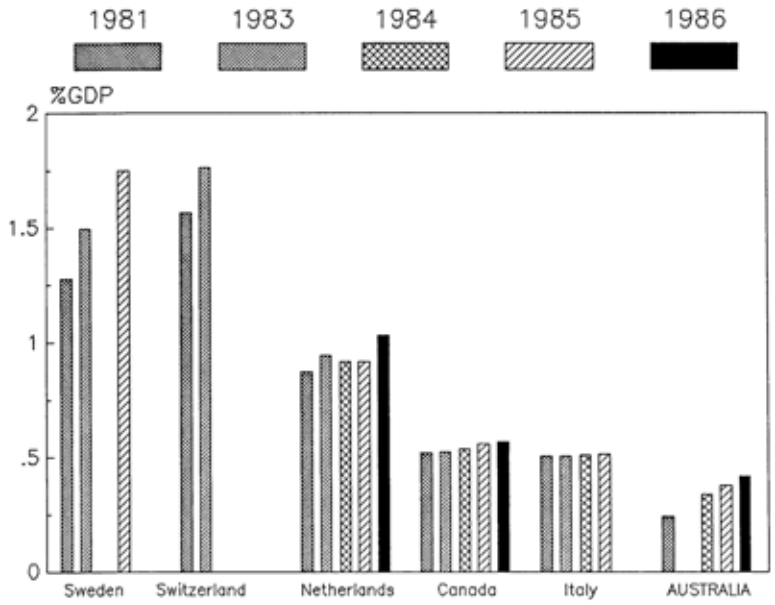
In 1986-87, the latest year for which survey results are available, business enterprise R&D expenditure (BERD) in Australia was $1082m (0.42% of GDP)[1]. This compared with levels of $905m in 1985-86 (0.38% of GDP), $721m in 1984-85 (0.34% of GDP) and $374m in 1981-82 (0.24% of GDP) and represents an increase of some 85% in real terms since the latter year. BERD in Australia was at an historic low, at around 0.24% of GDP, over the period from 1976-77 to 1981-82.

Present estimates are that there was a real R&D increase in the region of 5% in 1987-88. This estimate would lift BERD to about $1200m (about 0.43% of GDP) in 1987-88. Factors contributing to these encouraging increases in R&D activity have been changing economic conditions, Government initiatives such as the 150% tax concession for industrial R&D and the development of a generally more positive attitude to R&D among Australian managers.

A significant feature of development in Australia's total R&D effort since the early 1980s has been the relative increase in business R&D activity compared to levels of research in government agencies. As an indication of this, while business enterprise R&D expenditure has increased from $374m in 1981-82 to about $1200m in 1987-88, Commonwealth funding for R&D in the CSIRO has increased from $274m to $359m over the same period.

Figure 13 shows Australian business funding of R&D relative to other OECD nations which are middle-ranking in terms of overall R&D expenditures. Despite the recent significant increases from the low base of the early 1980s, Australia still lags behind comparable countries in our business investment in R&D.

Fig. 13 Trends in business enterprise R&D funding as a percentage of GDP for selected OECD countries



(1) Australian Bureau of Statistics: Research and Experimental Development, Business Enterprises, Australia, 1986-87, Preliminary (Catalogue No 8105.0 - 18 April 1988); Quarterly Estimates of National Income and Expenditure, Australia, December Quarter, 1987 (Catalogue No 5206.0 - 28 March 1988).

4.3 Technology-based trade

Table 12 gives an indication in broad terms of Australia's low position among OECD countries in relation to exports of "technology-based" products. While all manufactured products are technology-based according to a strict definition of technology[1], the term "technology-based" is used in this report to refer to products falling within Standard International Trade Classification divisions which include the recognised "high-technology" or "technology-intensive" product classes. The data are drawn from OECD publications[2], in the Standard International Trade Classification divisions 51 (organic chemicals), 52 (inorganic chemicals), 53 (dyeing, tanning and colour materials), 54 (medicinal and pharmaceutical products), 58 (artificial resins and plastic materials and cellulose esters and ethers), 59 (chemical materials and products n.e.i.), 71 (power generating machinery and equipment), 72 (machinery specialised for particular industries), 73 (metalworking machinery), 74 (general industrial machinery and equipment n.e.i. and machine parts n.e.i.), 75 (office machines and automatic data processing equipment), 76 (telecommunications and sound recording and reproducing equipment), 77 (electrical machinery, apparatus and appliances n.e.i. and electrical parts thereof), 87 (professional scientific and controlling instruments and apparatus n.e.i.) and 88 (photographic apparatus, equipment and supplies, and optical goods n.e.i., watches and clocks).

Although some of the products in these product divisions would not be regarded as technology-intensive on the usually accepted basis of above average R&D intensity in the associated industry class, and some high technology products (eg. aircraft and associated parts) have not been included, taken overall it is thought that exports in these fifteen product divisions may be regarded as a reasonably satisfactory comparative measure of a country's capability in producing technology-based products. Aircraft and parts were excluded because Australia's exports in this product class are almost entirely re-exports of imported products.

Trade data of this kind should be interpreted with some caution. It may well be that countries such as Australia which are low on the scale of technology-based exports have either consciously elected or through market forces come to rely on trade in other commodities in which they have comparative advantage and/or traditional involvement. The indigenous levels of installed technology and technical skills of the workforce are among the economic determinants of the national product mix and competitiveness on the export market. In looking at trade in the technology-based product groups we are looking at the outcome of many economic factors and influences, but to some degree exports in these product groups can be taken as a measure of technological capability. Furthermore, it should be noted that Table 12 refers to 1985. More recent data for Australia show some improvements in technology-based exports.

There is a need for particular comment on the import figures. The high level of imports in technology-based products is partly due to the need for advanced equipment to modernise and develop Australian industry. Thus the import figures have positive aspects. Again, it should be noted that Table 12 refers to 1985. More recent data for Australia show a slowing in the growth of imports of technology-based products.

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(1) "Technology is a perishable resource comprising knowledge, skills, and the means of using and controlling factors of production for the purpose of producing, delivering to users, and maintaining goods and services from which there is an economic and/or social demand."

(2) (i) OECD Trade by Commodities Market Summary: Exports 1985
(ii) OECD Trade by Commodities Market Summary: Imports 1985
(iii) United Nations "Monthly Bulletin of Statistics"

Table 12: Trade in Selected Technology - Based Products - OECD Nations, 1985

Country	Populn (m)	Exports (US $m)	Imports (US $m)	Ratio exports/ imports	Per Capita exports (US$/person)
Large R&D Performers					
USA	236.3	83313	97458	0.855	348.2
FRG	61.0	72264	38070	1.898	1184.3
Japan	120.8	83407	16802	4.964	690.7
UK	56.1	36478	33211	1.098	650.0
France	55.2	28461	28852	0.986	515.9
Medium R&D Performers					
Switzerland	6.4	16467	9180	1.794	2585.1
Sweden	8.4	9747	9312	1.047	1167.3
Netherlands	14.5	17575	17022	1.032	1213.7
Canada	25.4	12711	24508	0.519	501.0
Belgium	10.3	10341	11559	0.895	1006.9
Italy	57.1	24242	19394	1.250	424.3
AUSTRALIA	15.8	954	9165	0.104	60.6
Small R&D Performers					
Finland	4.9	2792	3986	0.700	568.6
Norway	4.2	1827	4759	0.384	440.2
Denmark	5.1	4770	4784	0.997	933.5
New Zealand	3.3	415	2049	0.203	127.7
Ireland	3.6	4608	3495	1.318	1298.0
Portugal	10.2	999	1848	0.541	97.7
Austria	7.6	5814	6153	0.945	769.0
Greece	9.9	235	1948	0.121	23.7
Spain	38.6	4497	7777	0.578	116.5
Turkey	49.6	711	3503	0.203	14.3
Yugoslavia	23.1	3048	3763	0.810	131.8

APPENDIX A

MINISTRY ACTIVITIES

Al PRESENTATION

This Appendix is a presentation of Commonwealth R&D and S&T expenditures by ministry. Readers are reminded that the S&T figures include the R&D expenditures, and that the purpose of the S&T figures is to identify programs and agency units primarily devoted to S&T activities. (See Appendix E for definitions and further details).

The tables for the ministries are presented in two categories (for some ministries only one applies): Commonwealth direct expenditure, and expenditure from other sources. Figures listed under **Commonwealth sector direct expenditure** correspond to expenditure on S&T from amounts appropriated by Parliament under the Appropriation Acts, plus residuals of appropriations retained from previous years, trading revenues of government enterprises, disposals of plant and sales of publications. Together these amounts constitute all direct funding by the Commonwealth Government. Expenditure from other sources covers amounts received for S&T activities by Commonwealth bodies from non-Commonwealth sources, such as private industry, State or foreign governments, or private non-profit organisations. Note that revenue from commercial activities is included in direct expenditure from Commonwealth sources, rather than other sources.

The accompanying text is a brief of the activities listed in the relevant tables. However, for selected agencies, illustrative details are also given. As in previous Statements, the aim has been to list expenditures of each agency or program for all years under the Ministry which holds responsibility for that agency or program at the time the Statement is drafted. A major reorganisation of portfolios occurred in July 1987. Where appropriate, the former Ministry is shown for each organisation. In general, sources for the information presented in the tables are the agencies listed.

A2 DERIVATION, VALIDATION AND ABBREVIATIONS

Data for the Science and Technology Statement are derived through a survey of about 70 agencies or units of the Commonwealth Government. These respondents return over 350 data collection forms for processing by the Department of Industry, Technology and Commerce (DITAC). In a few cases (notably for AIDAB) there are special data collection procedures. Validity of the data is checked, as far as possible, by staff of DITAC who refer to Annual Reports, Budget documents, departmental explanations of estimates and other material for this purpose. (For the definitions used see Appendix D).

Great stress is placed on continuity of reporting procedures from year to year. In addition, it is sometimes necessary to discuss returns with respondents and amend the returns as a result. In a few isolated cases, agencies are unable to provide their survey data in time and these data are estimated by DITAC staff. In these cases, the ability to validate data adequately is correspondingly reduced and the data presented for those organisations should be regarded appropriately. Any such data are marked by an ampersand (&) in the ministry tables.

Abbreviations:

cap.	Intramural capital expenditure, mainly in the NSE.
cur.	Intramural current expenditure, mainly in the NSE.
ext.	Extramural expenditure, mainly in the NSE.
S	As above, but mainly in the SSH.

A3 ABORIGINAL AFFAIRS

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Dept. of Aboriginal Affairs	ext.S	0.10	0.15	0.08	0.01	-	0.01	-
Institute of Aboriginal Studies	ext.	0.08	0.12	0.16	0.21	0.22	0.21	0.22
	cap.S	0.00	0.00	0.00	0.01	0.01	0.20	0.16
	cur.S	0.17	0.06	0.05	0.51	0.51	2.66	2.76
	ext.S	0.17	0.32	0.24	-	-	0.71	0.73
	Total	0.52	0.65	0.53	0.73	0.74	3.79	3.87

See page 51 for explanation of abbreviations.

A3.1 DEPARTMENT OF ABORIGINAL AFFAIRS

The Department of Aboriginal Affairs is contained within the Community Services and Health Portfolio. The Department's Investigations and Research Program, undertaken by outside agencies, sponsors research addressing contemporary Aboriginal issues and providing immediate benefit to Aboriginals. Departmental policy development and evaluation is also assisted by research under this program.

A3.2 AUSTRALIAN INSTITUTE OF ABORIGINAL STUDIES

The Institute promotes Aboriginal studies and assists relevant cooperation among universities, museums and other institutions. This entails the collection, processing and storage of data on all aspects of Aboriginal culture and the facilitation of studies by its own staff and others. Work being undertaken by the Institute includes the preservation of Aboriginal languages, compilation of dictionaries of the main languages, recording of music and dances, taping of oral history and studies of food sources and herbs used by Aborigines. The Institute disseminates information about Aboriginal culture, both by publishing its own findings and making available material from other sources.

A4 ADMINISTRATIVE SERVICES

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Scientific Services	cap.	0.11	0.22&	0.01	0.02	0.01	0.36	0.26
	cur.	0.88	0.94&	0.03	0.08	0.08	1.80	1.87
Survey & Land	cap.	-	-	-	-	-	4.05	13.87
Information Group*	cur.	-	-	-	-	-	34.73	30.27
	ext.	-	-	-	-	-	4.59	5.22
Bureau of	cap.	0.09	0.41	0.46	0.18	0.29	3.96	5.74
Meteorology	cur.	1.65	1.76	2.37	2.50	2.75	61.29	65.09
	ext.	0.15	0.15	0.16	0.01	-	0.01	-
Bureau of Meteorology international activities	cur.	-	-	-	-	-	0.40	0.33
	ext.	-	-	-	-	-	0.64	0.73
Ionospheric	cap.	0.01	0.00	0.03	0.08	0.11	0.10	0.12
Prediction Service	cur.	0.09	0.10	0.11	0.15	0.17	1.61	1.89
Australian Government	cap.	0.05	0.03	0.03	0.23	0.25	0.68	1.04
Analytical Labs	cur.	0.63	0.50	0.54	0.48	0.51	8.08	9.55
	Total	3.65	4.11	3.73	3.73	4.18	122.29	135.96
B. Expenditure from other sources								
Bureau of	cap.	-	-	-	0.01	-	1.27	1.77
Meteorology	cur.	-	-	-	0.13	-	19.70	20.26
	Total	-	-	-	0.14	-	20.97	22.03
Total expenditure (all sources)		3.65	4.11	3.73	3.87	4.19	143.26	157.99

See page 51 for abbreviations

- The Survey and Land Information Group will generate approximately $23m revenue in 1987-88.

A4.1 DEPARTMENT OF ADMINISTRATIVE SERVICES

The new Department of Administrative Services is an amalgamation of the largest functions of the former Departments of Housing and Construction, Local Government and Administrative Services, and the Special Minister of State. It also comprises functions transferred from the former Departments of Arts, Heritage and the Environment (Australian Archives), Resources and Energy (National Mapping), Science (Bureau of Meteorology, Ionospheric Prediction Service, Australian Government Analytical Laboratories), Sports, Recreation and Tourism (Australian Government Publishing Service, Information Coordination), Territories (Parliament House Construction Authority) and Treasury (Valuation Services).

Scientific Services Branch (Housing and Construction)

The Scientific Services Branch of the Department of Administrative Services' Construction Group conducts S&T activities directly concerned with the design and construction of departmental projects. Topics include natural and processed materials, building products, processes and systems and operating and environmental conditions.

A4.2 SURVEYING AND LAND INFORMATION GROUP

The Surveying and Land Information Group is an amalgamation of the Australian Survey Office (formerly in Department of Local Government and Administrative Services) and the Division of National Mapping (Natmap, formerly in the Department of Resources and Energy).

It is the Government's control service agency responsible for providing cost effective surveying, mapping and associated services for Commonwealth purposes throughout Australian and its Island Territories. The Group is also responsible for the provision of advice to the Minister and the Government on a wide range of issues relating to the surveying and mapping industry through the Australian Surveying Industry Advisory Committee and the Intergovernmental Committee on Surveying and Mapping, and for the promotion of the export of surveying services as assessing potential export markets.

The Group supports Government programs in:

. national development and defence

. community services

. scientific and environmental studies

. exchange and utilisation of land-related information.

Approximately 51% of this year's program will be directed towards national development and defence requirements. Major projects will include continued support for construction at Brisbane and Sydney airports, Tindal Defence Aerodrome, the Jindalee site in Western Australia, the Cape York forward defence airfield and various government establishments throughout the country. In addition, surveying and associated services for land development in the ACT is expected to consume about 24% of the budgetary allocation.

Surveying services in support of Government programs will be necessary for Aboriginal settlements in various regions, communication networks in remote areas and the production of tactual maps for the visually impaired in public areas of Commonwealth buildings, About 10% of the work program will aid Government services to the community.

Surveying support of scientific and environmental projects will account for approximately 14% of budget outlays and include large geological and geophysical projects for the Department of Primary Industries and Resources, assistance with the declaration and ground marking of national parks and activities for the Heritage Commission.

The two main series of topographic maps are at 1:100,000 and 1:125,000 scale. Compilation of the remaining 1:100,000 scale maps is due for completion in 1988, and subsequent derivation of the 1:250,000 scale maps is due for completion by 1989.

Four national atlases are being produced by the Mapping Group - the Atlases of Australian Resources, Population and Housing, Commonwealth Electoral Divisions and the Tactual Atlas of Australia. Two atlases, Volume 6 "Vegetation" of the Atlas of Australian Resources and the Atlas of Commonwealth Electoral Divisions 1902-1988, are endorsed as Australian Bicentennial activities.

Preparation of these and other client specified thematic maps are partly funded through the budget and to some extent by the clients themselves. Revenue from the sales of maps, map products and remotely sensed data is expected to reach $2 million in 1987-88.

The Government has agreed to expenditure of $10.9 million for the upgrading of the Australian Centre for Remote Sensing. As well as benefiting private industry, the satellite information will be used to supplement various government programs on offshore regions around Northern Australia and for soil degradation studies for primary industry.

A4.3 AUSTRALIAN GOVERNMENT ANALYTICAL LABORATORIES (AGAL)
(Science)

The objectives of the Australian Government Analytical Laboratories are:

. To provide, in a timely and efficient manner, independent quality services in analytical chemistry and microbiology to enable:-

  (i) client Government Department and Agencies to meet their responsibilities in protecting public health, collecting revenue on imported goods, enforcing laws against the importation of illicit drugs and drugs of abuse and protecting the good name of export agricultural products, and

  (ii) client Australian industries to compete for domestic and overseas markets with products independently certified for quality and safety.

. To develop new or improved methods of analysis so that up-to-date techniques can be used as the basis for advice.

. To provide specialist scientific and advisory services to the Australian Government Analyst and to Australian industry and Government clients.

. To ensure laboratory competence through collaborative studies, analytical quality assurance activities and the provision of specialist in-house services.

A4.4 BUREAU OF METEOROLOGY
(Science)

The Bureau of Meteorology provides the national meteorological service. This covers a broad spectrum of activities including observing and forecasting the state of the atmosphere throughout Australia and adjacent territories, issuing warnings of hazardous weather events, and publishing and promoting use of meteorological information. It also undertakes the research needed to maintain it as a viable modern service.

The Bureau of Meteorology Research Centre (BMRC) provides the main organisational framework for carrying out the research responsibilities of the Bureau of Meteorology. The Centre's role is to perform the functions of a national meteorological research agency and to provide R&D support for the operational and service functions of the Bureau.

The objectives of the Research and Development Program are:

. to advance the science of meteorology

. to develop an integrated, comprehensive description and scientific understanding of Australian weather and climate

. to solve specific problems in meteorology

. to develop the application of meteorology to the needs of the Australian community

. to support the operations and services of the Bureau.

There are four individual research areas, as follows:

. Pure Research. To advance the science of meteorology through increased understanding of the basic physics and chemistry of atmospheric processes and phenomena without regard to geographic boundaries. This research is at the frontiers of knowledge of the fundamental mechanisms of the atmosphere.

. Strategic Research. To develop an integrated comprehensive description and scientific understanding of Australian weather and climate. This research is directed at contributing to the community's store of knowledge of the basic meteorology of the Australian region.

. Applied R and D. To (a) solve specific scientific problems in meteorology as part of a Bureau service or arising in the course of the Bureau's operations; and (b) develop the application of meteorology in support of the needs of the general community, defence, shipping, aviation, primary production, industry, trade and commerce. This involves research at the interface with other disciplines such as agriculture, engineering, architecture, aerodynamics, and biology.

The Bureau of Meteorology also promotes Australia's role in international meteorological activities, eg, operation of the World Meteorological Centre, Melbourne; participation in the programs of the World Meteorological Organisation; and promotion of the transfer of technology to developing countries.

A4.5 IONOSPHERIC PREDICTION SERVICE (IPS)
(Science)

The Ionospheric Prediction Service provides assistance and advice to radio communicators through the distribution of long-term operational and planning radio predictions, and to radio communicators, geophysicists and other users of the earth-space environment through short-term forecasts of the state of the sun, the earth's upper atmosphere and magnetic field.

IPS is concerned with two broad areas of research:

. to study the Earth's upper atmosphere, ionosphere, and magnetosphere; and radio wave propagation through them. This is fundamental to radio communications, navigation and radio direction finding.

. to study the development of solar activity regions, the propagation of solar disturbances through interplanetary space, and the effects of such disturbances on terrestrial communication, navigation and geophysical systems. This knowledge is central to the forecasting of terrestrial effects of solar activity.

Specific projects for 1987-88 are:

. development of an automatic ionospheric data system

. completion of an ionospheric data model

. support for satellite radio beacon measurements of ionospheric variation.

A5 ARTS, SPORT, ENVIRONMENT, TOURISM AND TERRITORIES

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Bureau of Flora and Fauna	cap.	-	0.04	0.02	0.02	0.02	0.02	0.02
	cur.	0.14	0.05	0.06	0.14	0.14	0.67	0.69
	ext.	0.47	0.53	0.01	0.46	0.57	0.85	0.94
Environment Division	cur.	-	-	-	-	-	2.71&	2.80&
	ext.	-	-	-	-	-	1.35&	1.40&
Australian Environmental Council	ext.	-	-	-	-	-	0.07&	0.07&
Australian Film and Television School	cur.S	0.10	0.11	-	0.27	0.24	0.27	0.24
	ext.S	-	-	-	0.05	0.05	0.05	0.05
Australian National Parks and Wildlife Service	ext.	0.19	0.36	0.31	0.29	0.30	0.65	0.70
Great Barrier Reef Marine Park Authority	cur.	-	0.04	0.06	0.01	-	0.03	-
	ext.	0.08	0.07	1.01	0.79	0.66	1.19	0.98
	ext.S	0.04	0.01	0.02	-	-	0.03	0.03
National Library	cap.	-	-	-	-	-	1.40	1.43
	cur.	-	-	-	-	-	0.37	0.37
	cap.S	-	-	-	-	-	2.79	2.87
	cur.S	0.01	-	-	-	-	11.96	12.32
Supervising Scientist of the Alligator River	cap.	0.99	0.53	0.91	1.71	0.91	1.71	0.91
	cur.	3.26	3.87	3.37	4.13	4.90	4.13	4.90
	ext.	0.24	0.35	0.23	0.30	0.30	0.30	0.30
National Botanic Gardens	cap.	0.00	0.00	0.04	0.06	0.07	0.93	0.07
	cur.	0.35	0.32	0.36	0.33	0.33	3.69	0.33
Antarctic Division	cap.	6.50	6.15	6.11	4.77	4.99	7.24	7.38
	cur.	12.11	15.14	16.93	21.71	22.69	34.51	35.95
	ext.	0.01	0.03	-	0.60	0.34	0.61	0.34

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure (continued)								
ACT Schools Authority	cur.S	0.13	0.13	0.28	0.21	0.30	0.21	0.30
ACT Health Authority	cap.	-	-	0.01	0.01	0.01	0.01	0.01
	cur.	0.17	0.18	0.17	0.23	0.23	0.23	0.23
	ext.	-	-	-	0.01	-	0.01	-
	cap.S	-	-	-	0.01	0.01	0.01	0.01
	cur.S	0.17	0.02	0.12	0.16	0.16	0.16	0.16
National Capital Development Authority	cur.	0.00	0.00	-	-	-	0.04	0.06
	ext.	0.02	0.02	-	0.10	0.15	0.18	0.35
	cur.S	-	-	-	0.00	0.01	0.66	0.67
	ext.S	-	-	-	0.02	0.01	0.28	0.23
Other territories functions	cap.	-	-	-	-	-	0.10&	0.10&
	cur.	0.04	0.06	0.06	0.08&	0.09&	1.31&	1.36&
	ext.	-	-	-	-	-	0.03&	0.03&
	cur.S	0.12	0.13	-	-	-	0.06&	0.07&
	Total	25.00	27.96	29.91	36.50	37.48	81.29	79.15
B. Expenditure from other sources								
Australian Environmental Council	ext.	-	-	-	-	-	0.07	0.07
Australian National Parks and Wildlife Service	ext.	-	-	0.05	0.04	0.04	0.04	0.04
National Library	ext.S	-	0.00	0.02	0.01	0.02	0.01	0.02
Other Territories Functions	cap.	-	-	-	-	-	0.00&	0.00&
	cur.	-	-	-	-	-	0.01&	0.01&
ACT Health Authority	cap.	-	-	-	0.00	0.00	0.00	0.00
	cur.	0.17	0.17	0.17	0.25	0.27	0.25	0.27
	cap.S	-	-	-	0.00	0.00	0.00	0.00
	cur.S	-	-	-	0.05	0.06	0.05	0.06
	Total	0.18	0.19	0.24	0.36	0.40	0.44	0.49

($ million)	R&D					S&T (including R&D)	
	83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
Total expenditure (all sources)	25.18	28.15	30.15	36.86	37.88	81.73	79.64

& DITAC Estimate. See page 51 for explanation of other abbreviations.

* Capital expenditure for the National Library includes monographs, serials, films and databases.

A5.1 DEPARTMENT OF ARTS, SPORT, ENVIRONMENT, TOURISM AND TERRITORIES

The portfolio of the Arts, Sport, the Environment, Tourism and Territories has broad responsibility for the areas of sport and recreation, tourism, the Antarctic, the arts, film and television, heritage, conservation, the environment and territories.

Environmental Activities (Arts, Heritage and Environment)

The Environment Division provides the focus for Commonwealth responsibilities in environmental matters and for communication with international environmental agencies, particularly the United Nations Environment Programme and the Environment Directorate of the OECD. In general, the Division is responsible for policy advice, developing proposals, administering legislation, implementing programs, carrying out studies and assessments and general coordination of Commonwealth environmental interests.

A National Air Quality Data Program is being commenced to expand the data provided by the States to the National Air Quality Data Centre. This data is used for the development of long term strategies for the control of motor vehicle emissions and the establishment of national air quality goals and standards.

A National Notification and Assessment Scheme for industrial chemicals is being developed. The Department is also completing a National Inventory of Existing Chemicals.

Marine environment activities have included work on the marine quality assessment program, which includes monitoring baseline pollution levels and bio-indicator studies.

Environment studies undertaken by the Environment Policy Division include measurement of the costs of environment protection measures, utilisation of environment statistics, and the evaluation of the environmental implications of present and proposed public policies that may be environmentally important. The responsibility of the Division also includes the administration of grants to voluntary conservation bodies, and the provision of secretariat and other support services to the Australian Environment Council, the Australian Council of Nature Conservation Ministers and the Australian Ionising Radiation Advisory Council.

Territories functions (Territories)

The Department of Territories is responsible for the administration of the Australian Capital Territory, the Jervis Bay Territory, the Territory of Cocos (Keeling) Islands, the Territory of Christmas Island, the Coral Sea Islands Territory and the Territory of Ashmore and Cartier Islands, and for Commonwealth responsibilities on Norfolk Island. The Department's involvement in science and technology is mainly limited to management oriented activities such as the management of wildlife populations, forests, parks, nature reserves and rural land.

The Housing Branch administers the Government's rental housing and housing finance assistance schemes in the ACT and carries out research to identify housing needs of the ACT population.

The Branch is particularly concerned with three areas of research:

. demand for housing: to analyse vacancy rates, interest rates, the demand for crisis accommodation and alternative forms of public housing and their applicability to the ACT.

. the supply of housing: to monitor public/private market trends and review public sector housing programs.

The Branch has a number of research projects underway. These include:

. producing assessments of the housing outlook

. monitoring construction programs

. reviewing alternative housing programs and their applicability to the ACT

. aspects of maintenance and upgrading of public rental stock.

The Weights and Measures Office has the objective to ensure equity in trade. Its activities are therefore directed towards accurate trade measuring instruments and accurate measuring practices.

The Welfare Branch collects data and compiles statistics on various social welfare activities for management purposes, policy formulation, monitoring of activities, provision of information in relation to research and projects and also for inclusion in the National Welfare Statistical Collection (WELSTAT).

The Parks and Recreation Division is responsible for the management and maintenance of parks and open space, nature reserves, water catchments, lakes and streams, rural areas and commercial pine plantations. It is also responsible for co-ordination and control of animal disease and livestock movements in the ACT.

The Wildlife and Environment Unit of the Land Management Branch carries out scientific and technological programs related to the monitoring and management of flora and fauna in the ACT and Jervis Bay. The data collected and the techniques developed assist in specific management priorities of the division. Current research projects include

. status of the koala in the ACT

. distribution and abundance of rare and threatened fauna in the ACT and a survey of vegetation of the Namadgi National Parks.

Recent publications included papers on techniques used for estimating grey kangaroo numbers on rural lands, and the distribution and abundance of Aprasia parapulchella and Dasyornis brachypteris.

The Horticultural Services Unit of the Land Management Branch meets the Division's commitment to an ongoing program of tree management, plant propagation and introduction, integrated pest and weed management, turf and irrigation management and aquatic plant control. These programs are aimed at the development and/or selection of new plant species, machinery and procedures suited to the horticultural and park management situation in the ACT. Recent studies include

. an evaluation study of Eucalyptus species for landscaping in the ACT

. the harvesting and handling of native grass seeds

. pest management prescription sheets

. soil/plant water relations for consideration in turf irrigation design

ACT Forests Branch (Territories)

Some ACT forests are administered by the Forestry Branch of the Department. Forest activities are run as a business undertaking with commercial, conservation and amenity objectives. The commercial program is funded by the ACT Forestry Trust Account.

The Branch is researching environmental factors affecting plantation development, the effects of fire on catchment management and the computer modelling of forest growth. Recent research projects include:

. foliar analysis for aiding the formulation of fertilizer programs

. development of cultivation equipment for first and second rotation crops

. development of helicopter strip spraying techniques.

A5.2 AUSTRALIAN NATIONAL BOTANIC GARDENS
(Arts, Heritage and Environment)

The Australian National Botanic Gardens' responsibilities are to collect, research, exhibit and explain the National Heritage Collection of Australian and related plants for the use, better understanding and enjoyment of all people. The Gardens' research role is principally to secure information needed to ensure the survival of Australian flora and to provide a better and more accurate information service.

The Gardens are concerned with three areas of research:

. botanical research concerned with the systematics of the Australian and related flora and provision of data for the identification and classification of Australian flora

. horticultural research for the successful introduction, establishment, maintenance and long term survival of plants in the Gardens' collection

. biological research to investigate the biology of Australian flora for the formulation of conservation strategies, especially for the rare and endangered plant species.

Current research projects include:

. revisionary and nomenclatural studies

. cladistic studies

. biogeographical studies

. flora treatments

. in vitro studies: concerned with the in vitro production of herbaceous and woody plants through tissue, embryo, haploid cells and seed culture

. plant selection studies: these laboratory-based studies are aimed at the development of new plant varieties for use in the horticultural trade

. germ-plasm storage studies: the program involves the development and introduction of new techniques for cryogenic storage of plant and fungi germ-plasm, in particular those of endangered taxa

- propagation/cultivation studies: these studies are aimed at increasing the number of Australian native plant taxa in cultivation at the Australian National Botanic Gardens through traditional methods of propagation

- rare and endangered plant studies: conservation biology studies of rare and endangered taxa, aimed at increasing understanding of their breeding and pollination biologies, in the interests of developing effective management strategies

- breeding systems/pollination biology studies: these studies concentrate on Australasian members of the families Orchidaceae, Rutaceae and Fabaceae

- phytochemical/isoenzyme studies: this group of projects concentrates on biological studies of the above three families, providing information essential to current taxonomic and systematic studies

- biology of mycorrhizal fungi: this program investigates plant/mycorrhizal relationships in Australasian plants.

A5.3 BUREAU OF FLORA AND FAUNA
(Arts, Heritage and Environment)

The Bureau of Flora and Fauna is responsible for conducting the Australian Biological Resources Study (ABRS). The objectives of the ABRS are:

- to co-ordinate all work aimed at collecting, describing and classifying Australian plants and animals and determining their distribution

- to establish priorities for taxonomic research

- to record and collate information on flora and fauna collected when geographical areas have been studied or surveyed in any way

- to co-ordinate publication of a systematic series of flora and fauna handbooks

- to maintain comprehensive information on, and provide professional evaluation of, national taxonomic collections.

To reach these objectives the ABRS uses database management techniques to manage the taxonomic and distributional information, and computer-assisted production techniques to publish major taxonomic works on the Australian flora and fauna.

The ABRS encompasses all States and Territories, immediate offshore islands, Macquarie Island, Lord Howe Island and all external Territories.

Particular objectives at present are to:

- improve and increase the output of taxonomic research and documentation in Australia by means of a grants scheme, called the Participatory Program. This program, which awards grants to researchers in the States and Territories, is the core of the ABRS activities.

- promote the writing and publishing of *Flora of Australia*. This work, of about 60 volumes, will be the first national *Flora* for over 100 years and the first to be written in Australia. The *Flora*, with five volumes already published, is widely recognized as a significant work of reference and a major aid to the identification of Australian flora.

- promote the writing and publishing of a 10-volume *Fauna of Australia*, the first work to provide comprehensive information on the identification of Australia's fauna. This work complements the *Zoological Catalogue of Australia* , a multivolume work on the taxonomy of Australia fauna. The Zoological Catalogue will also be developed as an on-line computerized database.

. develop a database system for distributional and taxonomic specimen data held by Australian museums and herbaria, to be known as the Australian Biogeographic Information System (ABIS). From time to time publications will be produced from this database - eg *A Preliminary Atlas of Elapid Snakes of Australia* and *Atlas of Australian Mangroves,* both currently in preparation.

. investigate the methodology needed to use the ABIS for planning and co-ordinating biological surveys, environmental sampling and to assist taxonomic research. In particular, information in the ABIS will help provide a scientific basis for conservation and resource management.

. review the program to map Australia's vegetation.

A5.4 AUSTRALIAN FILM, TELEVISION AND RADIO SCHOOL

(Arts, Heritage and Environment)

The School is empowered by its act to conduct and encourage research in conjunction with the production of programs. Research is carried out by the Research and Information Branch which includes the School's Research Unit as well as its Library, Resources Unit and Publication Unit.

The objective of the Research Unit is to provide research based information and advice on film, radio and television issues identified by the School, industry and government.

A Media Research Network was established recently to avoid duplication of research effort and to disseminate research data. Current research topics include

. establishing by survey questionnaire emloyment levels in the film and television industry

. studies into occupational health and safety in the film, radio and television industry

. surveying the training courses on film, television, radio and related media subjects available in Australia

The research unit co-ordinates the Production Technology Network which was established in 1987 by the school to encourage technical research and development processes by staff and students.

A5.5 AUSTRALIAN NATIONAL PARKS AND WILDLIFE SERVICE

(Arts, Heritage and Environment)

The Australian National Parks and Wildlife Service is responsible for providing policy advice to the Commonwealth Government. Its role embraces both terrestrial and marine nature conservation issues which are nationally and internationally significant. The Service's diverse role necessitates extensive information requirements for policy development and for planning and managing national parks.

Scientific information gathering is achieved primarily through the Service's Research and Survey Program. The prime objective of this program is to sponsor research, survey and monitoring projects in order to collect information on ecological resources and ecological processes. The program covers a wide range of nature conservation policy and park management related issues.

Research projects cover topics such as:

. Kakadu National Park (Aboriginal rock art, impact of fire, species surveys)

- Uluru National Park (cross-cultural interpretive material development, flora and fauna studies)
- Christmas Island (surveys of Golden Bosunbird and marine habitats)
- Norfolk Island (rat and weed control, surveys of Norfolk Island Boobook Owl, Long-billed White-eye and Scarlet Robin)
- macropods (eg population dynamics, fox control studies, assessment of aerial surveys)
- koalas (disease and stress)
- ornithology (eg studies of waders, migratory birds)
- flora (eg updating list of rare or threatened Australian plants)
- marine protected areas (Elizabeth and Middleton Reefs marine resources survey, inventory of Australian estuarine and in-shore waters)
- whale protection (surveys of Right Whales and Humpback Whales)

A5.6 GREAT BARRIER REEF MARINE PARK AUTHORITY (GBRMPA)

(Arts, Heritage and Environment)

The Great Barrier Reef Marine Park Authority (GBRMPA) is responsible for the development and care of the Great Barrier Reef Marine Park within the Great Barrier Reef Region.

The Authority's research role is principally to secure information needed for marine park planning and management. The Authority is concerned with three broad areas of research:

- studies of marine organisms and ecosystems, reef geomorphology, hydrology and other aspects of the biological and physical environment. A basic understanding of the Reef and human use is fundamental to the development and monitoring of the Authority's zoning and management plans as well as monitoring of the Reef environment.
- knowledge of the impact of human uses on the biological and physical environment, leading to identification of the levels of use at which critical damage begins to occur.
- demographic, sociological and economic studies which will enable the Authority to anticipate changing patterns and intensities of use and adjust its planning accordingly.

Current research projects include:

- the 4 year major research program into the Crown of Thorns Starfish which began in 1985-86, continues to be coordinated by the Authority. It includes: a study, by the Coastal Zone Colour Scanner using the micro-BRIAN computer program developed by CSIRO, on water mass characteristics to determine a relationship between plankton productivity and starfish infestation; population dynamics, as well as other projects continuing from 1986-87 on biological control; risk analysis; geological sedimentology, surveys, data analysis and modelling; a trial control program; and continuing projects on oral history; socio-economic effects, and human causes.
- monitoring of the biological processes in the vicinity of Cape Tribulation fringing reefs and of the impact of rainforest clearing on fringing reefs continues through 1987-88.
- new developments include:
    - emphasis on developing methods and standards for monitoring the great Barrier Reef region

- establishment of a central database to store long time series data for monitoring reef health and the effects of human usage
- a review of the impacts of trawling
- investigations into the effects of enhanced levels of nutrients in waters of the region

- major projects continuing from 1986-87 include

  - biological basis for management of dugong
  - a study of green turtle population dynamics
  - Red Spot King Prawn by catch study

- significant components in the S&T field are

  - a review of oceanography
  - aerial survey data entry and analysis
  - survey of reef communities
  - seagrass surveys
  - development of monitoring programs for usage of the region and the effects of this use

A5.7 NATIONAL LIBRARY OF AUSTRALIA
(Arts, Heritage and Environment)

The National Library of Australia has a statutory responsibility to:

- maintain and develop a national collection of library materials in all areas of science and technology;

- make these materials available, through reference, current awareness and retrospective search services by traditional or computer based methods; and

- encourage the development of resource sharing networks among libraries and organisations with similar objectives in order to ensure that information is readily available to the nation.

Harold White Fellowships were offered to three scholars in 1986-87. The aims of the scheme are

- to promote the Library as a centre of scholarly activity and research

- to encourage scholarly and literary use of the collections and the production of publications based on them

- to publicise the Library's collections.

Topics researched in 1986-87 were

- Political action, language, argumentation and symbolism in the traditional Chinese state
- Pompey Elliot : a biography
- Racial themes in Australian fiction

A5.8 OFFICE OF THE SUPERVISING SCIENTIST FOR THE ALLIGATOR RIVERS REGION

(Arts, Heritage and Environment)

The Supervising Scientist for the Alligator Rivers Region has a supervisory, research and co-ordination role under the Environment Protection (Alligator Rivers Region) Act for ensuring the protection of the environment in the Alligator Rivers Region (ARR) of the Northern Territory from the effects of uranium and exploration mining operations. It also has a supervisory and research role in relation to protection of the environment from the effects of general (non-uranium) exploration and mining operations in a conservation zone declared in the Region.

The Supervising Scientist manages the ARR Research Institute (ARRRI) which collects and assesses information and undertakes and promotes research of environmental importance in the ARR, in order to provide advice on environmental protection, and to assist in the development of standards and measures to minimise the potentially harmful effects of mining operations. Environmental protection responsibilities include not only the biophysical environment but also the impacts of mining and milling operations on human health and safety.

The Supervising Scientist conducts a multi-disciplinary research program, active components of which include aquatic biology (toxicity testing and biological monitoring), environmental radioactivity, environmental chemistry, geomorphology, plant ecology and environmental modelling.

Major scientific studies currently relate to water management and tailings management both in the short and long term, and several smaller projects are directed towards aerial dispersion of radionuclides at or near the Ranger site. These studies also provide information relating to public health and worker health and safety.

Significant developments during 1986-87 included:

. submission to Government of a major technical report on the question of whether the Ranger Water Management System should include the option, under appropriate controls, of occasional release of mildly contaminated waters stored on the mine site.

. amendment of the Environment Protection (Alligator Rivers Region) Act 1978 to confer on the Supervising Scientist responsibilities associated with general (non-uranium) exploration and mining activities in the conservation zone declared within Stage 3 Kakadu National Park.

A5.9 NATIONAL CAPITAL DEVELOPMENT COMMISSION (NCDC)

(Territories)

The NCDC is responsible for the planning, design and construction of the city of Canberra as the National Capital of Australia. Current R&D or S&T activities are:

. provision of social and demographic analysis to support NCDC operations eg social climate assessments, social impacts of physical development proposals, specific studies for management and design of public (government) housing, community needs (for built facilities)

. provision of economic and demographic analysis to support NCDC operations eg economic development, population forecasts, specific industry studies (retail, manufacturing, tourism, industrial and private land demand, office needs forecasts)

. water quality baseline monitoring to determine the effects of urban and other land use on the water quality of lakes and rivers in the ACT

. measurement and prediction of traffic noise levels

- evaluation of protection measures for threatened cultural sites as part of the land use planning process
- monitoring of air quality characteristics to determine trends and changes
- study of significant sites in the ACT (ecological, geological, cultural) which need to be considered in planning various land uses
- study of birds and their habitats in specific areas of planning interest.
- development of an interpretive plan for development and use of the natural and cultural resources of the Murrumbidgee River Corridor
- development of models/guidelines on water quality
- study of native grasses for potential application in landscaping work.

A5.10 ACT SCHOOLS AUTHORITY
(Territories)

The research program of the ACT Schools Authority is aimed at improving the operation of schools and education in the ACT. Major areas of research and development are:

- the nature and extent of homelessness amongst ACT secondary students
- a database on current course work and career aspirationsof ACT year 10-12 students
- a database of community donations to schools
- a database of costs of running schools in the ACT
- evaluation pilot studies of a binational school at Telopea Park, a primary school music program, use of teacher modules, literacy and numeracy programs, and an early intervention program for students with reading problems

A5.11 ACT HEALTH AUTHORITY
(Territories)

Current research programs administered by the ACT Health Authority are:

- cell spawning and generation research
- Natural Killer (NK) cells sensitisation research
- cancer research:
    - to generate specific immune response in lymphocytes to tumour cells
    - residual tumour cell destruction in post-therapeutic applications
- research into pathogenesis of allergic encephalalgion in immunoglobin deficiency rates
- investigation of an autoimmune carrier state of allergic encephalomyelitis
- survey of occupational stress amongst health workers
- investigation of health related attitudes, knowledge and skills in the ACT
- determination of demographic profiles of ward users in the ACT

. a needle exchange program to be run as a 6 month pilot research project to prevent HIV spread

A5.12 ANTARCTIC ACTIVITIES

(Science)

The Antarctic Division is responsible for overseeing Australia's Antarctic Program. The objective of the program is to enhance Australia's sovereignty, political, strategic, environmental and economic interests in the Antarctic and, where relevant, the sub-Antarctic.

The scientific research program is aimed at providing scientific knowledge to assist effective management of the Antarctic environment and to protect Australia's long-term economic interests.

The program included the following fields of research:

Glaciology	Land-based Biology
Marine Science	Upper Atmosphere Physics
Cosmic Ray Physics	Medical Research

Scientific research in Antarctica directly benefits Australia by providing a basis for understanding Australia's weather and climate, knowledge of the living and non-living resources of Antarctica which might bring economic benefit to Australia, and protecting the Antarctic environment and its dependent ecosystems.

Current research programs include:

. glaciological research in principal areas including several multi-year projects such as the study of 'greenhouse' gases (carbon dioxide, methane, and nitrous oxide) in ice cores, the seasonal sea ice zone, oversnow traverses and a detailed survey of the Law Dome summit area

. investigation of a new form of cosmic ray

. further development of research into krill, one of the key elements of the Antarctic food chain

. investigation into Antarctic and global climate history using ice cores extracted by deep drilling techniques

. expanded surface meteorology data network using automatic weather stations

. investigation of the Vestfold Hills area; population survey of elephant seals, penguins, and other birds; and botanical investigations of the Casey Station environs

A6 ATTORNEY-GENERAL'S

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Australian Institute of Criminology	cap.S	0.02	0.08	-	0.03	0.03	0.07	0.08
	cur.S	0.52	0.64	0.74	0.73	0.79	2.25	2.34
Criminology Research Council	ext.S	0.05	0.07	0.11	0.13	0.13	0.13	0.13
Human Rights Commission	cap.S	0.02	0.05	0.06	0.06	0.05	0.06	0.05
	cur.S	0.84	1.15	1.28	1.28	1.35	1.28	1.35
	ext.S	0.03	0.11	0.11	-	-	-	-
Institute of Family Studies	cap.S	0.04	0.00	0.16	0.05	-	0.05	-
	cur.S	0.60	0.70	0.65	0.69	0.67	0.69	0.67
	ext.S	0.01	0.01	-	-	-	-	-
Law Reform Commission	cap.S	0.13	0.16	0.05	0.04	0.02	0.04	0.02
	cur.S	1.79	2.42	2.50	2.42	2.59	2.42	2.59
Australian Federal Police	cap.	0.05	0.07	0.07	-	-	-	-
	cur.	0.07	0.02	0.05	-	-	-	-
	ext.	0.12	0.14	0.15	0.06	0.06	0.06	0.06
National Police Research Unit	cap.	0.02	0.01	0.01	0.01	0.01	0.01	0.01
	cur.	0.13	0.18	0.19	0.21	0.23	0.21	0.2
Other Attorney General's	cur.S	0.03	0.05	-	-	-	-	-
	ext.	-	-	-	-	-	0.10	-
	ext.S	0.07	0.12	-	-	-	0.29	-
	Total	4.56	5.98	6.11	5.70	5.93	7.66	7.53

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
B. Expenditure from other sources								
Australian Institute of Criminology	cur.S	-	-	-	0.04	0.03	0.04	0.03
Criminology Research Council	ext.S	0.05	0.07	0.10	0.12	0.12	0.12	0.12
Institute of Family Studies	cur.S	-	-	-	0.13	0.16	0.13	0.16
Law Reform Commission	cur.S	0.04	0.07	0.03	0.03	0.05	0.03	0.05
National Police	cap.	0.05	0.01	0.02	0.02	0.02	0.02	0.02
Research	cur.	0.26	0.36	0.38	0.43	0.47	0.43	0.47
Unit	ext.	0.01	0.03	-	-	-	-	-
	Total	0.41	0.55	0.52	0.78	0.84	0.78	0.84
Total expenditure (all sources)		4.97	6.53	6.63	6.48	6.77	8.44	8.37

See page 51 for explanation of abbreviations.

A6.1 AUSTRALIAN INSTITUTE OF CRIMINOLOGY
(Attorney-General's)

The Institute's principal function is to conduct criminological research and undertake conferences, seminars and workshops on matters related to the prevention of crime and treatment of offenders. The results of such activities are communicated to the appropriate Commonwealth and State Government agencies.

Current projects in research and statistics include work on the following subjects: crime trends, drug indicators, corporate crime, correctional statistics, sentencing, youth and crime, video classification, missing persons, and minorities and criminal justice.

A6.2 CRIMINOLOGY RESEARCH COUNCIL
(Attorney-General's)

The Criminology Research Council was established in 1972 to control and administer the Criminology Research Fund and to determine the manner in which the moneys in the Fund are applied to criminological research. The State Governments match the Commonwealth Government's annual contributions to the Fund on a dollar for dollar basis, individual State Government contributions being determined on a pro rata population basis.

The Council invites applications for research grants from individuals and organisations wishing to undertake research on matters concerned with the causes, correction and prevention of criminal behaviour and related activities. To date the Council has funded over 150 research projects extending over a wide range of subjects. Projects funded during

1986-87 included research on the folowing subjects:- Aboriginal/police/community relations; crime perception and victimisation; public disorder in contemporary Australia; analysis of patterns in public perception of crime; crime and compulsive gambling: the limits of the criminal law and the regulation of insider trading; the general prevention of drinking and driving; prison environment indicators; intellectually disabled persons as victims of crime; forensic aspects of physical and sexual child maltreatment; reform of Australian fire arms laws; and preliminary investigation into persons with severe behaviour disorders. The Australian Institute of Criminology provides administrative and secretarial services to the Council.

A6.3 AUSTRALIAN INSTITUTE OF FAMILY STUDIES

The Australian Institute of Family Studies was established to conduct, encourage and coordinate research into the factors affecting marital and family stability in Australia. It also collects, analyses and disseminates information on the impact of government policies and social change on families.

Recent achievements include:

. the publication of Settling Up: *Property and Income Distribution on Divorce in Australia*

. the submission of a report on maternity leave in Australia, funded by the Women's Research and Employment Initiative Program

. a report on the first round of interviews in the evaluation of the capital-indexed loan scheme for low income families funded by the Victorian Ministry of Housing

New activities launched include: follow-up studies with a sample of 2500 to study factors which affect family formation; a more detailed study of the costs of children and extension of the institute's capacity to analyse alternative taxation and social security transfer options affecting families.

A6.4 THE LAW REFORM COMMISSION

The Commission was established as a result of the Government's decision to modernise, simplify, eliminate defects in, and adopt more effective methods for administering the law and dispensing justice. The Commission assesses the relevance and suitability of laws, and advises on Law Reform, taking into account community views and the need for uniformity and coordination.

The Commission works pursuant to references from the Commonwealth Attorney General. The final product of the research undertaken in the Commission is a Report to the Commonwealth Parliament. Reports contain a full discussion of an area of law which needs to be developed, changed or modernised as well as draft legislation.

A6.5 HUMAN RIGHTS AND EQUAL OPPORTUNITY COMMISSION

The Human Rights and Equal Opportunity Commission was established in December 1986. Its mandate is to advise the Government on whether the laws of the Commonwealth and acts and practices under those laws conform with the provisions of the International Covenant on Civil and Political Rights, the Declaration on the Rights of the Child, the Declaration on the Rights of Mentally Retarded Persons, the Declaration on the Rights of Disabled Persons and International Labour Organisation Convention 111 on the elimination of discrimination in employment. The Commission is also responsible for the administration of the Human Rights and Equal Opportunity Commission Act 1986, the Racial Discrimination Act 1975 and the Sex Discrimination Act 1984.

The Commission's Research program involves three main strands - research stemming from formal complaints to the Commission, research following a reference of existing or draft

legislation by the Attorney-General, and research which the Commission considers to be of priority concern for the protection of human rights in Australia.

The R&D program is aimed at the protection of Human Rights by ensuring that Australia is complying with its own domestic legislation in this area as well as with the obligations outlined in the various international Human Rights institutions to which Australia is a signatory - major projects in 1987-88 will include a study into homeless children, a study in relation to the rights of the mentally ill, a study into the social and material needs of certain Aboriginal communities, as well as the ongoing examination of enactments and the development of legislation consistent with human rights objectives.

A6.6 AUSTRALIAN FEDERAL POLICE (AFP)

The Scientific Research Directorate of the AFP is responsible for a contract Forensic Science Research program. The objective of this program is the development of new scientific techniques to support police investigations. During 1986-87 the only area of research was in the field of latent fingerprint development techniques. Equipment developed in this program is now being marketed commercially. This research program is being continued. In-house research into the use of computer techniques for the enhancement of police operational photographs is also continuing.

A6.7 NATIONAL POLICE RESEARCH UNIT (NPRU)

An agreement to set up the NPRU was signed by members of the Australian Police Ministers' Council in May 1982. The agreement provides for the Commonwealth to pay one third of the costs of the NPRU and the other two thirds to be paid by the participating States and Territories. The Unit's objectives are to maximise the utilisation of academics and recognised specialists in research projects approved by the Board of Control, and to facilitate the 'Interstate Professional Experience Award' Scheme to encourage greater interaction of policy specialists within the Australian police community. The NPRU in conducting research into police matters, equipment and strategies, and sociological influences on police with a view to ameliorating police practice.

A7 COMMUNITY SERVICES AND HEALTH

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Child Care Programs	cur.S	0.02	0.02	0.02	-	-	-	-
	ext.S	0.08	0.08	0.14	-	-	1.98	2.52
Other Community Services	cur.S	0.66	0.63	0.68	0.61	0.65	1.38	1.30
	ext.S	0.07	0.04	-	0.27	0.01	1.32	1.09
Aust Radiation Lab	cap.	0.22	0.21	0.25	0.38	0.36	0.64	0.60
	cur.	2.19	2.37	2.71	2.42	2.69	4.03	4.49
Grant- W&E Hall Inst	ext.	3.54	6.26	2.64	1.56	-	1.56	-
School of Public Health and Tropical Medicine	cap.	0.19	0.24	0.24	0.08	-	0.08	-
	cur.	2.43	2.78	2.25	1.66	-	2.46	-
National Acoustics Laboratory	cap.	2.01	0.93	1.08	1.17&	1.26&	4.87&	5.26&
	cur.	0.85	0.85	1.14	1.23&	1.33&	4.33&	4.68&
National Biological Standards Laboratory	cap.	0.41	0.57	0.65	0.72	0.82	1.64	1.87
	cur.	2.72	2.99	3.33	3.69	4.21	11.45	13.05
	ext.	-	-	-	-	-	0.03	0.04
National Health and Medical Research Council	ext.	37.98	44.18	51.24	58.95	64.36	58.95	64.36
Australian Institute of Health Research Grants	ext.S	0.31	1.38	1.43	1.61	1.19	1.82	1.35
Ultrasonics Inst	cap.	0.12	0.15	0.16	0.26	0.22	0.32	0.28
	cur.	0.38	0.40	0.42	0.68	0.72	0.85	0.90
Pathology Labs	cap.	-	-	-	-	-	1.21	1.00
	cur.	-	-	-	-	-	15.37	15.36
Commonwealth Serum Laboratories	cap.	0.29	0.23	0.42	0.21&	0.21&	0.22&	0.22&
	cur.	5.21	5.99	6.81	8.67&	8.67&	9.14&	9.14&
	ext.	0.14	-	0.42	0.35&	0.35&	0.35&	0.35&

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
Other Health	cur.	-	-	-	-	-	0.23	0.28
	ext.	0.46	0.07	0.11	0.11	0.07	0.14	0.09
	ext.S	0.03	0.01	0.11	0.14	0.18	0.14	0.18
Australian Housing Research Council	ext.	0.07	0.14	0.10	0.06	0.13	0.06	0.13
	Total	60.38	70.51	76.35	84.45	87.05	124.59	128.55
B. Expenditure from other sources								
Welfare research	cur.S	-	-	-	-	-	0.05	0.08
Residential programs	cur.S	-	-	-	-	-	0.04	0.03
	ext.S	-	-	-	-	-	0.25	0.05
Aust Housing Research Council	ext.	0.07	0.10	0.09	0.10	0.10	0.10	0.10
	Total	0.07	0.10	0.09	0.10	0.10	0.49	0.26
Total expenditure (all sources)		60.45	70.61	76.44	84.55	87.15	125.08	127.81

See page 51 for explanation of abbreviatons.

A7.1 DEPARTMENT OF COMMUNITY SERVICES AND HEALTH

The Department of Community Services and Health is an amalgamation of the former Departments of Community Services and of Health.

A7.2 Community Services

Child Care Program Development (Community Services)

Various community-based organisations that are under contract, or to which grants are provided, perform a range of services related to the welfare of children such as:

. assessing and providing information on the effectiveness and appropriateness of current programs and services

. identifying needs for new or revised Government initiatives in the area of child care

. providing information and advice on the resources available to families and community groups

. collecting data on the provision and use of early childhood services.

Studies on Rehabilitation and Services for the Handicapped (Community Services)

Examples of projects undertaken in the Rehabilitation Division include:

. development of a profile of disability service providers and potential client population

. a survey of past clients to evaluate long term outcomes

. examination of regional employment markets.

Welfare Research (Community Services)

WELSTAT is a joint State and Commonwealth project concerned with the standardisation and improvement of social welfare statistics. The project is managed by committees consisting of representatives from each State and Territory Welfare Department, the Australian Bureau of Statistics, the Commonwealth Department of Community Services and Health and the Social Welfare Policy Secretariat. It is serviced by a Secretariat which operates full time and which is located in the central office of the Department of Community Services and Health.

WELSTAT has developed statistical standards for the collection of data on a range of welfare matters including children in care, children under detention, adoption, child maltreatment and emergency assistance. WELSTAT also provides the forum for the development of statistical standards and data collection for the purpose of monitoring and evaluating the Home and Community Care (HACC) and the Support Accommodation Assistance Program (SAAP). The development of each data collection has involved extensive consultations between the Commonwealth, States and Territories, and the non-government sector.

Policy Co-ordination Unit (Community Services)

The role of the Unit is to provide advice on, and promote the coordinated development and review of policies and programs in the broad field of community services, health and welfare; and to promote the direction of appropriate research and statistical activities to these ends.

Residential Programs Division (Community Services)

The Residential Programs Division is responsible for the development of policies and the administration of programs for the provision of residential care for the aged and disabled.

The Division's S&T role is principally to maintain statistical and financial data bases for policy development and management purposes. The Division also contracts out research projects to external consultants.

The Division is currently concerned with the following areas of research in relation to residential care:

. cost structures of Commonwealth subsidised nursing homes and hostels

. quality of care and staffing in Commonwealth subsidised nursing homes and hostels

. the problem of dementia and the various types of care available for persons with dementia

. geriatric assessment.

Current research projects include:

. assessment of elderly people with dementia making use of a special purpose nursing home for persons with dementia as a management program for such persons

. effects of day care for dementia sufferers on the well-being of their care givers.

S&T projects include:

. investigation of the need for respite care in residential settings and examination of the structures and funding of and access to respite care under current program arrangements

. establishment of standard levels for nursing and personal care services provided to nursing home residents.

A7.3 Health

Australian Radiation Laboratory (ARL) (Health)

ARL undertakes research and development relating to the public and occupational health implications of the uses of ionising radiation, radioactive materials, non-ionising radiation, and of uranium mining and milling and of levels of radioactivity in the Australian environment.

School of Public Health and Tropical Medicine (Health)

The School was disbanded in March 1987, with most of its functions being taken over by the University of Sydney and its tropical health function being transferred to the University of Queensland.

National Acoustics Laboratories (NAL) (Health)

NAL undertakes research and development on hearing aids and their application to the needs of individuals, and in the problems of noise as it affects individuals. Projects underway include the investigation of auditory processing problems in children, techniques for the selection, fitting, evaluation and development of hearing aids and methods of rehabilitation of deaf people, and studies of the physiological and sociological effects of noise.

National Biological Standards Laboratory (NBSL) (Health)

The NBSL is the laboratory facility involved in carrying out the Commonwealth's responsibility to ensure that therapeutic goods for human and veterinary use in Australia are safe, effective and of good quality. The Laboratory's work includes evaluating some therapeutic goods prior to marketing, testing goods on the market for compliance with standards, investigating failure and complaints and inspecting manufacturing facilities.

Applied research is conducted which is primarily involved with developing new analytical methods and investigating specific problems with products.

National Health and Medical Research Council (NH&MRC) (Health)

The NH&MRC is an independent body which advises the Minister for Community Services and Health on the application of funds from the Medical Research Endowment Fund. The Fund provides assistance to Commonwealth and State Governments engaged in medical research, to universities and other institutions for the purpose of medical research, and to persons engaged in medical research and in the training of persons in medical research. NH&MRC grants form the major proportion of the total Commonwealth funds spent on medical research in Australia.

Australian Institute of Health Research Grants Programs (Health)

The Australian Institute of Health was established in 1984-85 to provide a national focus for health services research and planning. The purpose of the grants is to improve, through research and demonstration, the technique and practice of administration, evaluation, planning and delivery of health care in Australia, and also to provide information which will assist the development of health services policy.

Ultrasonics Institute (Health)

The Ultrasonics Institute carries out research and provides an advisory service in relation to the use of ultrasonic radiation and other forms of radiation in the diagnosis and treatment of diseases. Programs of the institute include investigation of techniques, signal processing, transducer development, instrumentation and applications in medical diagnostic ultrasound.

Other health research

Family Planning Program (Health)

Funds are provided under the Family Planning Program to encourage research into social, medical and demographic aspects of family planning, as one means of advancing the knowledge and practice of family planning.

National Diseases Control Program (Health)

The objectives of the National Diseases Control Program have been to reduce the incidence of vector-borne diseases such as dengue fever, malaria, Australian encephalitis, and epidemic polyarthritis, and to minimize the impact of these diseases in Australian communities. The NDCP has been marked for phased termination, and funding will cease at the end of the 1987-8 financial year.

National Health Technology Advisory Panel (Health)

The objective of the National Health Technology Advisory Panel is to provide advice to the Commonwealth Government on the impact and cost effectiveness of new and existing health technologies. The Panel has published reports on a number of health technologies, including reports in 1986-7 on Bone Mineral Assessment and Osteoporosis, Surgical Stapling, Lasers in Gynaecology and the Luxiscope. The NMRI (nuclear magnetic resonance imaging) Technical Committee of the Panel is coordinating a program for the evaluation of NMRI in 5 Australian hospitals.

This body is now located within the Australian Institute of Health.

Pathology Laboratories (Health)

The Commonwealth Pathology Laboratories plan and coordinate the operation of the Australian Government Pathology Laboratory Service. Pathology laboratories are located in three states. They provide diagnostic services to hospitals and the medical profession in their respective regional areas.

Paralaboratory Pathology Testing Committee (Health)

The terms of reference of the committee are to monitor and report on progress achieved by the National Health Technology Advisory Panel (NHTAP - see above) and the National Pathology Accreditation Advisory Council (NPAAC) in relation to paralaboratory pathology testing.

Drugs of Dependency Branch (Health)

R&D activities of the Branch include:

- development and testing of methodologies suited to Australian conditions to comprehensively monitor illicit drug use in the community
- examination of the prevalence of psychotropic and other drug use in a random sample of 1200 households in Newcastle.
- examination of popular attitudes towards drugs and drug use and the relationship between socio-economic and demographic characteristics, pschological characteristics and drug use.
- development of methodologies for determining aetiological fractions for drug-caused morbidity and mortality
- assessment of data collection strategies

Dental Health Unit (Health)

The Science and Technology activities of the Unit are:

- continuing assessment of dental health of children as part of the determination of the dental health of the general community.
- listing of individual communities (and their populations) using water containing significant levels of fluoride cither naturally or added. This is important in the field of preventative dentistry.

A7.4 Australian Housing Research Council (AHRC)
(Housing and Construction)

The AHRC comprises Commonwealth, State and Northern Territory Ministers with responsibility for housing. Its objectives are to provide for research into those aspects of housing of particular concern to Housing Ministers, and with special emphasis on social and economic aspects of housing research; to disseminate this research; to promote the co-ordination of research, and where possible to complement research carried out by other organisations.

Current projects include studies into accommodation needs of single people, the development and evaluation of transportable "granny flats", housing in the community for people who have been living in institutions, an evaluation of programs of spot purchase of houses by housing authorities, and an examination of the effectiveness of special purpose housing for the elderly.

The 1987-88 Research Program will include studies on the provision of housing for women, the accommodation needs of full-time tertiary students, the implications of a portable income-related "housing benefit", and an investigation of the need for courses in housing studies at tertiary education institutions.

A7.5 THE COMMONWEALTH SERUM LABORATORIES (CSL)
(Health)

The Commonwealth Serum Laboratories undertake research and development of therapeutic and diagnostic products for human and animal use. Many of the products developed by CSL are designed for and are unique to Australia. Work includes improvements to the methodology of vaccine production and the development of new vaccines.

A8 DEFENCE

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Defence Science and	cap.	-	-	20.65	27.50	20.70	31.89	23.70
Technology	cur.	-	-	117.34	124.83	125.97	152.02	153.46
Organisation (DSTO)	ext.	-	-	0.65	0.71	0.76	0.71	0.76
Office of	cap.	-	-	-	-	-	1.48	2.98
Defence	cur.	-	-	-	0.32	0.55	24.79	25.27
Production	ext.	-	-	-	-	-	1.13	1.25
Services &	cap.	-	-	-	-	-	10.23	17.44
Defence	cur.	-	-	-	-	-	50.26	51.76
Central	ext.	-	-	0.42	0.25	0.25	14.16	14.39
Department of	cap.	17.75	22.69	-	-	-	-	-
Defence (total) #	cur.	102.55	109.18	-	-	-	-	-
	ext.	0.91	1.12	-	-	-	-	-
	Total	121.21	132.99	139.07	153.61	148.22	286.68	291.01
B. Expenditure from other sources								
Defence Science and Technology Organisation (DSTO)	cap.	-	-	0.01	0.09	0.07	0.09	0.07
	cur.	-	-	0.07	0.40	0.42	0.40	0.42
Office of Defence Production	cur.	-	-	-	-	-	0.02	0.04
Department of Defence (total) #		0.24	0.25	-	-	-	-	-
	Total	0.24	0.25	0.08	0.49	0.49	0.51	0.54
Total expenditure (all sources)		121.45	133.24	139.15	154.10	148.71	287.19	291.55

See page 51 for explanation of abbreviations.

Disaggregated data was not available for all years. Capital expenditure for 1985-86 and 1986-87 includes capital expenditure by DSTO and the armed services, but not that by the Office of Defence Production.

The costs shown in the table are estimates of expenditure or actual expenditure incurred against appropriations to the Department of Defence and from other sources. Costs classified as R&D expenditure include:

- Most capital and current expenditure by the Defence Science and Technology Organisation (DSTO); and
- payments to CSIRO for assistance to Defence on environmental matters relevant to land management.

Costs classified as expenditure on S&T (other than R&D) include:

- a portion of DSTO expenditure relating to policy determination, staff training and the operation of library and information services for DSTO laboratories;
- expenditure by the Office of Defence Production on S&T activities in the aircraft and munition factories;
- expenditure on projects and production development in private industry; and
- expenditure by the Armed Services on S&T work.

A8.1 DEPARTMENT OF DEFENCE

Defence Science and Technology Organisation (DSTO) (Defence)

The function of the DSTO is to contribute to the development and implementation of Australian defence policies through the application of science and technology, including the provision of assistance to the Australian Defence Force, the Department of Defence, other defence agencies and, as necessary in the direct interests of Australian defence, Australian industry.

The objectives of the DSTO are to:

. develop and maintain a base of skill and knowledge in defence science and technology, and foster scientific and technological expertise in industry and tertiary institutions, concentrating on areas relevant to the Australian strategic and natural environment

. provide scientific and technical advice on defence policy matters and advice on the selection and acquisition of new equipment and systems and their suitability for operation in the Australian environment

. contribute to the solution of scientific and technological problems of the Australian Defence Force, the Department of Defence, other defence agencies and relevant Australian industries, including those arising from the operational use, maintenance, local production and extension of life of equipment and systems

. conceive new devices, equipment or systems of potential value to Australian defence and, in accordance with delegated approvals, manage or undertake successive stages of development

. assist appropriate non-Defence bodies where the DSTO has skills or facilities not available elsewhere in Australia and where Defence priorities permit.

Current projects of significance include the NULKA system for ship defence, DSTO support for the Australian over-the-horizon-radar network, the laser airborne depth sounder (LADS), and the KARIWARA buoyant fibre slimline acoustic towed array.

DSTO actively participates in bilateral and multilateral international cooperative programs in science and technology, notably the Technical Co-operation Program (Australia, Canada, New Zealand, UK and USA).

The work of DSTO is matched to the needs and trends of Australian defence (present and future). While DSTO's work mostly involves its principal customers - the Australian Defence Force and defence industry - there is considerable interaction with other science and technology bodies in the private and public sectors, including tertiary institutions, in Australia and overseas.

DSTO has a policy of contracting to industry, wherever possible, and tries to involve industry as early in the project as is practicable. However DSTO usually needs to maintain sufficient involvement and competence during the task to provide "R&D authority" supervision. R&D contracts with industry during 1986-87 totalled $7.4m.

DSTO interactions with industry are very wide-ranging and are carried out through lectures and presentations, internal and external publications and provision of information to the technical press. It also participates in exhibitions, organised tours of DSTO, establishmentsuses paid advertisements, engages in day-to-day contacts, briefings and consultancies on specific technology, and programs of technology transfer.

Commercialisation of DSTO innovations takes place through licensing of patents (currently some 30 extant and 35 under negotiation), through special relationships with technology parks, profit sharing joint ventures with private companies either to develop or market DSTO research and spin-offs. In June 1987 the Minister for Defence announced an agreement with Adelaide Innovation Centre to assist with commercial development of selected DSTO technologies. Earlier in the year an agreement was concluded with Australian Commercial R&D Ltd, a Queensland firm which will fund the exploitation of DSTO innovations on a profit sharing basis.

Some large DSTO tasks have been placed in Australian industry, eg $34m of the $53m R&D costs of the Barra sonobuoy were spent in Australian industry. Production orders with Australian industry now total $170m; $5m of the $12m R&D costs for the Mulloka ship sonar were spent in industry and production sales for industry have topped $60m; in the stage A & B experimental Jindalee over-the-horizon-radar, contracts of over $12.5m were let to Australian industry. Some 80% of the costs for hardware for the new $500m network of over-the-horizon radars announced during 1986-87 will be spent in Australian industry. Two contracts worth $22m with an Australian company were announced in January 1987 to upgrade the Jindalee Alice Springs radars; $5m of the $16m R&D costs of the laser airborne depth sounder (LADS) has been spent in industry. Industry production costs will be about $17m; R&D costs for the Kariwara slim-line towed acoustic array wil be $8m of which $4m will be spent in industry. In addition, full scale engineering development, mostly by industry, will amount to abour $7m.

DSTO's program of research agreements with tertiary education institutions continues to grow and was $0.75m during 1986-87. Current research agreements cover such areas as aerodynamics, lasers, toughened epoxies, optical fibre sensors, fault diagnoses, and atmospheric aerosols. They also include lasers, a series of different aspects of signal-processing, imagery generation, adaptive beam forming and multispectral imagery, polysulphide sealants, optoelectronic coatings, and acoustic properties of Australia's neighbouring sea waters. DSTO is represented on and provides funding for the Australian Telecommunications and Electronics Research Board. Funds are also provided to the Ocean Sciences Institute.

Recent Developments

R&D Activity in 1986-87 has included:

. advances in optoelectronics studies which have led to the development and application of sensors based on large focal plane array technology and advanced signal and image processing techniques

. the micro mechanics of initiation and propagation of cracks which control bulk failure of engineering polymers and which have been studied successfully using scanning electron microscopy

- an advanced form of the signal averaging technique of vibration analysis which has been developed and successfully applied to helicopter gearboxes resulting in the early detection of potentially hazardous faults

- the study of camouflage effectiveness which has led to the development of a powerful learning algorithm for image and pattern processing which could have application to automatic visual inspection

- oceanographic studies to determine the acoustic properties of many areas of ocean around Australia have continued

- the rheological behaviour of propellant doughs during extrusion and its relationship with propellant quality has been examined for Australian nitro cellulose propellants.

Other activities have included:

- paints research for Navy, Army and Air Force

- development of hard carbon optical coatings

- advice on military computer systems architectures and software to support automated tactical command and control information systems.

Office of Defence Production (Defence)

The Office of Defence Production (OOP) was created in December 1984 following the abolition of the Department of Defence Support. It incorporated the defence production establishments formerly within that department. The prime function of the ODP is to provide designated industrial support to the Australian Defence Force through the effective management of the Government-owned and operated factories and dockyards.

After rationalisation of various activities in 1986-87, ODP comprised some 12,500 staff in 9 operational Munitions Group establishments, the Government Aircraft Factories, two Dockyards and a Central Office located in Vic, NSW and the ACT. These establishments have a large range of capabilities, ranging frem heavy engineering, through chemicals and explosives to clothing.

1986-87 saw the closure of Albion Explosives Factory and commencement of planning for the transfer of selected capabilities to Mulwala Explosives Factory; the Aircraft Engineering Workshop was sold to private enterprise and major restructuring exercises were completed at the dockyards and several factories. In addition, the Government has announced its intention to offer for sale to commercial organisations a controlling interest in the Williamstown Dockyard. A Government owned company, Aerospace Technologies of Australia, is to take over the operations of the Government Aircraft Factories in 1987/88.

Armed Services (Defence)

The Armed Services each conduct some scientific and technological work to meet specific operational needs. Production development of products and production processes is funded in private industry. Various extramural tasks are carried out by private industry for the Department.

Extramural research and consultancy in relation to land management of Defence properties which will ensure long term conservation is conducted by the CSIRO.

Capital Procurement Organisation (CPO), (Defence Industry Development (DID) Division)

Defence Industry Development (DID) Division was created in December 1984 as part of the existing Capital Procurement Organisation, following the abolition of the Department of Defence Support. The principal functions of DID Division are:

. to provide advice on private industry capability

. to formulate and implement programs for the development of private industry for defence and its participation in defence related equipment acquisitions

. facilitate the commercial exploitation of indigenously developed and produced defence equipment and intellectual property.

In the performance of its functions, DID Division manages three expenditure programs concerned with S&T (excluding R&D work);

. Australian Industry Involvement (All) (minor projects only), concerned with the development in private industry of new or improved products for use by the Australian Defence Force

. Production Development concerned with the improvement of efficiency and effectiveness of production processes

. the patenting and licencing of inventions, products and processes developed within DOD establishments or under DOD contracts.

A9 EMPLOYMENT, EDUCATION AND TRAINING

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Commonwealth Tertiary Education Commission (CTEC):								
Grants to Universities #(NSE)	ext.	73.60	81.40	91.00	91.00	97.50	91.00	97.50
Grants to Universities #(SSH)	ext.S	30.40	32.60	35.00	35.00	37.50	35.00	37.50
Special Research Centres (NSE)	ext.	5.20	5.50	5.51	5.78	6.43	5.78	6.43
Special Research Centres (SSH)	ext.S	0.50	0.20	0.49	0.52	0.27	0.52	0.27
CTEC - Evaluations & Investigations	ext.S	-	-	-	-	-	0.98	0.75
Australian Research Council:								
ARGC Grants (NSE) (incl. Marine Science)	ext.	18.81	21.79	24.02	30.04	30.21	30.04	30.21
ARGC Grants (SSH)	ext.S	4.47	5.04	5.46	5.41	5.40	5.41	5.40
ARGC Grants (admin)	cur.	-	-	-	-	-	1.13	1.05
Post-graduate Awards (NSE)	ext.	8.62	9.01	10.66	11.17	11.71	11.59	12.12
Post-graduate Awards (SSH)	ext.S	5.98	6.40	6.91	7.77	8.13	9.28	9.62
NRF-QEII and QEII Fellowships (NSE)	cur. ext.	- 1.04	- 1.07	- 1.04	- 1.16	- 1.29	0.05 1.16	0.05 1.29
NRF-QEII and QEII Fellowships (SSH)	cur.S ext.S	- -	- -	- 0.18	- 0.16	- 0.18	0.01 0.16	0.01 0.18
National Research Fellowships (NSE)	cur. ext.	- 0.13	- 1.08	- 2.82	- 4.05	- 4.21	0.10 4.05	0.09 4.21
National Research Fellowships (SSH)	cur.S ext.S	- 0.06	- 0.39	- 1.02	- 0.71	- 0.74	0.01 0.71	0.02 0.74
Grants to Academies and ANZAAS	ext. ext.S	- -	- -	- -	- -	- -	0.68 0.28	0.73 0.30

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
Other Employment, Education & Training:								
Aust Council for Educational Research	ext.S	0.44	0.49	0.54	0.54	0.56	0.54	0.56
Commonwealth	cur.S	-	0.40	-	-	-	-	-
Schools Commission	ext.S	0.09	0.79	0.47	-	-	0.72	0.66
Australian Standard Classif'n Occupations	cur.S	-	-	-	-	-	0.21	-
Labour Market	cur.S	0.79	1.34	1.39	1.60	-	1.60	-
Research	ext.S	0.39	0.55	2.05	2.51	-	2.51	-
Aust Council for	cur.	-	-	-	-	-	0.21	0.30
Employment & Training	ext.	-	-	0.33	-	-	1.94	2.00
Office of Youth Affairs/ Youth Bureau	ext.S	0.06	0.03	0.08	0.71	0.20	0.71	0.20
Other expenditure	ext.	0.02	-	-	-	-	-	-
(DEET ministry)	cur.S	0.45	0.16	0.75	1.04	0.99	1.11	1.03
	ext.S	1.40	0.85	0.46	0.43	0.91	0.52	0.93
Anglo-Australian	cap.	0.41	0.14	0.09	0.20	0.31	0.20	0.31
Telescope Board	cur.	1.32	1.43	1.54	1.73	2.02	1.73	2.02
	ext.	0.06	0.32	0.39	0.19	0.18	0.19	0.18
Total (direct Commonwealth funding)		154.25	171.01	192.21	201.73	208.75	210.15	216.65
B. Expenditure from other sources								
Other expenditure	cap.S	-	-	0.01	0.01	0.01	0.01	0.01
(DEET ministry)	cur.S	-	-	0.43	0.54	0.56	0.54	0.56
	ext.S	-	-	0.06	0.06	0.06	0.06	0.06
Anglo-Australian	cap.	0.41	0.14	0.09	0.20	0.31	0.20	0.31
Telescope Board	cur.	1.32	1.43	1.54	1.58	1.84	1.58	1.84
	ext.	0.06	0.32	0.39	0.19	0.18	0.19	0.18
Total (other sources)		1.79	1.89	2.52	2.57	2.96	2.57	2.96
Total (all sources)		156.04	172.90	194.73	204.30	211.71	212.72	219.61

See page 51 for abbreviations.

Includes funds specifically earmarked for research in the State Grants (Tertiary Education Assistance) Act or by the institutions themselves from their general recurrent and equipment grants. The figures do not include expenditure on research activities which are part of the general teaching and research functions of the universities. See page 94 for further details; see also Australian S&T Budget Brief 1987, page 9, for the overall picture.

A9.1 DEPARTMENT OF EMPLOYMENT, EDUCATION AND TRAINING

The Department of Employment, Education and Training was formed by amalgamation of the employment function of the previous Department of Employment and Industrial Relations, the former Department of Education, and components of the Departments of Science (Research Grants and Fellowships, Anglo-Australian Telescope Board) and Prime Minister and Cabinet (Office of Youth Affairs).

Australian Council for Educational Research (ACER) (Education)

The annual research program and level of funding of ACER is agreed to by the Australian Education Council (AEC) which provides Commonwealth/State coordination at ministerial level. As well as receiving the Commonwealth grants shown in the table, ACER also receives matching grants from the States.

The grant to ACER assists it:

- to undertake research and development in education by itself and collaboratively with others in Australia and overseas
- to promote research and development in education in Australia
- to foster the training of research workers in education
- to disseminate the results of research and development.

From July 1987, ACER'S R&D program will be organised on a triennial basis and will be thematic. The themes for 1987-88 are:

- the compulsory years of schooling
- beyond compulsory schooling
- cognitive process and education
- education and technology
- teachers in Australian society.

OECD Centre for Educational Research and Innovation (CERI) (Education)

Current Australian participation in the OECD Centre for Educational Research and Innovation is directed to investigatory exercises in the areas of school development and new approaches to learning (including information technologies), teacher education, school leadership and organisation, and innovation exchange.

Youth Bureau/Office of Youth Affairs (Prime Minister and Cabinet)

The research program of the Office of Youth Affairs (from August 1987, the Youth Bureau of DEET) aims to obtain information on the situation and needs of Australian youth

necessary to advise Government and develop policies to meet those needs. Areas investigated in 1986-87 include community attitudes affecting young people, evaluation of youth support programs, access to youth training programs, youth and the law, and youth and drugs. Some projects are funded jointly with the States under the National Youth Affairs Research Schemes.

A9.2 AUSTRALIAN RESEARCH COUNCIL (ARC)

The Australian Research Council, currently being established, will be responsible for advising on funds presently allocated to the following schemes:

- Australian Research Grants
- National Research Fellowships
- Queen Elizabeth II Fellowships
- Marine Science and Technologies Grants
- Commonwealth Postgraduate Awards
- Grants to Learned Academies
- Grants for Special Research Centres and Key Centres of Teaching and Research (in co-operation with CTEC).

Pending the ARC's advice the Government has reallocated $5 million from university recurrent research grants. These funds will be used for:

- $1.2m for two new Special Research Centres
- $1.2m for six new Key Centres of Teaching and Research
- $2.6m for research by institutes of technology

The ARC is to convene a research consultative committee that brings together the heads of the major Federal bodies involved in funding research and research training. The ARC will advise on national research policy and priorities and on the co-ordination of the national research effort.

Priorities for the ARC are the concentration and better focusing of existing targeted research schemes and beginning the process of targeting university recurrent research grants.

Australian Research Grants Scheme (Science)

The Australian Research Grants Scheme (ARGS) supports high level research by individuals and teams in universities and other non-government institutions. Grants are provided on the basis of the quality of the proposed research and the ability of the investigators. Scientific excellence is the sole criterion. Total amounts of $27.5m, $32.4m and $32.4 were allocated for the calendar years 1986, 1987 and 1988 respectively under ARGS. The trend towards fewer and larger grants slowed temporarily with average grant size increasing from $18,953 to $22,318 to $22,333. Grants are awarded in all fields of basic and applied science, social science and humanities.

National Research Fellowships (Science)

The Australian Government established the National Research Fellowships Scheme in 1983 to strengthen Australia's national research and development capability by providing opportunities to undertake research of national significance. Fellowships are awarded to persons holding a PhD or with equivalent research or professional experience and may be taken up in industry, universities, colleges of advanced education or government research organisations in Australia.

Fifty fellowships, with a term of three years, are awarded annually.

Fellowships are awarded in the following approximate proportions:

40% priority areas of national interest
20% industry-based research
40% fundamental research.

National Research Fellowships - Queen Elizabeth II Awards (Science)

The Australian Government has established the National Research Fellowships - Queen Elizabeth II Awards to replace the previous Queens' and Queen Elizabeth II Fellowships Schemes. The NRF - QEII Awards aim to promote excellence in research by providing funds for outstanding researchers to work in Australia for two years. Fifteen awards are made annually to persons who must hold a PhD or equivalent qualification. Fellowships may be taken up in universities, industry, colleges of advanced education or government research organisations within Australia.

Marine Science Grants (Science)

The Marine Sciences and Technologies Grants Scheme (MSTGS) supports high quality research covering activities and disciplines in accordance with policies and priorities as defined by the Minister, after receipt of advice from the Australian Marine Sciences and Technologies Advisory Committee (AMSTAC). The Scheme is intended to provide support for Australian marine scientific and technological research whether undertaken within or outside Australia. Specifically the Scheme supports research which:

. is of high priority in the national interest and which would not otherwise be carried out;

. will utilise the collective skills and expertise of different specialists from one or more organisations;

. is likely to produce results of significance in the short to medium term for more effective management of the marine environment and the development of marine technologies; and

. is able to stimulate education and training in the marine sciences and technologies.

Applications of remote sensing, factors affecting the design of offshore structures, and mariculture were identified as areas deserving particular attention from 1988. Total amounts of $3.037m and $3.145m were allocated to individuals and research teams in private, tertiary and government research institutions for the calendar years 1987 and 1988 respectively under the Scheme.

Postgraduate Awards (Education; now administered by Australian Research Council)

There are three categories of postgraduate awards. Research awards are for PhD and Masters research courses in universities and course awards are for coursework Masters programs in universities. Advanced Education Institution awards are for Masters programs in Colleges of Advanced Education. The living away from home allowance will rise in 1988 to compensate for the increase in Comsumer Price Index over the past 2 years. Dependant children allowances will be transferred to the Family Allowance Scheme.

Grants-in-Aid (Science)

The Department disburses government grants-in-aid to a number of bodies. The grants to the four learned Academies contribute towards the costs of their affiliation with overseas and international organisations and general administration. The learned academies are the Australian Academy of Science, the Australian Academy of Technological Sciences and Engineering, the Academy of the Social Sciences in Australia, and the Australian Academy of Humanities. These grants also enable members of these academies to participate in scientific exchange programs with their Chinese counterparts. The grant to the Australian and New Zealand Association for the Advancement of Science (ANZAAS) assists a number of young Australian scientists to attend the Congresses of ANZAAS.

A9.3 TAFE NATIONAL RESEARCH AND DEVELOPMENT CENTRE Ltd. (Education)

The TAFE National Centre for Research and Development Ltd has two main aims:

- to undertake and encourage research and development projects that are of national significance to TAFE (Technical and Further Education)
- to disseminate information on research and development in the TAFE Sector.

There were 39 research projects conducted in 1986-87, including:

- selection of trades
- the delivery of TAFE services to remote areas
- initial and continuing education needs for TAFE academic staff
- education and labour force trends - a TAFE database
- computer integrated manufacturing training programs
- national feasibility study of alternative training approaches in the printing industry
- transferable skills - integration into the curriculum.

The Centre also conducts commissioned research for industry, for training authorities, and for government agencies.

A9.4 AUSTRALIAN STANDARD CLASSIFICATION OF OCCUPATIONS (ASCO)

(Employment and Industrial Relations)

The Department of Employment, Education and Training (formerly the Department of Employment and Industrial Relations) and the Australian Bureau of Statistics, jointly developed the new national occupational classification. It was developed for use by the ABS, State and Commonwealth Government Departments (including the Commonwealth Employment Service), universities, schools, and private industry to assist in functions such as:

- labour market analysis
- development of education and training programs, and labour force planning
- accessibility to occupational information
- matching of job-seekers, vacancies and skills.

The ABS released the ASCO Statistical Manual in September 1986 and the former Department of Employment and Industrial Relations released the ASCO Dictionary in June 1987.

A9.5 AUSTRALIAN COUNCIL FOR EMPLOYMENT AND TRAINING (ACET)

(Employment and Industrial Relations)

The Australian Council for Employment and Training replaced the National Training Council on 30 June 1986. It is a broadly-based national advisory body bringing together employers, unions, governments and community representatives to consult and advise on employment and training policies. The establishment of ACET was a major rationalisation of advising bodies and represents a significant up-grading of tripartite and community involvement in the employment and training fields.

Research plays an important role in supporting these functions and the research strategies and priorities of ACET recognise the views of its employer, trade union and government representatives and economic and industry development policies of the Commonwealth

Government and in particular, the important role played by the labour market in assisting the enhancement of our international competitiveness, the growth of exports and the progressive replacement of imports.

ACET's initial research priorities focus upon a number of cross-sectoral employment and training issues including skill formation, industry training, labour market planning and multi-skilling. These research priorities have been developed within the context of current national employment and training policy initiatives including the meeting of the community's demands for skilled human resources in a cost efficient manner; the improvement of labour market access to promote equality of opportunity; the progressive extension of employee participation in work place decisions; the development of more effective forms of work organisation; and the encouragement of more efficient work and management practices.

Current research projects include:

. an audit of skill requirements in trade - post trade and technical occupations in the electronic/electrical industry and an examination of the effectiveness and quality of training in this industry;

. an analysis of the motor vehicle industry with the aim of identifying how workers in the automobile industry can obtain the best training in the most efficient manner. The overall aim is to help create an industry which is competitive on internatinal markets

. a number of projects concerning aspects of Aboriginal employment and training which will provide input to the formulation of the Aboriginal Employment Development Policy.

New developments include a major project which will examine the occupational structure and training requirements of computing professionals.

A9.6 ANGLO-AUSTRALIAN TELESCOPE BOARD (AATB)

(Science)

The Anglo-Australian Telescope Board, jointly funded by the U.K. and Australia, maintains the 3.9 metre Anglo-Australian Telescope at Siding Spring, N.S.W. and associated facilities in Sydney. The Telescope is regarded world-wide as one of the most technically advanced optical telescopes, particularly in its tracking accuracy and electronic data acquisition and processing facilities. Refinements to the original installation, new instrumentation development, and scientific and technical support staff of the highest quality have maintained its place in the forefront of astronomical research. The Telescope is available by peer review of competitive proposals to astronomers from Australia, the United Kingdom, and other countries, to carry out research relating to all fields of astrophysics.

The Anglo-Australian Observatory, the operating agency of the Anglo-Australian Telescope Board, has continued to keep the Telescope in the forefront of astronomical research by providing state-of-the-art instrumentation.

The occurrence of the supernova 1987a in the Large Magellanic Cloud (LMC) in February 1987, had a significant effect on the work of the Observatory and on the deployment of instrumentation on the telescope. In addition, several new instruments were completed and commissioned during 1986-87

. a temporary ultra-high dispersion spectrograph was assembled using a mixture of borrowed and hastily-modified components in order to take advantage of the opportunity offered by the bright LMC supernova to study the interstellar and intergalactic clouds of matter between the LMC and the sun in much greater detail than has ever been possible previously. A spectral resolution of 520,000 was achieved.

. a complex Fabry-Perot grating interferometer known as Taurus II which enables the complex rotational velocities of gases in galaxies and nebulae to be determined has been added to the suite of standard AAT instruments.

. an automated optical fibre positioning system known as Autofib has been built. This considerably enhances the operational flexibility and efficiency of the AAT multi-object spectroscopic system.

. a special very efficient mult-slit low dispersion survey spectrograph designed for studying large samples of very faint stars and galaxies, has been successfully commissioned.

Because the scientists at the AAO have fixed-term appointments the main fields of research covered in-house vary with time, but generally include all branches of modern optical astronomy and astrophysics. As already mentioned, SN1987a has influenced the research interests of the staff to a considerable degree. The Anglo-Australian Telescope is one of the very few large telescopes situated in the southern hemisphere and thus able to study the supernova.

Two other research highlights during 1986-87 were the discovery of the first quasar with a redshift greater than four, being the most distant known object in the Universe, and the discovery of an extremely large but very low surface brightness galaxy, the first example of the long postulated 'iceberg' galaxies.

A9.7 COMMONWEALTH TERTIARY EDUCATION COMMISSION

(CTEC; Education)

The prime functions of the Commission under the Commonwealth Tertiary Education Commission Act 1977 (as amended) are to advise the Minister on the necessity for, and the conditions and allocation of, financial assistance in respect of universities, colleges of advanced education and technical and further education institutions, and to administer approved policies and grants. The Act specifies that the commission is to perform its functions with the object of promoting:

. the balanced and coordinated development of the provision of tertiary education in Australia;
. the diversification of opportunities for tertiary education; and
. closer co-operation and association between the various kinds of tertiary institution.

Evaluations and Investigations Program

The Commission's Evaluations and Investigations Program seeks to:

. obtain information which will assist in future decision-making by the Commission and its Councils, State authorities and individual institutions;

. encourage the development of evaluative skills;

. promote a climate of critical self-assessment within institutions and authorities.

Studies commissioned in 1986-87 include: changes in technology and tertiary education courses; responsiveness of tertiary education to the design needs of industry: effects of $250 administration charge; assessment of post-secondary educational needs of the rural community; and occupational retraining requirements.

Grants to Universities:

Commonwealth Special Research Centres

In 1982, ten Special Research Centres were established to concentrate research resources in areas of particular excellence and national significance. One of the Centres, the Nerve-Muscle Research Centre at the University of New South Wales, closed in 1984, and funding for another centre, the Centre of Policy Studies, will cease at the end of 1987. The Centres are an integral part of the research activities of the universities involved and, in most cases, form part of their normal organisational structure. In 1986, grants provided by the Commonwealth were more than matched by funds attracted from industry and other sources. Commonwealth funding for the program in 1988 will be continued at the same real level as for 1987. However, funding for existing Centres will be reduced to enable up to 3 new Centres to be established. A selection panel established by CTEC is currently considering proposals for new Centres.

Other Grants

Expenditure on research and development in universities falls into three categories.

These are:

1 Funds specifically earmarked for research in the States grants legislation (known as Special Research Grants), together with other funds earmarked for research by the institutions themselves from recurrent and equipment grants provided under this legislation, or, in the case of the Australian National University, from its direct appropriation. These identifiable research expenditures are shown in Table 13.

2 Funds specifically allocated to research activities but which are derived from sources other than those in Category 1 . It is assumed that the Commonwealth components of such funding (e.g. ARGC, NH&MRC, NERDDC) have been included as extramural expenditure by the departments and authorities concerned.

3 Expenditure on research activities which are funded from grants provided under the States grants legislation but which are part of the general teaching and research functions of the university. While the value of this research cannot be separately identified, an imputed value of $406m was estimated for 1984 in the 1984-85 ABS R&D Survey. If the 1984 proportion of imputed expenditure to total expenditure from all sources, is applied to total expenditure in subsequent years, the imputed value of this "non-identifiable" R&D would be approximately $430m for 1985, $460m for 1986, and $490m for 1987. These amounts are also shown towards the bottom of Table 1.

For colleges of advanced education, the R&D reported to the ABS Survey of Research and Experimental Development for 1984 was $23.12m which represented 2.9% of total Commonwealth grants to these bodies.

The imputed figures for R&D in Category 3 have not been included in the above table because they are based on subjective assessments and are thus subject to some degree of uncertainty.

Because financial accounting in universities is on a calendar year basis, the amounts shown in the above table are based on the following actual expenditures:

Table 13. Identifiable research expenditure* in universities

Identifiable research expenditure *	1980	1981	1982	1983	1984	1985	1986
	$m	$m	$m	$m	$m	$m	$m
- from general recurrent funds	57.9	65.3	72.2	78.8	83.8	86.5	93.3
- Special Research Grants	6.2	7.1	8.0	10.5	15.3	16.8	18.2
- from equipment grants	8.3	8.7	9.5	9.5	10.4	11.3	10.8
TOTAL *	72.4	81.1	89.7	98.8	109.5	114.6	122.3

* Note that this expenditure is from Commonwealth sources only, and thus does not correspond to CTEC's TIRE (total identifiable research expenditure) which includes funds from business enterprise, private non-profit, State and other sources, and is the sum of categories 1+2 above.

A9.8 COMMONWEALTH SCHOOLS COMMISSION

(Education)

The Commission advises the Minister for Education on the needs of schools in Australia and administers specific purpose programs designed to assist special target groups. The 1984 amendments to the Commonwealth Schools Commission Act 1973 created a Curriculum Development Council within the Commission structure. The Council reports to the Minister for Education and works closely with the Commission.

A major project funded through the Curriculum Development Centre for 1987-88 is on Education of Girls in Maths and Science. Other projects cover aspects of early childhood learning of Maths, distance learning of languages, Aboriginal education language and culture, computers in education and special education, teaching of new technologies, and parents' involvement in basic learning.

A10 FOREIGN AFFAIRS AND TRADE

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
ACIAR(NSE)	cur.	-	-	-	1.89	2.00	4.15	4.54
	ext.	4.75	8.62	7.72	9.22	9.73	9.69	10.26
	ext.S	-	-	0.88	-	-	-	-
Other Foreign Affairs	ext.	0.01	0.02	0.01	0.03	0.03	0.09	0.09
	ext.S	0.36	0.43	-	-	-	-	-
AIDAB -								
Bilateral Programs	ext.	7.51	8.19	8.46	15.30	16.71	62.66	73.67
	ext.S	0.49	0.65	0.79	2.39	2.94	22.81	21.19
Multilateral programs	ext.	1.12	1.08	0.72	4.58	4.60	22.21	9.20
	ext.S	0.51	0.53	1.55	1.17	-	8.12	-
Development and training	cur.	-	-	-	-	-	0.19	0.14
	ext.	3.50	4.05	4.56	4.99	1.10	44.91	22.45
	cur.S	-	-	-	-	-	0.09	0.07
	ext.S	1.59	1.75	1.92	2.01	0.54	29.25	11.05
Other	cap.	-	-	-	-	-	0.07	0.09
	cur.	-	-	-	-	-	5.23	2.18
	ext.	10.80	12.53	12.52	7.95	-	19.21	-
	cap.S	-	-	-	-	-	0.02	0.03
	cur.S	-	-	-	-	-	1.32	0.73
	ext.S	1.95	2.42	1.00	0.37	-	2.45	-
	Total	32.62	40.27	40.14	49.89	37.66	232.48	155.68
B. Expenditure from other sources								
ACIAR	ext.	-	-	2.64	-	-	-	-
	ext.S	-	-	0.36	-	-	-	-
	Total	-	-	3.00	-	-	-	-
Total expenditure		32.62	40.27	43.14	49.89	37.66	232.48	155.68

A10.1 DEPARTMENT OF FOREIGN AFFAIRS AND TRADE

Bilateral Agreements (Foreign Affairs)

The Department of Foreign Affairs supports scientific and technological exchanges with China through a number of individual grants-in-aid, mostly for reciprocal visits by scientists and experts.

Such grants are channelled through the Australia-China Council (ACC) and are mainly concerned with projects that have emerged from the Academy of Science's exchange program, or which involved government departments, universities, or private institutions. The Council acts as a focus for information dissemination, commissions research work and promotes Chinese studies in Australia.

Economic Studies (Foreign Affairs)

The Australia/Japan and Western Pacific Economic Relations Project was funded by both Australia and Japan and coordinated research by Australia and Japan on economic relations between the two countries. Support was also given to the Indonesia project at the Australian National University to carry out research on Indonesian economic affairs.

A10.2 AUSTRALIAN INTERNATIONAL DEVELOPMENT ASSISTANCE BUREAU (AIDAB)

(Foreign Affairs)

Australia's development assistance program is a major focus of our relations with many Third World countries. This program has given increasing priority to science and technology. New avenues outside the scope of the traditional aid framework have been instituted to strengthen scientific and technical institutions in developing countries.

ASEAN Australian Economic Co-Operation Program (AAECP) (Foreign Affairs)

The AAECP facilitates ASEAN regional co-operation by assisting projects of regional importance jointly conducted by member countries of ASEAN. This has stimulated research and development work, technology transfer, and has laid the foundation for further co-operation among ASEAN countries. Australia has established close contact with the ASEAN Committee on S&T (COST) through ongoing R&D projects in the food technology and energy areas. There are also others in the pipeline in the fields of marine science, training research and development management, diabetes research and food habits.

Bilateral Aid Projects (Foreign Affairs)

These projects are undertaken in response to requests from developing countries and many of them have a substantial scientific component or draw heavily on scientific knowledge or expertise. It is Australia's aim to use these projects to build up the development capacity of developing countries so there is a strong emphasis on technology transfer through the provision of experts, equipment and training associated with the projects. Most projects are concerned with agriculture, engineering and health, but there is significant component of economic planning and public administration, trade and social development.

Multilateral Programs (Foreign Affairs)

Organisations receiving funding include the United Nations Development Program which is the largest multilateral funding agency for technical assistance, the United Nations Fund for Population Activities which assists countries to be aware of the social, economic and environmental implications of population problems and the Commonwealth Fund for Technical Cooperation which provides technical assistance to the developing countries of the Commonwealth in fields such as finance, statistics, development planning, project evaluation and preparation, public administration and taxation.

Development Training (Foreign Affairs)

Training assistance enables Australia to assist in the development of skilled manpower resources in developing countries. The governments of developing countries decide how they will use the training allocation provided under the aid program.

Training can be offered to meet special needs. For example, within Australia funds are spent to enable Australian educational institutions to run Australian Development Assistance Courses (ADACS). These courses may be intensive practical or formal postgraduate programs. In addition, governments may nominate candidates to attend regular courses at Australian tertiary institutions.

While the emphasis of the program is on training in Australia, awards are also made available for study at institutions in the Pacific and South East Asian regions.

International Science, Technology and Research Programs (Foreign Affairs)

Support is provided for the core budgets and special projects of international and regional research programs. Institutes supported include the International Agricultural Research Institutes of the Consultative Group on International Agricultural Research (CGIAR) and other research institutes.

Co-financing with International Financial Institutions (Foreign Affairs)

The co-financing facility which began in 1982-83 provides funds in co-operation with the World Bank for financing and implementing development projects. In consultation with the World Bank a program in the Asia/Pacific region has been developed which concentrates on project preparation studies. Funds are supplied for studies in by: urban development, energy, water supply and administration and business.

Non-Government Organisations (Foreign Affairs)

Non-government organisations, operating mainly through channels outside the official aid program, effectively complement the Government's program. Government assistance is provided for the International Union for the Scientific Study of Population, the Population Council, the International Foundation for Science and the Association of Geoscientists for International Development.

Regional Programs and Organisations (Foreign Affairs)

This program provides funds for institutional and program support and fellowship grants for regional organisations and programs in the Asian and Pacific regions. Institutes and Centres receiving support include the Economic and Social Commission for Asia and Pacific (ESCAP), the International Atomic Energy Agency (IAEA), the World Health Organisation (WHO), the South Pacific Commission (SPC) and others.

A10.3 AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURE RESEARCH (ACIAR)

(Foreign Affairs)

The ACIAR was established by an Act of the Australian Parliament which came into effect in June 1982. The Centre is designed to encourage research aimed at identifying agricultural problems in developing countries and at finding solutions to such problems.

It is clear that Australia can assist in problems in crop and pasture legumes and areas such as biological nitrogen fixation, animal health and nutrition, plant protection, soil and water management, plant nutrition, agro-climatology, post-harvest technology and socio-economic analysis. ACIAR has developed projects covering some of these areas. The research is contracted to Australian research institutions and other suitably qualified groups in collaboration with scientists from developing countries whenever possible.

A11 DEPARTMENT OF IMMIGRATION, LOCAL GOVERNMENT AND ETHNIC AFFAIRS

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Other ILGEA	cur.S	0.04	0.10	0.12	0.18	0.22	0.36	0.35
	ext.S	0.14	0.23	0.23	0.35	0.31	0.41	0.39
Albury-Wodonga	cap	0.00	0.00	0.02	0.01	-	0.01	-
Development	cur.	0.04	0.09	0.10	0.16	0.13	0.16	0.13
Corporation	ext.	0.03	0.00	-	-	0.05	-	0.05
Total Commonwealth sector direct expenditure		0.25	0.41	0.47	0.70	0.71	0.94	0.92
B. Expenditure from other sources								
Albury-Wodonga	cap.	0.00	-	-	-	-	-	-
Development Corporation	cur.	0.03	-	-	-	-	-	-
Total other sources		0.04	-	-	-	-	-	-
Total expenditure from all sources		0.29	0.41	0.47	0.70	0.71	0.94	0.92

See page 51 for abbreviations

A11.1 DEPARTMENT OF IMMIGRATION, LOCAL GOVERNMENT AND ETHNIC AFFAIRS

The Department of Immigration, Local Government and Ethnic Affairs (DILGEA) develops, undertakes and oversees research projects designed to enhance departmental awareness on migrant and population issues and assist it in developing policies in the area of migration and settlement.

Research is directed at:

. improving the structure and content of ESL (English as a Second Language) learning arrangements;

. monitoring and evaluating the effectiveness of the Adult Migrant Education Program (AMEP); and

. providing a computer-based model to estimate potential future demand for the AMEP.

The Australian Population and Migration Research Program Trust Account, jointly funded by the Commonwealth and States, supports studies undertaken to gain a better understanding of the particular categories of immigrants entering Australia.

Studies undertaken in 1986-87 included:

. attitudinal survey of citizenship and related issues

. study of the problems and methodology of representative sampling of recently arrived settlers

. Ethnic Atlases project based on the 1986 Census.

A11.2 ALBURY-WODONGA DEVELOPMENT CORPORATION

(DOLGAS)

The development of Albury-Wodonga is a joint venture of the Commonwealth, New South Wales and Victorian Governments. In 1973 and 1974, legislation was enacted by the three parliaments to establish the Albury-Wodonga Development Corporation (Commonwealth), the Albury-Wodonga (Victoria) Corporation, and the Albury-Wodonga (New South Wales) Corporation.

The major activities of the corporations have been land acquisition, development of residential, industrial and commercial land and provision of rental housing and factory accommodation. The Commonwealth has also undertaken a research program into the effects of the increased urbanisation of the Albury-Wodonga area on the flora, fauna and chemical quality of the water in the River Murray.

A11.3 AUSTRALIAN INSTITUTE OF MULTICULTURAL AFFAIRS

(Immigration and Ethnic Affairs)

The Institute was abolished at the end of 1986 (see page 105 of the 1986-87 Science and Technology Statement for information on its activities). An Office of Multicultural Affairs was established in 1987 within the Department of the Prime Minister and Cabinet (see page 155).

A12 INDUSTRIAL RELATIONS

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
National Occupational Health & Safety Commission	cap.	-	-	-	0.01	0.01	0.97	1.43
	cur.	-	-	-	0.09	0.09	4.29	4.57
	ext.	-	0.17	1.27	0.24	0.24	1.43	1.41
Other Industrial Relations	ext.S	-	0.09	-	1.01	0.61	1.01	0.61
	Total	-	0.26	1.27	1.36	0.95	7.70	8.02

See page 51 for explanation of abbreviations.

A12.1 DEPARTMENT OF INDUSTRIAL RELATIONS

Worksafe Australia (National Occupational Health and Safety Commission)
(Employment and Industrial Relations)

The National Occupational Health and Safety Commission (Worksafe Australia) aims to encourage, and work for, the spread of safety awareness and safety practices throughout Australia by providing an authoritiative source of information, opinion and advice to industry, unions, Governments, media and the community. Objectives of the National Occupational Health and Safety Commission Research Grants Scheme are:

- to fund and generally support high quality research in the field of occupational health and safety according to a developed list of appropriate priorities;
- to improve the quality of occupational health and safety research in Australia and strengthen Australian research capability;
- to promote cooperation and liaison between the Commonwealth, the States, academic institutions and the private sector in occupational health and safety research; and
- consistent with the functions of the National Occupational Health and Safety Commission, to support research which would lead to an improvement in the health, safety and welfare of people at work.

Grants for 1987-88 include projects on safe handling of pesticides, hazards of asbestos insulation in buildings, asbestos fibre counter proficiency, machinery noise control, and machinery safety guarding systems. Institute research programs include cell culture methods for investigating chemical toxicity, cadmium toxicity and mutagenicity, studies on mutagenicity and carcinogenicity of chemicals such as pesticides and polycyclic aza-aromatic compounds and their metabolites.

Working Environment Branch

The Working Environment Branch aims:

. to increase the awareness and practice of industrial democracy in both the private and public sectors by the provision of information disseminating services and training material; the sponsoring of research and the administering of financial subsidies for specific projects

. to increase the knowledge and understanding amongst target groups of broader work environment issues by information dissemination.

A13 INDUSTRY, TECHNOLOGY AND COMMERCE

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Bureau of Industry	cap.S	-	-	-	0.02	0.03	0.02	0.03
Economics	cur.S	1.92	2.20	1.89	2.23	2.20	2.23	2.20
	ext.S	-	-	-	0.03	0.03	0.03	0.03
Automotive Industry R&D Grants	ext.	-	-	4.00	2.50	3.70	22.90	22.00
National Space Program	ext.	-	-	2.90	5.04	3.05	5.04	3.05
Materials Handling	cap.	-	-	-	-	-	0.23	-
Bureau##	cur.	-	-	-	-	-	1.38	-
Australian Nuclear	cap.	1.75	2.96	3.74	2.29	3.37	3.63	6.07
Science and	cur.	22.78	25.07	26.15	28.29	31.08	44.47	48.16
Technology Orgn.	ext.	0.56	0.67	0.65	0.67	0.68	0.67	0.68
Patent Office*	cap.	-	-	-	-	-	0.56	0.92
	cur.	-	-	-	-	-	22.17	25.27
	ext.	-	-	-	-	-	0.13	0.20
Contributions to International Patent Bodies	ext.	-	-	-	-	-	0.64	0.62
National Standards	cap.	-	-	-	-	-	0.08	0.07
Commission	cur.	-	-	-	-	-	1.51	1.64
Australian Institute	cap.	0.69	0.94	0.54	0.87	1.11	0.87	1.11
of Marine Science	cur.	6.34	6.56	7.22	8.04	9.10	8.04	9.10
	ext.	-	-	-	0.25	0.35	0.25	0.35
Commission for	cur.S	-	-	0.01	0.05	0.04	0.07	0.07
the Future	ext.S	-	-	0.01	0.12	0.18	0.14	0.21
National Building	cap.	0.05	0.13	0.60	0.72&	0.79&	0.98&	1.13&
Technology Centre	cur.	0.97	1.06	1.32	1.84&	1.96&	3.13&	3.33&
	ext.	-	-	0.15	0.26&	0.27&	0.31&	0.33&
Snowy Mountains	cap.	-	-	-	-	-	0.28	-&
Engineering Corp	cur.	-	-	-	-	-	36.08	25.00&
AUBRCC	ext.	0.02	0.03	0.03	0.06	0.24	0.06	0.24
CSIRO**	cap.	58.14	42.75	47.67	49.94	41.86	50.88	43.01
	cur.	262.97	276.07	302.11	304.40	315.34	324.57	336.78
	ext.	1.49	1.90	1.52	2.31	2.70	5.14	5.87

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure (continued)								
Public Interest Projects (AIRDIS)@	ext.	-	-	-	-	-	3.51	1.04
AIRDIB Commencement Grants@	ext.	14.56	16.26	14.30	16.90	3.20	16.90	3.20
AIRDIB Project Grants@	ext.	43.24	38.13	37.65	17.50	10.43	17.50	10.43
GIRD Scheme	ext.	-	-	-	11.25	25.63	11.25	25.63
Biotech Grants#	ext.	0.72	2.14	4.30	-	-	-	-
Malaria Joint Venture	ext.	-	-	0.32	0.39	1.00	0.39	1.00
Grants to Industry Research Assocns	ext.	1.68	1.90	1.92	1.98	2.15	1.98	2.15
NIES	ext.	-	-	-	-	-	10.84	11.64
Support - Industry Service Assocns	ext.S	-	-	-	-	-	6.63	5.77
Other admin costs	cur.	-	-	-	-	-	5.25	5.74
	ext.	2.53	-	-	-	-	0.13	-
Fifth Generation Computer Devt	ext.	-	0.24	0.24	0.05	0.22	0.05	0.22
Bilateral S&T Cooperation	cur.	-	-	-	-	-	0.12	0.08
	ext.	0.14	0.19	0.43	0.18	0.32	0.33	0.47
	ext.S	0.01	-	-	-	-	-	-
Other International Cooperation	cur.	-	-	-	-	-	0.13	0.07
	ext.	-	-	-	0.03	0.05	0.24	0.29
ASTCON Network	cur.	-	-	-	-	-	0.66	0.63
ASCA	cur.	-	-	-	-	-	0.01	0.01
	ext.	-	-	-	-	-	0.02	0.02
NASA Space Projects	cap.	-	-	-	-	-	0.09	-
	cur.	-	-	-	-	-	0.05	0.14
	Total	420.54	419.18	459.69	458.22	461.06	612.66	605.99

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
B. Expenditure from other sources								
Bureau of Industry Economics	cap.S	-	-	-	0.00	0.00	0.00	0.00
	cur.S	-	-	-	0.03	0.05	0.03	0.05
ANSTO	cap.	0.00	0.02	0.01	0.05	0.06	0.29	0.50
	cur.	0.01	0.25	0.22	0.70	0.59	3.55	3.36
Australian Institute of Marine Science	cap.	0.01	0.10	0.12	0.21	0.13	0.21	0.13
	cur.	0.14	0.68	1.66	1.92	1.09	1.92	1.09
Commission for the Future	ext.S	-	-	-	0.01	0.03	0.01	0.03
National Building Technology Centre	cap.	0.01	-	-	-	-	-	-
	cur.	0.24	-	-	-	-	-	-
AUBRCC	ext.	0.02	0.03	0.03	0.06	0.24	0.06	0.24
CSIRO**	cap.	5.68	5.19	5.82	5.52	5.79	5.55	5.83
	cur.	27.27	35.41	43.69	47.19	57.96	48.18	58.82
NASA Space Projects	cap.	-	-	-	-	-	4.21	-
	cur.	-	-	-	-	-	2.70	2.74
	ext.	-	-	-	-	-	8.49	9.12
	Total	33.38	41.67	51.57	55.68	65.95	75.20	81.92
Total (all sources)		453.92	460.85	511.26	513.90	527.01	687.86	687.91

See page 51 for explanation of abbreviations.

@ AIRDIS has largely been replaced by the 150% tax concession as the main Commonwealth support scheme for industrial R&D. The tax revenue foregone through this scheme is estimated as: 1985-86 : $20m; 1986-87 : $105m; 1987-88 : $150m.

From 1986-87, the Biotechnology Grants Scheme forms part of the GIRD scheme.

This program ceased in 1986-87.

* Revenue generated by the Patents Office is estimated at $29 m in 1986-87 and $31 m in 1987-88.

** Most of the scientific and technological service activities undertaken by CSIRO are integral with the Organisation's research programs and have been included under the heading R&D. The following activities have, however, been identified as S&T (other than R&D) for the purposes of these tables: information, library, editorial, patenting, science communications, overseas aid and the servicing of Australia's standards of physical measurement.

A13.1 DEPARTMENT OF INDUSTRY, TECHNOLOGY AND COMMERCE

Commercial Development of Technology (Industry, Technology and Commerce)

Major programs have been aimed at the commercial development of Australian technology.

- InterScan (Australian Microwave Landing System (MLS)). The commercial development phase of the MLS program was completed in 1983-84.

Grants to Industry Research Associations (Industry, Technology and Commerce)

Research Associations receiving support through the Department of Industry, Technology and Commerce are associations of firms engaged in applied industrial research and development and technology transfer activities within a particular industry sector or a common technology. There are eight industry research associations covering particle board, timber, welding, bread, brick development, medical engineering, radiata pine and sugar. The bulk of the income of these bodies (over 60 percent) is traditionally provided by industry and through the sale of services. Applied industrial research and development is carried out both within the associations themselves and through contractual arrangements with publicly funded research institutions including CSIRO, institutes of technology and universities. The Research Association Program was renewed by the BIE in 1986.

Public Interest Projects, Commencement Grants and Project Grants
(Industry, Technology and Commerce)

These projects and grants formed the Australian Industrial Research and Development Incentives Scheme (AIRDIS), which was established under the Industrial Research and Development Incentives Act 1976. This Act was superseded by the Industry Research and Development Act 1986 and the AIRDI Scheme ceased to operate as of 30 June 1986. Agreements entered into prior to June 1986 will be honoured in accordance with the IR&D Act 1976, but payments may only be made in respect of expenditure incurred up to 30 June 1989. For further details of these projects and grants, see pages 111-112 of the 1985-86 Science and Technology Statement.

Malaria Vaccine Joint Venture (Industry, Technology and Commerce)

An important initiative announced by the Government in 1985-86 was its decision to use the 'national interest' provisions of the Australian Industry Development Corporation Act to enable the AIDC to provide assistance to a joint venture to produce an anti-malaria vaccine. The joint venture comprises the Walter and Eliza Hall Institute of Medical Research, the Queensland Institute of Medical Research, the Commonwealth Serum Laboratories and Biotechnology Australia Pty Ltd and was formed to capitalise on an apparent breakthrough in the development of a vaccine against malaria - a disease which has re-emerged as a major health hazard in tropical regions. Following a request from the participants to the Government that it assist with funding over three years to permit more research, additional funding will be provided to help keep Australia at the forefront of research into a malaria vaccine. Expenditure in 1987-88, to cover costs of interest foregone and of management by the AIDC, is estimated at $1m.

Australian Uniform Building Regulations Coordinating Council (AUBRCC)
(Housing and Construction)

The AUBRCC aims to achieve the following objectives:

. the promotion of the safety, health and amenity of the community in buildings;

. the maintenance, issue and further development of the Building Code of Australia (or its successors) as a uniform cost effective basis for the technical requirements of building regulations in Australia

. the provision and co-ordination of research and investigation necessary to support regulatory development and the introduction of technical standards to facilitate the adoption of modern technology and innovation in the building and construction process.

It is jointly funded by the Commonwealth, State and Territory governments.

5th Generation Computer Development (Science)

The purpose of the program is to encourage and develop Australian capability in Artificial Intelligence and Fifth Generation Computing. The Machine Intelligence Project has supported research into:

. a PROLOG compiler

. an indexing scheme, query optimization and integrity constraints for very large databases

. unification chip design

. an expert systems workbench.

A13.2 GRANTS FOR INDUSTRY RESEARCH AND DEVELOPMENT (GIRD) SCHEME

(Industry, Technology and Commerce)

This Scheme, created under the Industry Research and Development Act 1986, aims to promote the development and improve the efficiency and international competitivenes of Australian industry by stimulating R&D spending, and is designed to complement the 150 per cent tax concession scheme for eligible research and development. It will operate for five years from 1 July 1986.

The GIRD scheme consists of three elements:

- Discretionary Grants: a grant of up to 50 per cent of eligible R&D expenditure conducted either in-house or by an approved research institution.

- Generic Technology Grants: these cover emerging technologies such as biotechnology and advanced materials which are considered to have fundamental significance for industry competitiveness in the 1990s but would be unlikely to develop if left to the market alone. These grants fund research in collaboration with industry to a stage where the private sector will take up further development.

- National Interest Agreements: for projects of significant national interest which would not otherwise have been undertaken by industry.

A13.3 BUREAU OF INDUSTRY ECONOMICS (BIE)

(Industry, Technology and Commerce)

The Bureau of Industry Economics is a centre for economic research on the manufacturing and commerce sectors of the Australian economy. The Bureau has professional independence in the conduct and reporting of its research.

The work of the Bureau is intended to achieve three broad objectives:

. to increase community and industry understanding of economic developments and policy issues in the manufacturing and services sectors by conducting and publishing objective research;

. to carry out applied economic research to assist the evaluation and formulation of industry policies and programs; and

. to foster basic and applied ecomonic research into industry policy issues at Australian tertiary institutions and research institutes.

The research and analysis carried out by the Bureau seeks to identify the principal factors influencing industry performance and growth, so that a more competitive and efficient industry structure can be developed. Thre Bureau also provides the Government with an independent capability to assess the economic aspects of submissions and papers put to it by industry and trade unions and to evaluate the effectiveness of existing industry policies and programs.

The Bureau publishes the results of its research, makes submissions to the IAC and organises seminars and conferences on key areas of industry economics, often in cooperation with universities, colleges and other research organisations.

Suggested topics of research for possible inclusion in the Bureau's annual work program are actively sought from private sector organisations as well as governmental bodies. Proposals are considered in consultation with the BIE Council of Advice.

The broad research priorities in 1987-88 are:

. completing research projects commenced in 1986-87

- a study of the acquisition of technology from overseas by Australian manufacturing
- a case study of the impact of certain Telecom regulations relating to leased lines and networks pricing of secondary aluminium
- Australia's international trade in services
- technical change and economies of scale
- industrial development and innovation policies in overseas countries
- case studies in the depreciation of the Australian dollar
- technical efficiency in manufacturing
- taxing capital income

. new research studies (subject to changing priorities and availability 0of resources)

- determinants of invesrtment in the Australian manufacturing sector
- longer term effects of the Australian dollar depreciation
- case studies in productivity in Australian industry
- speed of diffusion of technology to Australian industries
- case studies of social and private rates of return from industrial R&D in Australia
- the impact of globalisation on Australian manufacturing strategies
- export performance of small Australian firms
- company taxation and cross-border investment incentives.

A13.4 THE MOTOR VEHICLES AND COMPONENTS DEVELOPMENT GRANTS SCHEME

(Industry, Technology and Commerce)

The Motor Vehicles and Components Development Grants Scheme commenced in October 1984 and is administered by the Automotive Industry Authority, a body established to encourage the passenger motor vehicle industry to develop in line with Government objectives. The Grants Scheme was set up to foster the use of Australian design skills and thereby the development of automotive products that will enhance the local industry's competitiveness. The Scheme's central features are that:

- coverage will be limited to projects for the development of new or improved products;

- eligible products will be restricted to vehicles of a kind covered by the Passenger Motor Vehicle Manufacturing Plan and components for these vehicles;

- development activities eligible for support will extend beyond R&D to include design activities, including design costs for new tools, jigs and dies;

- assistance will be in the form of taxable cash grants, to be paid progressively over the life of the project as expenditure is incurred;

- the provision and level of grant assistance will depend on the extent to which the Authority believes a project meets the Government's policy objectives for the automotive industry.

A13.5 NATIONAL INDUSTRY EXTENSION SERVICE AND SUPPORT FOR INDUSTRY SERVICE ASSOCIATIONS

(Industry, Technology and Commerce)

The Department of Industry Technology and Commerce (DITAC) has responsibility for the Commonwealth's participation in the National Industry Extension Service (NIES). NIES is a joint Commonwealth and State Government initiative that has been established to upgrade and co-ordinate the wide range of advisory services to industry. NIES is helping Australian firms to achieve international competitiveness by encouraging the adoption of improved technologies, management and business practices.

The program co-ordinates the delivery of Commonwealth, State and semi-governmental extension services and encourages access to, and the development of, a more efficient private sector extension service.

Through a single contact point in each State and Territory, firms can be provided with information, or referred to appropriate specialist sources of advice, on issues that include strategic business planning, product innovation, design, quality, the application of new technologies, marketing, the contribution of labour, and issues of particular concern to small business. Financial assistance may be provided towards the cost of business planning services.

The NIES program has several elements that involve encouraging the adoption of improved technology. Some concentrate on demonstrating the benefits and application of advanced manufacturing technologies. For example, the Integrated Manufacturing (IM) Project aims to help companies to apply IM technology as a philosophy of manufacturing. Demonstration companies are being used to enable their experiences with IM to be made available to all industry.

Funds are provided through the Department's Budget allocation to the States and Territories to assist them in delivering NIES services to industry. In addition, funding is provided for the national NIES program, which includes the development of new elements of the program and assistance to five non-profit providers of extension services: the Technology Transfer Council, Australian Productivity Council, Industrial Design Council of Australia, Standards Association of Australia, and National Association of Testing Authorities.

The establishment of NIES brought about significant changes in the funding arrangements for the first three organisations. A guiding principle of NIES is the desire to encourage growth of private sector extension services. The provision of general grants to non-profit organisations providing services in competition with the private sector was judged to be inconsistent with this approach. Consequently general grants to those three organisations ceased on 30 June 1987. Their important national interest roles will continue to be supported by NIES, and contracts have been signed to provide funding for the next two years for specified national interest projects.

In 1987-88 the Commonwealth is providing $17.4 M for NIES. Of this $7.6 M is provided to the States and Territories for the implementation of NIES. The remainder is allocated to permit DITAC to continue with the implementation and operation of NIES at the national level.

A13.6 NATIONAL MATERIALS HANDLING BUREAU

(Industry, Technology and Commerce)

The National Materials Handling Bureau ceased operations as of 30 June 1987. See pages 111-112 of the 1986-87 Science and Technology Statement for information on its operations.

A13.7 SPACE PROGRAMS

National Space Program (Industry, Technology and Commerce)

The National Space Program, under the direction of the Australian Space Board, aims to increase Australia's involvement in space-related research and development and so promote the development of commercially viable industries based on space technologies.

The Program provides funding to industry for R&D in space-related projects. The aim is to expand Australia's technological and industrial base from which to compete for a share of the large world market for space-related goods and services.

Projects are chosen which have community relevance in either operational services or in science, and which also have industrial development potential.

Projects currently being funded under the program are:

- Project Endeavour, an experiment to be flown on the Space Shuttle to space qualify detectors for a space telescope
- Project Lyman, in which feasibility studies are being carried out for the Lyman high resolution ultraviolet space telescope
- ERS-1, in which and Australian ground station is being developed to receive and process data directly from the European ERS-1 remote sensing radar satellite
- Air Data Instrumentation, in which the feasibility of developing instruments for trans-atmospheric hypersonic spacecraft is being examined
- MOS-1, in which an Australian ground station is being developed in collaboration with CSIRO to receive and process data from the Japanese remote sensing satellite MOS-1
- Small Satellite Bus, in which feasibility studies are being carried out in collaboration with industry for the construction of a small Australian satellite.

The development of ERS-1 and MOS-1 ground stations will enable Australia to receive and process data from European and Japanese remote sensing satellites for use in resource and environmental management programs.

The Endeavour project will enable Australian astronomers to test a new type of photon counting detector in space as a preliminary step to possible use with the European Lyman space telescope.

NASA Space Projects (Science)

The Department plays a central role in Australian space activities and in the operation of the NASA tracking stations and communication network in Australia under an international

agreement. It also supports ballooning and sounding rocket operations in Australia under international agreements.

A13.8 NATIONAL BUILDING TECHNOLOGY CENTRE

(Housing and Construction)

The National Building Technology Centre is responsible for building and construction research and the dissemination of the results. The Centre's research role is to develop safe, durable and cost-effective building systems and building repair and restoration systems.

The Centre has four principal research sections:

- Fire Technology: the fire behaviour of and hazard represented by building materials, components and systems; active and passive fire protection and smoke control; evacuation systems.

- Building Performance: properties and structural and functional behaviour of building and construction materials, components and systems; resistance to gravity, wind and earthquake; weathertightness and durability; techniques for repair and restoration of buildings including historic buildings.

- Building Services: heating, ventilation, air-conditioning acoustics, lighting, plumbing, drainage, electrical services, emergency services, solar control, energy studies.

- Building Studies: special studies with emphasis on the functional efficiency of the built environment; post-occupancy evaluation of the performance of buildings as functional units, risk analysis, housing studies, social and economic studies.

In addition two subsections provide the following services:

- Appraisal and Accreditation: the provision, through the research sections, of consultancy and commercial testing services, including services to the Australian Building Systems Appraisal Council for the appraisal of innovative building products and systems.

- Codes, Standards and Regulations: the co-ordination and provision of services to codification and regulatory authorities such as the Standards Association of Australia, the Australian Uniform Building Regulations Co-ordinating Council, the Chief Officers' Conference of Water Supply and Drainage Authorities and Natspec.

A13.9 SNOWY MOUNTAINS ENGINEERING CORPORATION

(Housing and Construction)

The Snowy Mountains Engineering Corporation is a Commonwealth Government Authority providing specialist engineering consulting services on a commercial basis to government and private organisations both within Australia and overseas.

The fields of practice, stemming from the Corporation's origins in water and power engineering, cover many supportive activities which include civil, electrical and mechanical engineering, road engineering, hydrology and hydraulics, geology and soil and rock mechanics, surveying, estimating, contract supervision, irrigation, agriculture, economics, training, equipment procurement and project management.

The Corporation has also developed special expertise in the areas of hydrology, fluid mechanics and geomechanics and has well established fluid mechanics and geomechanics laboratories.

While continuing to undertake significant work in Australia, the Corporation has become increasingly committed to assisting with engineering development programs in developing countries and by far the largest part of the work is now performed overseas, often through ADAB (A12.2) funding.

A13.10 AUSTRALIAN NUCLEAR SCIENCE AND TECHNOLOGY ORGANISATION

(Resources and Energy)

On 27 April 1987, legislation was proclaimed which brought into being the Australian Nuclear Science and Technology Organisation (ANSTO) which replaced the Australian Atomic Energy Commission. Primarily ANSTO will be oriented towards applied research and toward the practical utilisation of nuclear science and technology for the benefit of Australia.

ANSTO is the principal agency for nuclear science and technology R&D in Australia. The Organisation also provides technical advice to government on a range of nuclear related matters. Its main research programs cover:

. nuclear waste management, including development of the Synroc process for the immobilisation of high level radioactive wastes;

. the production of and research into the application of radiopharmaceuticals and radioisotopes for diagnosis and therapy;

. the use of radioisotopes and radiation for industrial processing, tracing applications, food irradiation and sterilisation;

. environmental science with special reference to the Australian uranium mining industry; and

. supporting research in fields of fusion technology, nuclear safeguards, fission and health and safety assessments of nuclear plant and operations.

ANSTO operates two research reactors: the 10MW High Flux Australian Reactor (HIFAR) and the 100KW Moata reactor. These reactors are used for the commercial production of radioisotopes for use in medicine, industry and research, as well as providing research facilities for ANSTO, universities and other tertiary bodies. A 3MV van de Graaff accelerator is also used for research and a broad range of applications of nuclear science to industry and the communtity.

Technical liaison is maintained with a wide range of bodies involved in atomic energy including the International Atomic Energy Agency, the OECD Nuclear Energy Agency, national and international governmental authorities, Australian State Government bodies and universities.

A13.11 International Cooperative Arrangements in Science and Technology

Bilateral international agreements are an important source of support for the development of science and technology in Australia. There is considerable activity under seven agreements administered by the Department: the United States-Australia Agreement for Scientific and Technical Co-operation, the Federal Republic of Germany-Australia Science and Technology Agreement, the India-Australia Science and Technology Agreement, the Japan-Australia Science and Technology Agreement, the China-Australia Science and Technology Agreement, the Mexico-Australia Science and Technology Agreement, and the USSR-Australia Science and Technology Agreement (more details are provided in Appendix B). Support is provided for seminars/workshops, individual research visits and for delegations of senior scientists to visit other countries to assess capabilities, to observe new techniques and equipment and to establish future collaborative exchanges.

The Department is responsible for managing Australia's involvement in the Association for Science Cooperation in Asia (ASCA). The Association exists to encourage scientific and technical co-operation among member countries with a view to promoting development in the region.

Australia also contributes to the budget for the Commonwealth Science Council, a liaison body formed in 1946 to facilitate collaboration and exchange of information between Commonwealth scientists.

Regional Activities

Funds are provided in support of international cooperation in science and technology where no formal government-to-government agreement exists. Programs of cooperation were commenced with France and the Republic of Korea. Programs in the ASEAN region were supported through the Scientific Industries Steering Committee (SISC).

Australian Science and Technology Counsellor Network (ASTCON)

ASTCON's goals are to contribute to the development of Australia's scientific and technological capability by improving knowledge of and access to overseas research and development, and to project Australia's image as a strong performer of science and technology. The functions considered most effective in trying to achieve those goals are:

. gather, assess and disseminate information on trends and developments in S&T of interest to Australia

. assess and report on overseas governments' policies and programs in S&T

. identify and facilitate the exploitation of opportunities for cooperation in S&T between Australia and other countries

. provide advice to the heads of missions and departments on S&T aspects of international relations

. promote recognition in other countries of Australian S&T capabilities.

A13.12 PATENT, TRADE MARKS AND DESIGN OFFICE

The Offices:

. administer Australian industrial property systems for the protection of inventions, trade marks and industrial designs;

. investigate all applications for patents, for inventions and for the registration of designs and trademarks;

. issue deeds of letters patent and certificates of registration and publishes details of successful applications;

. act as a Receiving Office, International Searching Authority and an International Preliminary Examining Authority under the Patent Co-operation Treaty; and

. facilitate diffusion of technology by enabling access by research, manufacturing and industrial concerns to information contained in patent specifications.

. contributes advice and expertise to other areas of the Department concerned with encouraging invention and technological innovation.

The Offices provide policy advice to the Minister in relation to the development and administration of industrial property laws, practices and procedures so that they may encourage innovation and creative activity for the national benefit. They also contribute advice and expertise to other government departments and agencies concerned with invention and technological innovation. The offices are responsible for administering Australian participation in bilateral and multilateral international agreements and contribute to various intellectual property bodies operating under the control of the World Intellectual Property Organisation (WIPO), and also to the International Patent Documentation Centre, to facilitate the transfer of foreign patent information to the Australian Patent Office.

The Government has determined that the Offices will recover their operating costs and notional overheads, such as superannuation and rent, and the cost of upgrading their computer system. (In the Ministry Table above such revenues have been offset against the Department's Budget Appropriation).

A13.13 COMMISSION FOR THE FUTURE (CFF)

(Science)

The Commission for the Future is a national organisation which carries out education and public awareness programs to stimulate discussion of the social and economic impacts of technological change and long-term planning options for Australia.

Its objectives are to promote:

. wider understanding of science and technology and their importance for Australia's future

. awareness and discussion of the social and economic effects of scientific and technological development

. increased public involvement in the setting of directions for research and development

. the ability of individuals to take account of technological change when making decisions about their own futures and when considering future directions for Australia.

In pursuing these objectives the Commission has mounted a series of issues analysis, education, information, and public involvement programs.

Issues anlaysis

The Commission's terms of reference include the securing of information relating to future forecasting of scientific and technological developments, and their likely social and economic impacts.

The first cycle of issues and trends analysis completed by the Commission include:

. future challenges of Australia's information industry

. demographic change and its social consequences

. futures forecasting methodologies

. attitudes to science, technology and the future.

Ongoing issues analysis projects include:

. the future of work
  - unions of the future, a joint study with the ACTU
  - work leisure and time use

. education, training and retraining needs for a technological future

. future telecommunications technologies

. Australian future studies, a series of interconnected studies using the lifecycle as a framework for analysing future issues

. creativity for a productive future, a joint study with the Australia Council

. Australian attitudes to science, technology and the future

. survey of Australian futures studies, a contribution to a UNESCO project on perceptions of the future in the Asian region.

Education

. Bicentennial Futures Education Project, with assistance from the Australian Bicentennial Authority, is producing teaching materials to introduce a futures perspective into school subjects, and to dispel the mystery surrounding science and technology.

. A major conference is being organised with the Australian Teachers' Federation to elaborate future demands on the public education system.

Public involvement

. The Greenhouse Project: Planning for Climate Change, a joint project with the CSIRO aims to raise awareness of the social and economic effects of anticipated climate changes and to promote anticipatory research and planning.

. Development of a Community Science and Technology Exchange with Swinburne Institute of Technology.

. Clearing House on Future Issues

. Future Issues Network.

A13.14 AUSTRALIAN INSTITUTE OF MARINE SCIENCE (AIMS)

(Science)

The Australian Institute of Marine Science (AIMS) carries out research in marine science and collaborates with other institutions in carrying out such research. The Institute's role is mainly to conduct research and to arrange, co-operate with, and assist other institutions or persons, in conducting marine science research as well as to collect and disseminate information relating to marine science.

AIMS' objectives are to advance the development of national knowledge of the marine environment; to communicate this knowledge so that it can be applied to the development, conservation and management of the marine resources; to create opportunities for technological and commercial development; and to foster cooperation between researchers with similar interests.

AIMS' core research is organised into four closely integrated programs. These are:-

. Coastal Processes and Resources Program: aimed at investigating the physical and biological factors affecting the present or potential resources of the coastal zone, with particular emphasis on mangrove forests and significant river systems.

. Reef Studies Program: directed towards integrated geological, biological and physical oceanography studies, over a wide range of temporal and spatial scales of coral reefs to understand how and why reefs exist as they now do.

. Environmental Studies Program: aimed at identifying, measuring and interpreting records of environmental variability which are constructed by selected marine organisms, particularly those records contained within the structures of reef-building corals, and to provide long, proxy records of environmental factors for practical applications, including climatic modelling and hydrography.

. Marine Systems Analysis Program: seeks to understand natural phenomena in the ocean at a systems level and through a systems approach. It will attempt to provide a synthetic and integrated understanding of marine systems by focussing on phenomena common to all marine systems, rather than on the peculiarities of particular marine systems.

The four core research programs have been augmented by funding from other agencies which allow for continuing major research on the Crown-of-Thorns Starfish phenomenon, accelerated research on weather records in corals, and mangrove forests through CEP projects and assistance to ASEAN countries to develop technologies for assessing their coastal marine resources, especially mangroves and coral reefs.

Current Developments

. AIMS is currently undertaking a project to identify and measure the important food chain processes within mangroves and the trophic connections between the mangroves and near-shore waters and benthos, with particular attention to the importance of mangrove forests to fisheries resources in the coastal zone.

. In conjunction with ICI Australia Operations Pty Ltd, AIMS is studying the ecological role and synthetic chemistry of UV blocking screens. UV blocking substances found in corals, are also found in many other organisms occupying shallow reef environments. The ecological role of these substances is now being studied. Synthesis of UV(B) absorbing compounds to exemplify provisional patents is being carried out for completion of an Australian patent application.

. In collaboration with oceanographers and climatologists, coral density records will be examined to determine if periodic fluctuations correlate with significant environmental variables such as insolation and sea surface temperature. These correlations will be used to generate proxy records for the environmental parameters. Finally the use of some proxy records in climatic modelling will be initiated.

. AIMS, in collaboration with CSIRO and GBRMPA, is using the Institute microBRIAN facility to develop standardized ground truthing procedures for Landsat imagery in shallow marine systems and is in the process of establishing a North-East Australian Satellite Imagery System (NASIS) for long term studies of sea surface temperatures and water circulation patterns.

. As part of a Coral Spawning Experiment (CORSPEX) in collaboration with James Cook University, AIMS is using field data on material dispersal between reefs and numerical models of reef-induced circulation, to examine the nature of connectivity between reefs. The objective is to increase understanding of the significance of mass coral spawning events in the dynamics of coral reef ecosystems.

. As part of an Australian Monsoon Experiment (AMEX) in collaboration with the Bureau of Meteorology and CSIRO, AIMS is using conductivity/temperature/depth meters, current meters, weather buoys and satellite data, to determine the fate of river runoff, the water circulation and the heat budget in the Gulf of Carpentaria during the monsoon period. The objective is to understand the role of the entrapped Gulf waters in the development of the monsoon, which controls the regional prawn fisheries.

. With the assistance of grants from GBRMPA and the Townsville Motor Boat Club AIMS is establishing a network of weather stations on the Great Barrier Reef which will provide weather data for research purposes as well as instant weather conditions for local boat operators and fishermen.

. A book ‘Corals of Australia and the Indo-Pacific’ was published in 1987 and is the first systematic reference book of its kind for reef building corals.

A13.15 NATIONAL STANDARDS COMMISSION (NSC)

(Science)

The National Standards Commission's main function under the National Measurement Act 1960 is to promote and coordinate the use of a uniform system of units and standards of measurement of physical quantities, throughout Australia, including use of the metric system, and to advise the Minister on matters relating to Weights and Measures.

The Commission is also responsible for the approval of patterns of measuring instruments used for trade in Australia.

A13.16 COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO)

(Science)

CSIRO was established as an independent statutory authority by the Science and Industry Research Act 1949. It succeeded the former Council for Scientific and Industrial Research established in 1926. The Act has been amended on a number of occasions since then, but the most significant amendments were made in 1978, following the Government instigated 'Birch Committee of Inquiry' and, more recently in November 1986, when it was amended to reflect the decisions on the recommendations of the review of public investment in research and development in Australia, including specifically CSIRO, carried out by the Australian Science and Technology Council (ASTEC).

The decisions announced by the Government in June 1986 and reflected in the 1986 amendments, confirmed that CSIRO's primary role was to continue as an applications oriented research organisation in support of major industry sectors and selected areas of community interest, but with a stronger commitment to the effective transfer of its results to users. The most recent amendments have also included changes to the top management structure and the Organisation's advisory mechanisms.

Under the new arrangements the previous Executive has been replaced by a Board comprising a part-time Chairman and eight external part-time members. The Chief Executive as the most senior officer of the Organisation is the only full time member of the Board. The previous formal advisory mechanisms consisting of the CSIRO Advisory Council and State advisory committees have been abolished, to be replaced by new mechanisms to be determined by the Board. These appointments came into effect on December 1, 1986.

CSIRO's primary statutory functions are:

- to carry out scientific research relevant to Australian industry, the community, national objectives, national or international responsibilities, or for any other purpose determined by the Minister;

- to encourage and facilitate the application and utilisation of the results of such research.

Other functions, in summary form are:

- to encourage or facilite the application or utilisation of the results of any other scientific research;

- to carry out services, and make available facilities, in relation to science;

- to liaise with other countries in matters of scientific research;

- to train research workers;

- to make grants and award fellowships and studentships relevant to the Organisation's research;

- to recognise, cooperate with and make grants to industrial research associations;

- to establish, and promote the use of, standards of measurement of physical quantities;

- to collect, interpret and disseminate scientific and technical information; and

- to publish scientific and technical reports, periodicals and papers.

The Organisation is funded primarily by direct appropriations from the Commonwealth. Decisions on research priorities are made by the Board on the basis of strategic and annual operating plans submitted by the Chief Executieve and in the light of advice from the Organisation's advisory mechanisms, government departments, industry and other interested bodies.

The research work of the Organisation is carried out in Institutes, each headed by a Director and each specifically established to undertake work in support of industry or community interest sectors of the Australian economy. Institutes are comprised of Divisions which, headed by Chiefs, are responsible for broad programs of research in support of the objectives of the Institute.

Current Institutes are:

- Institute of Animal and Food Sciences
- Institute of Biological Resources
- Institute of Industrial Technology
- Institute of Physical Sciences
- Institute of Energy and Earth Sciences

Support services include:

- Information and Public Communication	Library and information services, public and internal communication policy and practice.
- Office of the Chief Executive	Corporate policies, strategic planning and administrative coordination.
- Finance and Administration	Budget, works, administrative services and systems.
- Personnel	Policy advice and operational assistance in all staff matters.
- International Activities	Policy and coordination of aid activities and international research cooperation.

On 30 June 1987, CSIRO had a total staff of 7 347 in more than 100 locations throughout Australia. About one-third of the staff were professional scientists, with the others providing technical, administrative or other support.

During 1987 CSIRO has reviewed its structure and support services in the light of the Government decisions and the amendments to its Act. As a result, the Board has decided that a new Institute and Divisional structure will be introduced from 1 January 1988. Six Institutes will replace the present five and 31 Divisions will replace the present 42.

The new Institutes and Divisions will be as follows:

Institute of Information and Communication Technologies
Institute of Industrial Technologies
Institute of Minerals, Energy and Construction
Institute of Animal Production and Processing

Institute of Plant Production and Processing
Institute of Natural Resources and Environment.

Institute of Information and Communication Technologies

Division of Information Technology
Division of Radiophysics
Division of Mathematics and statistics
COSSA

Institute of Industrial Technologies

Division of Manufacturing Technology
Division of Materials Science and Technology
Division of Applied Physics
Division of Chemicals and Polymers
Division of Biotechnology

Institute of Minerals, Energy and Construction

Division of Construction and Engineering
Division of Exploration Technology
Division of Mineral and Process Engineering
Division of Mineral Products
Division of Coal Industry
Division of Fuels Production

Institute of Animal Production and Processing

Division of Animal Health
Division of Animal Production
Division of Wool Technology
Division of Tropical Animal Production
Division of Food Processing
Division of Human Nutrition

Institute of Plant Production and Processing

Divisin of Plant Industry
Division of Tropical Crops and Pastures
Division of Horticulture
Division of Entomology
Division of Soils
Division of Forestry and Forest Products

Institute of Natural Resources and Environment

Division of Water Resources
Division of Fisheries
Division of Oceanography
Division of Atmospheric Research
Division of Wildlife and Ecology
Centre for Environmental Mechanics

The objectives of the existing Divisions are:

Animal Health

Main objectives are to discover and develop methods for the diagnosis, control or eradication of the major endemic diseases of farm livestock in temperate Australia, and to collaborate with industry in the development and application of disease control products. These objectives exploit a range of skills in microbiology, parasitology and immunology using

modern methods in molecular biology that lead to new diagnostic testing, sub-unit vaccines and vaccine delivery systems for a variety of bacterial, viral and parasitic diseases.

Animal Production
Main objectives are to improve the efficiency of livestock production and the quality of derived animal products. The Division's strategy concentrates on problems of national significance, in particular in the sheep industry, where the application of new scientific principles will result in substantial gains in livestock productivity.

Australian Animal Health Laboratory
The objective of the Laboratory is to enhance Australia's capability and preparedness to combat exotic diseases, by a concentration of effort in the development of diagnostic capabilities and effective control methods for exotic diseases that represent the greatest threat to Australia. Research strategy involves disease diagnosis, research, training, vaccine development and testing.

Entomology
The objectives are to develop strategies and techniques for the management and control of insect and related pests of crops, livestock and man, and to understand the role of insects in the environment. These objectives involve the exploitation of skills in taxonomy, ecology, physiology, behaviour, genetics, pathology and molecular biology in developing novel pest control techniques - using biological rather than chemical methods.

Horticultural Research
The objectives of the Division are to improve the competitiveness and profitability of woody perennial horticultural crops grown in the temperate, subtropical and tropic zones of Australia. Emphasis is placed on the development of new techniques for the selection and breeding of improved plant types, and on understanding the complex interaction between plant performance and the environment.

Plant Industry
The objectives are to improve profitability and stability of agricultural production in Australia through the development of new and improved crop and pasture plants and management practices, and to provide a scientific basis for the documentation, utilisation and management of Australian flora and vegetation. Strategies use skills in basic and applied plant science, with an emphasis on modern molecular biological approaches, the development of computer-based farm management systems and new and improved crop and pasture plants.

Tropical Animal Science
The objective is to develop ways to increase the efficiency of production of grazing livestock (particularly beef cattle) in the tropical areas of Australia. The strategy used to achieve this objective is aimed at improving the productivity of genotypes that already have high levels of resistance to stress by developing techniques to increase reproduction and growth rates, reduce or eliminate disease stress by vaccination and to boost the utilization of both wet and dry season forages.

Tropical Crops and Pastures
The objectives are to improve the efficiency of livestock production from legume-based pastures in northern Australia, to maintain the productivity and stability of the native grasslands and woodlands (excluding arid rangelands), and to improve field crop productivity. A range of scientific skills and consultation with representatives of rural industries are utilized to meet these objectives.

Energy Chemistry
The objective is to develop new or improved processes for the production and use of fossil fuels and substitute liquid fuels. A wide range of chemical, materials science and engineering skills are applied to improve and modify fuel technologies to better suit them to the characteristics of Australian feedstocks and better identify new technological approaches.

Energy Technology
The objective is to promote the effective and efficient use of energy in Australia. The Division utilizes its engineering and scientific skills to develop processes and equipment that assists transport and manufacturing industries to make and market more cost effective energy technologies.

Fossil Fuels
The objective is to improve and support the production, use and marketing of Australian coal, natural gas and other fossil fuels. Scientific and engineering skills are applied to aspects and use of fossil fuels and to their specification to meet customer needs, as well as the consideration of environmental effects of fossil fuel and mineral processing.

Geomechanics
The objective is to improve methods for the design and implementation of engineering projects in the earth's surface and subsurface. The strategy concentrates on the development of geo-engineering procedures and devices to monitor rock and soil under applied load; fundamental studies of the structure and properties of geological materials; developing methods of modelling geologic systems under load; and field studies of rock masses.

Mineral Chemistry
The objective of the Division is to stimulate and assist development of Australia's mineral resources and to augment the value and range of applications of its mineral products. Strategies used to meet this objective include the application of skills in the chemical processing of minerals and extraction of metals to assist the minerals and related manufacturing industries to maintain their international competitiveness.

Mineral Engineering
The objective of the Division is to increase the international competitiveness of mineral, energy and base-metal industries in Australia. Skills in chemical engineering, mineral processing, physics and mathematics are applied through theoretical, experimental, and application studies for stages of processing and beneficiation of metalliferous ores, coal and oil shale that offer the most cost effective returns or means of improvement for the industry. Particular emphasis is placed on instrumentation and control; handling and beneficiation; and smelting and base metal production.

Mineral Physics and Mineralogy
The Division's main objective is to improve and develop procedures for industry to use in locating mineral and hydrocarbon deposits in Australia by the application of concepts and techniques suitable for such exploration in Australia's unique weathered terrain. Emphasis is placed on geophysical, mineralogical and remote sensing techniques and the development of instruments for use by industry.

Minerals and Geochemistry
The Division's main objective is to develop more cost effective means of finding and processing minerals, particularly in Western Australia. New methodologies are used to enhance exploitation of existing orebodies and to develop or improve processes for the production of higher value products from mineral raw materials.

Atmospheric Research
The main objectives of the Division are 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. Research focuses on fundamental problems of forecasting weather, climate and climate change, practical problems relevant to community concerns and problems that affect primary and secondary industry.

Environmental Mechanics
The objectives of the Division are to solve problems in hydrology, environmental quality, industrial processes and plant productivity by an understanding of the physical processes in

the natural environment. Research focuses on effective scientific management of hydrological, environmental and agricultural resources and on the development of techniques, analyses, and instruments to expedite the practical application of the work.

Fisheries Research
The main objective of the Division is to maintain, develop and improve Australia's fisheries, with particular reference to the rational exploitation of the resource, the interests of the catching sector, and the quality and value of the product. Research focuses on problems of economic importance particularly in the Australian Fishing Zone by studies of physical, chemical and biological factors affecting the distribution, abundance and population dynamics of commercial fisheries and potential commercial fisheries.

Forest Research
The objectives of the Division are to develop understanding, strategies and techniques for balanced management of forests for a broad range of uses including wood production, water supply, ecosystem conservation and scientific reference. Research is conducted to assist forest managers by elucidating responses of natural and man-made forests to disturbance and management, developing techniques to achieve management objectives and by improving planting stock.

Oceanography
The Division's objectives are to understand the physics and chemistry of the seas and oceans of the Australian region with particular reference to the needs of maritime activity and the effects of these waters on global climate. The Division also aims to promote the development and application of instruments, techniques and expertise to assist industry and public agencies with marine interests.

Soils
The Division's objectives are to increase knowledge of the properties and distribution of Australian soils so that they can be profitably and conservatively managed. Research centres on the physical, chemical, mineralogical and biological properties of soil, and the principles underlying their distribution and behaviour in the Australian environment.

Water Resources
The objective of the Division is to develop new or improved practices for the definition, use and management of Australia's water resources, including the maintenance of the quantity and quality of urban, rural and industrial water supplies. Research focuses on quantitative procedures and models for assessment and management of water resources as well as taking into account economic, social and cultural aspects of water resource management.

Wildlife and Rangelands Research
The Objectives of the Division are to improve the management and conservation of Australia's rangelands, wildlife and land resources. Research focuses on real Australian problems by the use of multidisciplinary, integrated programs and the use and development of modern ecological and biological techniques.

Irrigation and Freshwater Research
The objectives of the Centre are to develop ecologically sound methods for the management of irrigation water distribution systems and other surface waters, and to improve the efficiency of water use and the long term productivity of irrigated agriculture in southern Australia. Research focuses on plant performance and soil characteristics and their manipulation under irrigation, particularly in south-east Australia, and the characteristics and management of water bodies and irrigation supply systems.

Applied Organic Chemistry
The objectives of the Division are to develop new technologies aimed at making the Australian chemical and plastic industries competitive in domestic and international markets. The Division undertakes collaborative projects with companies or groups of companies to apply its research results and to utilize its expertise in chemical synthesis, polymer chemistry, and surface and colloid chemistry to develop new products and processes for the Australian chemical industry.

Chemical and Wood Technology
The objectives of the Division are to support Australian industries concerned with wood and fibre utilization, water purification and biotechnological processes by the development of new technologies and improving existing technologies. Research is directed towards assisting the timber industry to develop more efficient processes and to produce better value products and to the purification of waste waters using physico-chemical and biotechnological expertise.

Food Research
The objective of the Division is to develop ways to handle, process and add value to foods, that improve efficiency, maintain or improve quality and safety, and minimize or utilize wastes. Research focuses on knowledge of the chemical, physical and biological properties of foods, especially meat, dairy, fruit, and vegetables, and to apply this to their handling, processing and storage.

Human Nutrition
The objective of the Division is to improve human well-being and community health and reduce the incidence of diet-related disease in Australia by nutritional means. Research focuses on understanding nutrition-related disorders, in defining factors that lead to optimal growth and development, in developing techniques for assessing attitudes and knowledge about nutrition and encouraging the food industry to produce novel and healthy foods.

Molecular Biology
The objective of the Division is to discover, develop and implement new principles and methods in molecular and animal cell biology for application in biotechnological, manufacturing and rural industries. Research focuses on maintaining a core of longer-term research in DNA structure and function, gene technology and animal cell biology leading to generic applications, and exploitation of these in collaboration with other CSIRO divisions, research institutions and industry.

Protein Chemistry
The main objectives of the Division are to improve competition in international markets of Australian industries based on animal protein products such as wool, hides and skins, to assist industries based on plant protein products such as feedstuffs and to stimulate the creation of new industries based on biotechnology processes such as vaccine production, diagnostic probe development and industrial microbiology.

Textile Industry
The objective of the Division is to increase worldwide demand for Australian wool and wool products by improving processing methods and the development of new products with consumer appeal. Research focuses on the development of new product technology and improvement of existing product specification and performance characteristics.

Textile Physics
The objectives of the Division are to improve marketing procedures and textile product performance by the application of advanced technologies and new industrial measurement systems to increase the demand for Australian wool and wool products on international markets and to contribute to the viability of other manufacturing industries by the wider application of these technologies. Research focuses on the preparation, marketing and processing of wool that will enhance the performance, comfort, aesthetic and tailoring properties of wool textiles.

Wheat Research Unit
The objective of the unit is to develop a deeper understanding of the relationship between grain composition and quality to assist in optimising the returns for Australia's cereal grain and grain products. Research focuses on quality evaluation, objective testing, handling, value-added processing, processing efficiency, occupational hazards and cereal nutrition/intolerance.

Applied Physics
The objectives of the Division are to apply the methods of physics to the solution of problems of importance to Australian industry and the Australian community. Research focuses on physics and engineering investigations in the development of improved products, manufacturing processes, industrial instruments and measuring techniques. The Division also provides a first-level calibration service and collaborates with national organisations concerned with measurement and testing.

Building Research
The objectives of the Division are to increase efficiency and effectiveness in the building and construction sector of the Australian economy, to enhance the standard of accommodation and infrastructure for Australians, to ensure that the construction sector operates in a manner compatible with the environment and to collaborate with and provide advice to industry. Research focuses on basic research in collaboration with industrial applied research groups.

Information Technology
The objectives of the Division are to support growth in the Australian information industry and to assist industries such as agriculture, mining and manufacturing to improve their competitiveness through the use of modern information processing and communication systems. Research focuses on collaboration with the Australian Information Industry and other relevant bodies.

Materials Science and Technology
The objectives of the Division are to assist Australian industry by developing new and improved materials, relevant processes and instruments. Research focuses on strategic research, instrumental skills and collaborative work with industry.

Manufacturing Technology
The objectives of the Division are to develop new and improved processes that will increase competitiveness of Australian metals and related engineering industries, particularly those that are export oriented. Research focuses on collaborative work with industry in engineering, metallurgy and computer science.

Mathematics and Statistics
The objectives of the Division are to foster the application of statistics and other appropriate mathematics to research in CSIRO Divisions and to conduct related mathematical and statistical research; and to promote the use of mathematics and statistics in Australian industry through collaboration and consultation. Research focuses on internal high priority programs and statistical design and external work with individual firms towards optimising industrial procedures, collaboration with industrial groups and tactical research for industry under contract through SIROMATH Pty Ltd.

Radiophysics
The objectives of the Division are to extend and apply the knowledge and techniques of radiophysics and electronic engineering for the benefit of Australian industry and the community and to construct, operate and develop the Australia Telescope as a National Facility and to conduct research in radioastronomy and astrophysics.

Commercial Activities
The main aim of CSIRO's commercial activities has been to achieve the maximum possible economic and social benefits to Australia by contributing to commercially viable innovation. During recent years, there had been a greater emphasis on research in CSIRO that can be exploited by Australian industry, or that will bring more substantial benefits to Australia. The selection of commercial partners with the capability of developing, applying and marketing the innovation has become even more significant in the planning and evaluation of research in CSIRO. Economic and social benefits are maximised through the establishment of manufacturing or other activities based on CSIRO innovation. The benefits to the community come from resultant generation of wealth, employment and export income. It has also been recognised that the CSIRO technology with the greatest

potential to increase Australian industry's competitiveness, will be that which industry will be willing to pay the most for - judged against the cost and profit structure of the sector of industry concerned. A second but important aim of CSIRO's commercial policy is to continue to maximise CSIRO's revenue from its commercial transactions.

SIROTECH Limited

In the first eighteen months of its operation, SIROTECH has come to the forefront in technology transfer in Australia. SIROTECH was established by CSIRO in 1985 to help transfer research results with sound commercial potential to the Australian industry most suited to making the most use of those results. SIROTECH has been able to help identify and evaluate commercial opportunities, package and market them to industry and negotiate terms and finalize agreements. As a company set up to 'act commercially', it has continued to develop its capabilities in patent and intellectual property management, technology evaluation, market assessment and advice and successful negotiation of commercial agreements, joint ventures and collaborative deals.

By mid 1986 more than 60 commercial agreements had been negotiated in medium to large-scale projects as well as smaller projects. Some examples of those negotiations follow:

. Joint venture between SIROTECH and Du Pont Australia

An Australian-controlled joint venture between SIROTECH and Du Pont Australia called Dunlena Ltd will enter the multi-million agricultural crop protection market. SIROTECH holds a 51% share in Dunlena on behalf of CSIRO.

. SIROCHEM

A high level chemical consultancy service specialising in products and processes relating to the development of advanced chemicals such as polymers, adhesives and pharmaceuticals has been formed between SIROTECH and AMDEL.

. SIROSMELT

An agreement was reached with Ausmelt Ltd for marketing SIROSMELT, a novel smelting technology with Comalco for an aluminium refining technique, with Incor for a conveyor belt monitoring technique and with Davy McKee for an electro-dewatering technique to reduce water content in settling ponds.

. Micro-BRIAN

A powerful relatively inexpensive computer imaging processing system, which can be run on a microcomputer, was licensed to the Australian company, Microprocessor Applications Pty Ltd. Micro-BRIAN uses image processing data from the Landsat series of satellites.

Distribution of Research Effort

In the table which follows, CSIRO research is grouped under a number of socio-economic headings developed specifically for the presentation of CSIRO's activities. The classification scheme was originally prepared for strategic planning purposes and contains major sectors broken down progressively into sub-sectors and research areas. The scheme is used in CSIRO to meet management and reporting needs and continues to evolve in line with changes in these requirements. Data in this table are final expenditure figures of the last financial year and estimates for expenditure for the current financial year. These figures reflect all the funds which were spent by CSIRO, or on its behalf by other agencies, in each financial year.

A second table presents year-to-year data by sectors to provide an indication of trends at this broad level only. Readers wishing to pursue more detailed year-to-year comparisons are

invited to contact CSIRO by writing to the Acting Corporate Secretary, CSIRO, PO Box 225, Dickson, ACT, 2602.

Table 17. CSIRO EXPENDITURE BY RESEARCH SECTOR 1986-87 AND PROJECTED 1987-88

A. EXPENDITURE BY DETAILED RESEARCH SECTOR

($ million)	1986-87	Projected 1987-88
MANUFACTURING INDUSTRIES		
Technology Based Manufacturing Industries		
Scientific and Electronic Equipment and Instrumentation	10.863	11.750
Chemicals, Polymers, Pharmaceutical and Veterinary Products	19.189	20.400
Fabricated Metal Products and Processes	2.040	2.110
Machinery and Equipment	1.328	1.400
Not Specifically Allocated	0.560	0.540
Sub-total - Technology Based Manufacturing Industries	33.980	36.200
Resource Based Manufacturing Industries		
Food and Beverages	13.048	13.500
Textiles and Leather	8.309	8.600
Wood, Paper and Forest Products	4.971	5.100
Industrial Mineral Processing and Basic Metal Products	8.187	8.500
Not specifically allocated	0.558	0.600
Sub-total - Resource Based Manufacturing Industries	35.073	36.300
Manufacturing - General		
Generic Manufacturing Technologies	8.497	8.800
Advanced Materials	18.664	19.300
Standards for Manufacturing Industries	5.160	5.300
Not Specifically Allocated	0.670	0.700
Sub-total - Manufacturing General	32.991	34.100
Manufacturing Industries Not Specifically Allocated	0.286	0.250
TOTAL - MANUFACTURING INDUSTRIES	102.330	106.850

($ million)	1986-87	Projected 1987-88
RURAL INDUSTRIES		
Agriculture		
Cereal Crops	8.621	8.900
Oilseed and Legume Crops	3.851	3.975
Horticultural Crops	6.778	7.000
Fibre and Industrial Crops	3.315	3.425
Pastures	8.890	9.150
Sheep	16.701	17.250
Beef Cattle	6.431	6.625
Dairy Cattle	0.681	0.700
Intensive Livestock	1.582	1.625
Agricultural Systems	4.588	4.725
Multi-commodity Research	12.870	13.275
Not specifically allocated	15.875	16.350
Sub-total - Agriculture	90.183	93.000
Forestry		
Plantation Forests	7.035	7.300
Natural Forests	5.487	5.700
Bushfires	0.918	0.950
Not Specifically Allocated	0.936	0.950
Sub-total - Forestry	14.376	14.900
Fishing		
Fisheries	8.354	8.650
Marine Biology	3.005	3.100
Sub-total - Fishing	11.359	11.750
Rural Industries - Not Specifically Allocated	0.245	0.200
TOTAL - RURAL INDUSTRIES	116.163	119.850

($ million)	1986-87	Projected 1987-88
MINERAL, ENERGY AND WATER RESOURCES		
Mineral Resources		
Exploration	8.487	8.950
Mining	3.038	3.200
Minerals Beneficiation	5.188	5.500
Not Specifically Allocated	0.470	0.450
Sub-total - Mineral Resources	17.183	18.100
Energy Resources		
Coal Production	4.596	4.750
Coal Utilisation	5.518	5.725
Petroleum, Natural Gas and Oil Shale	8.408	8.725
Renewable Energy, Energy Storage, Conservation and Use	3.841	4.500
Sub-total - Energy Resources	22.363	23.700
Water Resources	6.881	7.250
Water Resource Management	2.039	2.150
Water Technology	0.383	0.400
Not Specifically Allocated		
Sub-total - Water Resources	9.303	9.800
Mineral, Energy and Water Resources - Not Specifically Allocated	0.022	0.100
TOTAL - MINERAL, ENERGY & WATER RESOURCES	48.871	51.700

($ million)	1986-87	Projected 1987-88
CONSERVATION AND THE NATURAL ENVIRONMENT		
Soils and Land Use		
Soils Resources	2.304	2.425
Land Use	1.706	1.800
Soil Conservation and Management	2.956	3.100
Not Specifically Allocated	2.809	2.975
Sub-total - Soils and Land Use	9.775	10.300
Ecology and Environment		
Aquatic Environment	3.242	3.400
Terrestrial Environment	4.923	5.200
Not Specifically Allocated	0.178	0.200
Sub-total - Ecology and Environment	8.343	8.800
Flora and Fauna		
Flora	2.437	2.600
Fauna	8.846	9.400
Not specifically Allocated	0.577	0.500
Sub-total - Flora and Fauna	11.860	12.500
Oceans and Atmosphere		
Oceans	7.118	7.500
Atmosphere	5.729	6.000
Not Specifically Allocated	0.414	0.450
Sub-total - Oceans and Atmosphere	13.261	13.950

($ million)	1986-87	Projected 1987-88
Environmental Protection		
Land	0.947	1.020
Water	4.292	4.520
Air	2.719	2.830
Human Environment	1.053	1.130
Sub-total - Environmental Protection	9.011	9.500
Conservation and the Natural Environment - Not Specifically Allocated	0.020	-
TOTAL - CONSERVATION AND THE NATURAL ENVIRONMENT	52.270	55.050
SERVICE INDUSTRIES		
Urban and Civil Engineering		
Transport Systems	0.265	0.280
Geo-Engineering	2.003	2.150
Construction	4.736	4.850
Urban Planning	0.541	0.560
Not Specifically Allocated	0.385	0.380
Sub-total - Urban and Civil Engineering	7.930	8.220
Human Health		
Nutrition and Food Safety	7.247	7.540
Medical Technology	2.793	2.900
Sub-total - Human Health	10.040	10.440
Standards for Service Industries		
Standards and Calibration Services	5.765	6.000
Sub-total - Standards for Service Industries	5.765	6.000
Service Industries - Not Specifically Allocated	0.040	0.040
TOTAL - SERVICE INDUSTRIES	23.775	24.700

($ million)	1986-87	Projected 1987-88
MULTI-SECTORAL TECHNOLOGIES		
Biotechnology	38.402	40.450
Information Technology	24.898	26.450
Space Technology and Astronomy		
- space technology	8.192	8.600
- astronomy	23.458	19.100
TOTAL - MULTI-SECTORAL TECHNOLOGIES	94.950	94.600
INTERNATIONAL AID	7.575	7.800
TOTAL ESTIMATED RESEARCH	445.934	460.550

B. SUMMARY DATA*

($ million)	80-81	81-82	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Manufacturing Industries	55.9	78.0	87.8	90.8	93.8	109.3	129.2	136.9
Rural Industries	107.5	132.2	150.3	144.2	136.5	155.9	155.1	159.1
Mineral, Energy and Water Resources	36.9	51.2	62.6	63.0	62.0	62.7	56.1	59.3
Conservation and the Natural Environment	37.6	44.9	52.7	49.8	60.9	63.2	72.7	71.9
Service Industries	20.3	20.7	21.0	28.7	27.2	27.2	32.8	33.4
TOTAL	258.2	326.8	374.4	376.4	380.4	418.4	445.9	460.6

*Note: In the summary data, the multi-sectoral technologies expenditure has been distributed across the other classifications.

A.14 DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Australian Bureau	cap.S	-	0.16	0.01	0.04	0.05	0.66	0.18
of Agriculture and	cur.S	1.43	1.54	1.49	1.56	1.66	9.09	9.37
Resource Economics	ext.S	-	-	-	0.04	0.01	0.04	0.01
Fisheries Service	cap.	-	-	-	-	-	-	0.01
	cur.	-	-	-	-	-	0.35	1.05
	ext.	0.31	0.49	0.56	0.47	0.69	2.05	2.39
Australian Quarantine Inspection Service	ext.	-	-	-	0.13	0.18	0.13	0.18
Forestry postgraduate awards	ext.	0.04	0.05	0.05	0.07	0.09	0.07	0.09
Australian contribution to the Commonwealth Forestry Institute	ext.	-	0.02	0.02	0.02	0.02	0.02	0.02
National Afforestation Program	ext.	-	-	-	-	-	-	0.25
Agricultural	cap.	0.02	0.01	0.01	-	-	-	-
Health and	cur.	0.31	0.45	0.37	-	-	-	-
Quarantine Service**	ext.	0.08	2.74	2.88	-	-	-	-
Bureau of Rural Science*								
. Fisheries Research	ext.	-	-	-	-	0.69	-	0.69
. Soil Conservation	ext.S	0.34	1.05	1.05	1.40	1.27	3.36	3.41
. Animal Science	ext.	-	-	-	-	-	0.16	0.17
. Other*	cap.	-	-	-	-	-	0.48&	1.11&
	cur.	-	-	-	-	-	4.68&	5.84&
	ext.	-	-	-	4.40&	4.67&	23.79&	21.68&

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Rural Industry Research Trust Funds#								
. Chicken Meat	cur.	-	-	-	-	-	0.03	0.05
	ext.	0.18	0.19	0.29	0.25	0.35	0.27	0.38
	cur.S	-	-	-	-	-	0.00	0.01
	ext.S	0.02	0.02	0.03	0.03	0.04	0.03	0.04
. Barley	cur.	-	-	-	-	-	0.21	0.21
	ext.	0.34	0.85	0.80	1.67	1.77	1.94	1.97
. Dairying	cur.	-	-	-	-	-	0.10	0.09
	ext.	0.38	0.43	0.53	0.50	0.64	0.59	0.78
	cur.S	-	-	-	-	-	0.01	0.01
	ext.S	0.04	0.05	0.06	0.06	0.07	0.07	0.09
. Grain Legumes	cur.	-	-	-	-	-	0.03	0.04
	ext.	-	-	-	0.08	0.35	0.10	0.40
. Dried Fruits	cur.	-	-	-	-	-	0.02	0.03
	ext.	0.11	0.17	0.13	0.09	0.13	0.10	0.18
. Fishing Industry	cur.	-	-	-	-	-	0.22	0.23
	ext.	1.68	3.86	4.02	3.87	4.73	5.62	6.20
. Fisheries Development	ext.	-	-	-	0.26	0.35	0.36	0.36
. Honey	cur.	-	-	-	-	-	0.02	0.02
	ext.	0.05	0.04	0.07	0.06	0.07	0.06	0.07
. Oilseeds	cur.	-	-	-	-	-	0.05	0.06
	ext.	0.28	0.31	0.28	0.33	0.39	0.37	0.44
. Pig Industry	cur.	-	-	-	-	-	0.09	0.11
	ext.	0.29	0.43	0.39	0.47	0.62	0.56	0.81
. Poultry Industry	cur.	-	-	-	-	-	0.05	0.05
	ext.	0.13	0.14	0.16	0.16	0.21	0.17	0.25
. Tobacco Industry	cur.	-	-	-	-	-	0.03	0.04
	ext.	0.38	0.46	0.51	0.51	0.57	0.59	0.67
. Wheat	cur.	-	-	-	-	-	0.21	0.21
	ext.	2.05	5.32	4.25	5.14	6.77	6.00	8.11

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
. Grape and Wine	cur.	-	-	-	-	-	0.01	0.02
	ext.	0.09	0.09	-	0.46	0.53	0.46	0.76
. Australian Special	cur.	-	-	-	-	-	0.10	0.15
	ext.	-	-	-	0.77	1.87	0.93	2.47
. Cotton	cur.	-	-	-	-	-	0.04	0.05
	ext.	0.27	0.52	0.57	0.80	0.72	0.88	0.88
. Meat	ext.	5.16	3.98	-	-	-	-	-
. Sugar	ext.	-	-	-	-	1.25	-	1.25
Australian Meat and Livestock Research and Development Corporation	ext.	-	-	11.18	14.90&	14.20&	14.90&	14.20&
Australian Wool Corporation – Wool R&D fund##	cur.	-	-	-	-	-	1.03&	1.35&
	ext.	9.22	11.11	7.68	12.49&	16.24&	12.49&	16.24&
Horticultural R&D Corporation	cur.	-	-	-	-	-	-	0.25&
NERDDC Administration	cur.	-	-	-	-	-	1.33	1.19
Energy Research Trust Account	ext.	13.23	12.04	12.09	12.46	11.76	12.46	11.76
	ext.S	0.49	0.25	0.37	0.05	0.05	0.05	0.05
Water Research	cap.	-	-	-	-	-	0.15	0.02
	cur.	0.11	0.03	-	-	-	0.86	1.00
	ext.	0.63	0.21	0.70	2.74	5.33	6.06	8.08
Safeguards Office	cap.	-	-	0.00	-	-	-	-
	cur.	0.03	0.04	0.04	0.04	0.04	0.04	0.04
	ext.	0.01	-	-	-	-	-	0.02

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Bureau of Mineral Resources	cap.	1.06	4.71	3.67	3.47	4.07	3.47	4.07
	cur.	15.23	19.27	23.09	26.02	26.74	33.40	35.92
	ext.	-	-	-	0.14	0.14	0.14	0.14
Other Primary Industry and Energy	cap.	0.25	0.03	0.08	-	-	-	-
	cur.	0.13	0.25	0.33	-	-	-	-
	ext.	0.59	0.70	0.84	-	-	-	-
	cur.S	-	-	-	-	-	0.49	0.45
Total Commonwealth sector direct expenditure		54.96	72.02	78.62	95.96	109.32	152.22	168.70
B. Expenditure from other sources								
Australian Bureau of Agricultural and Resource Economics	cap.S	-	0.02	0.00	0.01	0.01	0.08	0.02
	cur.S	0.21	0.16	0.20	0.24	0.29	1.13	1.10
Fisheries Service	cur.	-	-	-	-	-	0.29	-
Agricultural Health and Quarantine Service**	cap.	0.01	-	-	-	-	-	-
	cur.	0.05	-	-	-	-	-	-
	ext.	0.03	-	0.10	-	-	-	-
Bureau of Rural Science								
. Fisheries Research	cur.	-	-	-	-	0.17	-	0.24
. Animal Science	ext.	-	-	-	0.23	0.26	0.23	0.26
. Administration of Rural Research Trust Funds	ext.	-	-	-	-	-	0.63	0.88
. Other*	ext.	-	-	-	-	-	22.28&	19.86&

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
B. Expenditure from other sources								
Rural Industry Research Trust Funds*								
. Chicken Meat	cur.	-	-	-	-	-	0.04	0.05
	ext.	0.18	0.23	0.25	0.27	0.35	0.29	0.39
	cur.S	-	-	-	-	-	0.00	0.01
	ext.S	0.02	0.03	0.03	0.03	0.04	0.03	0.04
. Barley	ext.	0.43	0.97	1.55	0.93	1.13	1.09	1.26
. Dairying	cur.	-	-	-	-	-	0.11	0.13
	ext.	0.40	0.64	0.54	0.55	0.93	0.65	1.15
	cur.S	-	-	-	-	-	0.01	0.01
	ext.S	0.04	0.07	0.06	0.06	0.10	0.07	0.13
. Grain Legumes	cur.	-	-	-	-	-	0.07	0.06
	ext.	-	-	-	0.24	0.51	0.29	0.59
. Dried Fruits	cur.	-	-	-	-	-	0.04	0.03
	ext.	0.10	0.22	0.11	0.17	0.12	0.18	0.16
. Honey	cur.	-	-	-	-	-	0.02	0.01
	ext.	0.06	0.06	0.06	0.07	0.06	0.07	0.07
. Oilseeds	cur.	-	-	-	-	-	0.05	0.06
	ext.	0.30	0.31	0.38	0.32	0.39	0.35	0.45
. Pig Industry	cur.	-	-	-	-	-	0.11	0.13
	ext.	0.31	0.56	0.45	0.62	0.69	0.74	0.91
. Poultry Industry	cur.	-	-	-	-	-	0.06	0.04
	ext.	0.19	0.15	0.17	0.20	0.19	0.22	0.23
. Tobacco	cur.	-	-	-	-	-	0.03	0.04
	ext.	0.55	0.90	0.59	0.51	0.57	0.59	0.67
. Wheat	cur.	-	-	-	-	-	0.19	0.19
	ext.	4.55	5.63	5.20	4.75	4.21	5.55	5.36
. Grape and Wine	cur.	-	-	-	-	-	0.01	0.03
	ext.	-	-	-	0.58	0.64	0.58	0.64

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
B. Expenditure from other sources								
. Cotton	cur.	-	-	-	-	-	0.05	0.05
	ext.	0.41	0.52	0.70	0.90	0.70	1.00	0.86
. Meat	ext.	5.26	7.01	-	-	-	-	-
. Sugar	ext.	-	-	-	1.25	-	1.25	
Australian Meat and Livestock Research and Development Corporation	ext.	-	-	1.01	1.20&	1.10&	1.20&	1.10&
Australian Wool Corporation – Wool R&D Fund##	cur.	-	-	-	-	-	0.99&	1.28&
	ext.	9.22	9.20	10.48	11.81	15.34&	11.81&	15.34&
Coal Research Trust Fund	ext.	1.89	2.79	3.21	4.65	9.60	4.65	9.60
	ext.S	-	-	0.02	-	-	-	-
Water Research	ext.	-	0.25	-	-	-	-	-
Bureau of Mineral Resources	cap.	0.01	0.03	0.02	0.11	0.08	0.11	0.08
	cur.	0.07	0.13	0.16	0.84	0.50	0.92	0.60
	ext.	0.00	0.00	0.00	0.00	0.00	1.41	1.01
Other Primary Industry and Energy	cap.	-	0.02	0.05	-	-	-	-
	cur.	-	0.17	0.21	-	-	-	-
Total other sources		24.29	30.07	25.56	29.30	39.25	58.48	66.37
Total expenditure from all sources		79.25	102.09	104.18	125.26	148.57	210.70	235.07

See page 51 for explanation of abbreviations.

& Estimate

Amounts indicate payments for research made from the Trust Funds concerned. The convention adopted for the reporting of expenditure to and from Research Trust Funds is outlined in Appendix D7. See the table in the body of the text for industry contributions to the Trust Funds.

Before 1986-87 the Wool R&D Fund was administered by the Department of Primary Industry along with the other Rural Industry Research Trust Funds

* Includes parts of the former Australian Agricultural Health and Quarantine Service. The Bureau of Rural Science includes the Plague Locust Commission.

** The Bureau of Animal Health, Plant Quarantine and the Plague Locust Commission were combined into the Australian Agricultural Health and Quarantine Service which was in 1986 split into the Australian Quarantine Inspection Service and the Bureau of Rural Science.

A14.1 DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

The Primary Industries and Energy portfolio was formed through the amalgamation of the former Department of Primary Industry, major areas of the former Department of Resources and Energy, and the commodity trade areas of the former Department of Trade.

The principal activities dealt with are:

. agricultural, pastoral, fishing, forest, mineral and energy industries
. water and other natural resources
. primary industries inspection and quarantine
. primary industries and energy science and research including geoscience
. commodity marketing - including export promotion
. commodity - specific international organisations and activities
. administration of export controls in primary industries and energy products
. radioactive waste management.

Commonwealth Forestry Post-Graduate Research Awards (Primary Industry)

Each year the Department of Primary Industry makes available awards for the degree of Master and/or Doctor of Philosophy at an Australian university. Fields of study are nominated by the Standing Committee of the Australian Forestry Council and cover topics of current interest and calling for urgent investigation. Funds are provided mainly for projects not being undertaken by the various State forest services.

Australian Quarantine Inspection Service (AQIS) (Primary Industry)

In 1987-88 the Department of Primary Industries and Energy will provide $200 000 for horticultural quarantine research and ancillary purposes. This allocation is part of a five year program totalling $1 million made available under the April 1986, Minister for Primary Industry's Rural Policy initiative to set up research related to the development of disinfestation treatments for horticultural products in order to overcome overseas quarantine barriers.

Australian Agricultural Council Sponsored Projects (Primary Industry)

The Department provides funds for the Commonwealth contribution to Commonwealth/State projects recommended by the Australian Agricultural Council. Current projects include fresh fruit disinfestation, support for the Fruit Variety Foundation, citrus canker eradication program and *Helio operto* (Green snail) eradication. In addition, each year Australia makes a $20 000 contribution to the Commonwealth Forestry Institute (CFI). The CFI is closely associated with the Department of Agriculture and Forest Science, University of Oxford, UK, and conducts forestry research and training primarily for the benefit of developing countries.

National Afforestation Program (Primary Industry)

The National Afforestation Program has the objective of stimulating a sustained increase in the level of investment by States, individual landholders and industrial forestry companies in the development of hardwood plantations and in the rehabilitation of degraded land through afforestation.

A14.2 AUSTRALIAN BUREAU OF AGRICULTURAL AND RESOURCE ECONOMICS (ABARE)

(Primary Industry)

The Australian Bureau of Agricultural and Resource Economics provides independent, objective and professional economic analyses and promotes public policy debate on issues affecting Australian agricultural, minerals, energy, forestry and fishing industries.

The ABARE's program has three major R&D components:

. Economic Policy Analysis: research into and assessments of economic issues and policies which directly or indirectly relate to the Australian primary industry sector including the minerals and energy sector and its prospects. This research involves both domestic and overseas policy considerations.

. Production Economics: economic research and policy analyses in relation to production issues in the agricultural, minerals, energy, forestry and fishing industries. These activities are undertaken at the farm, industry and sector levels.

. Marketing and Outlook: economic research and policy analyses of marketing systems in domestic and export markets for crops, livestock and livestock products, minerals, energy, fish and forest products and inputs into primary industries. This involves the review and assessment of factors affecting demand, supply and prices of the economic efficiency of marketing systems in domestic and export markets for these products.

Major ABARE areas of study in 1986-87 included:

. water reliability policies in Australia

. an economic evaluation of the storage, transport and handling of Australia's grain harvest

. US agricultural policies

. effects of agricultural pricing and marketing arrangements on the competitiveness of processing

. various sectoral studies on the cotton, citrus, fish, meat, wool, sugar, wine and dairy industries, including the impact of new dairy marketing arrangements on the dairy industry

New studies to be initiated in 1987-88 include:

. forest resources policy

. measuring assistance to Australian primary industries

. trade barriers in minerals and metal markets

. petroleum supply model

. a study of the intersectoral effect of changes in Japanese agricultural policy

. capital formation and investment in Australiaan agriculture.

A14.3 BUREAU OF RURAL SCIENCE (BRS)

(Primary Industry)

The Bureau of Rural Science was established in 1986 to provide independent, objective and professional analysis of technical issues in the rural sector and promote public policy debate on technical issues affecting Australian agriculture, forestry and fishing.

The BRS's program has two major R&D components:

. Research Policy Analysis: research into and assessments of research funding and organisational issues and policies which relate to the Australian primary industry sector and its prospects. Particular attention will be paid to the role of the Commonwealth in supporting rural R&D, and the analysis of appropriate policies;

. The National Brucellosis and Tuberculosis Eradication Campaign (BTEC): this is funded jointly by industry (through a levy), States and Commonwealth. Research into the development of an alternative test for detecting tuberculosis in cattle is being undertaken by CSIRO, Melbourne University and the Australian National University and is funded by a small portion of the industry slaughter levy.

Some of the research programs undertaken or funded by the Bureau include:

. wildlife management

. model plans for the control of wildlife and feral animals in the event of an outbreak of exotic disease

. computer modelling of the epidemiology of foot and mouth disease in feral pigs

. assessment of the efficacy of poisoned baits and the determination of the home ranges of feral pigs

. studies of fish stock abundance and sustainable yields in the Great Australian Bight

. development of methods for collecting reliable catch and fishing effort data in Torres Strait fisheries

. the biology and stock status of commercially and traditionally fished species in Torres Strait.

The BRS is also responsible for the management of certain operational activities, which provide for:

. the protection and improvement of animal health, production and welfare

. plant health and protection

. coordination of the clearance of agricultural and veterinary chemicals

. management of the National Residue Survey

. plague locust control

. the review and provision of advice on matters for consideration under the Environment Protection (Impact of Proposals) Act and the Australian Heritage Commission Act

. the provision of scientific and technological support to Departmental activities, notably those of the Australian Quarantine and Inspection Service, the Australian Fisheries Service and assistance in the development of new and cost-effective methodologies.

The Australian Plague Locust Commission is financed by the States of New South Wales, Victoria, South Australia and Queensland with a matching contribution from the Commonwealth. The Commission engages in operations to combat outbreaks or potential outbreaks of the Australian plague locust and performs related research.

Operations include the collection and collation of data on locust populations, the forecasting of significant changes and developments in locust populations, control operation, the development of improved control measures, the monitoring of all actions and the effects of control operations, and the provision of advice to individual States on locust problems.

BRS is responsible for the administration of the Rural Industry Research Trust Funds which are discussed in Section A.14.6 and for the National Soil Conservation Program.

National Soil Conservation Program

The Government initiated the National Soil Conservation Program in 1983. The Program aims to develop and implement national policies for the rehabilitation and sustainable utilisation of the nation's soil and land resources. Its broad goals are:

. that all lands in Australia be used within their capability

. that land use decisions be based on whole catchment/regional land management planning concepts

. that all land users and levels of government meet their respective responsibilities in achieving soil conservation

. that effective co-operation and co-ordination occur between all sectors of the community, disciplines and agencies involved in the use and management of land and water resources

. that the whole community adopt a land conservation ethic.

The Program is directed at all sectors of the community with an interest or involvement in land management. The emphasis in on co-operation and co-ordination as the fragmentation of responsibility amongst many government agencies has contributed to the present extent of the damage. Financial assistance, although just one facet of the overall program, is an essential ingredient for the support of a range of other policy measures to be employed, such as education, training, demonstration, research, publicity, provision of technical assistance and construction of works. Funds have been provided for projects in these broad areas of activity.

Structurally, the Program presently has two components. The first provides funds to State soil conservation agencies to enhance their training, demonstration, research, public awareness, advisory, data collection, design and construction activities. The second component provides funds to other organisations who can contribute to the attainment of the aim of the Program through training, education innovation, research, program development and liaison or co-ordination activities. Projects of national importance involving State co-operation or national co-ordination are accorded priority.

A14.4 AUSTRALIAN AGRICULTURAL HEALTH AND QUARANTINE SERVICE (AAHQS)

(Primary Industry)

The AAHQS was, until 1986, responsible for many of the operational areas of the BRS and for many of the functions of the Australian Quarantine Inspection Service.

A14.5 AUSTRALIAN FISHERIES SERVICE (AFS)

(Primary Industry)

The Service manages Australian fisheries in cooperation with the States, including:

. interpretation of biological data on available species, sustainable catch rates and environmental aspects

. application of the most efficient and effective fishing gear and technology

. interpretation of available economic data and the evaluation of the likely impact of fisheries management proposals;

. procurement of accurate and timely catch, marketing and production statistics and information

. development of effective and efficient administration and management systems and plans for fisheries in the Australian fishing zone.

Other activities include the development of legislation affecting the management of fisheries; participation in the education/training of Commonwealth and State fisheries' officers involved in activity under Commonwealth delegation; encouraging the development of the Australian fishing industry by the provision of grants from the Fishing Industry Research Trust Account, in conjunction with the Bureau of Rural Science and the Fisheries Development Trust Account; provision of secretariat facilities to subcommittees of the Standing Committee on Fisheries; participation in negotiations within international organisations or with foreign governments on fisheries matters and in the formulation of agreements with foreign governments of corporations; dissemination of information and advice to the industry by the production of the monthly 'Australian Fisheries' and other publications; and where possible and consistent with Australia's international obligations, the provision of assistance to developing countries in relation to fisheries matters.

AFS also administers Australia's obligations under the Torres Strait Treaty and the Torres Strait Fisheries Act 1984.

The Torres Strait Treaty between Australia and Papua New Guinea, which was ratified in February 1985, provides for either country to propose joint management of particular fisheries in the Torres Strait Protected Zone. The Torres Strait Fisheries Act 1984 provides the necessary powers under Commonwealth and Queensland law for managing the fisheries in that area. The Treaty obliges Australia and PNG to protect the traditional way of life and livelihood of traditional inhabitants; cooperate and consult in conservation and management of Protected Zone fisheries; promote economic development and employment for traditional inhabitants; and protect and preserve the marine environment and indigenous flora and fauna. CSIRO, on behalf of AFS, is conducting a research program to support the implementation of the fisheries provisions of the Treaty. Projects currently in progress include tropical rock lobster, effects of trawling, and a seagrass study. In addition, the Department maintains field staff in Cairns and on Thursday Island to undertake monitoring of fishing activity in the area and to collect and analyse data relating to catch and effort.

A14.6 RURAL INDUSTRY RESEARCH TRUST FUNDS (RIRFs)

(Primary Industry)

The Rural Industry Research Trust Funds have the general objective of providing money for research and dissemination of information, relating to production improvement within the industry. Commonwealth support is in most cases on a 1:1 matching of expenditure to money raised from producers in the form of a levy on their produce.

The Funds promote a degree of self-help through industry involvement in selecting and financing industry-specific rural research. Their impact on research priorities is thought to be greater than the level of funding would suggest due to their 'pump-priming' or 'catalytic' effect.

During 1985-86 the RIRF system was expanded with the introduction of the Grain Legumes Research Fund and the Australian Special Rural Research Fund (ASRRF). ASRRF replaces the non-statutory Commonwealth Special Research Grant. Its purpose is to provide Commonwealth Government contributions to rural research outside the scope of the industry-specific Commonwealth rural research funding arrangements. Grant funds are usually matched on a dollar to dollar basis by the industry which benefits from the research. Other areas which are eligible for grant support include research not specifically related to a single industry (multi-industry research), development of new or emerging industries and research necessary in the national interest.

From 1 July 1986 wine and grape research has been assisted by the Grape and Wine Research Fund. This RIRF replaced the ad hoc funding arrangements which previously applied to wine research carried out at the Australian Wine Research Institute. This RIRF also established a statutory funding scheme for grape research, from which project allocations will commence in 1987-88.

On 1 July 1987, the RIRF system was expanded with the introduction of the Sugar Research fund. Research undertaken using the resources of this Fund will complement that already undertaken by the industry and project allocations are expected to commence in 1988-89. $250 000 has been set aside for the establishment of the Horticultural Research and Development Corporation which is expected to occur in 1987-88. On 1 July 1986 the administration of the Wool Research and Development Fund was transferred to the Australian Wool Corporation.

Some of the R&D supported by the funds includes the following:

. Wheat research programs cover a very wide range of projects including diseases of wheat and pest control, studies on soils and fertilisation, genetic research, harvesting methods and grain handling and marketing.

. The Fisheries Development Trust Account has funded research programs on exploratory prawn travelling in the Gulf of Carpentaria, purse seine trials for deepwater schools of jack mackerel off Tasmania, provision of isothermic charts based on satellite-derived data, experimental/exploratory longline operations in the Northern Territory, target fishing for orange roughy, cascade plateau target fishing survey and assessment of a potential sashimi tuna longline fishery off Southern Queensland. New projects funded by the account have included the survey of prospective orange roughy grounds off New South Wales and research into the size and extent of the orange roughy resource.

TABLE 17 INDUSTRY CONTRIBUTION TO RURAL INDUSTRY RESEARCH TRUST ACCOUNTS (estimated proportion of levies attributable to R&D and S&T purposes)

($ million)	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	Proj. 87-88
Barley	-	0.31	0.47	0.29	1.03	0.99	1.37	1.01	1.26
Chicken Meat	0.23	0.24	0.22	0.24	0.23	0.24	0.29	0.38	0.42
Cotton	-	-	0.20	0.25	0.67	1.00	0.89	1.04	1.00
Dairying	0.46	0.42	0.42	0.54	0.57	0.60	0.67	1.26	1.62
Dried Fruit	0.09	0.12	0.12	0.12	0.09	0.12	0.16	0.32	0.25
Grain Legumes	-	-	-	-	-	-	0.24	0.66	0.87
Grape & Wine	0.26	0.26	0.28	0.37	0.38	0.49	0.52	0.67	0.79
Honey	-	0.02	0.06	0.05	0.05	0.05	0.08	0.09	0.09
Meat	3.18	3.30	3.02	4.16	3.61	4.61	-	-	-
Oilseeds	0.41	0.28	0.30	0.23	0.30	0.31	0.55	0.40	0.61
Pig Industry	0.29	0.39	0.42	0.40	0.42	0.60	0.78	1.00	1.46
Poultry	0.10	0.14	0.15	0.15	0.15	0.16	0.22	0.31	0.28
Sugar	-	-	-	-	-	-	-	-	1.25
Tobacco	0.39	0.38	0.41	0.47	0.55	0.67	0.66	0.69	0.73
Wheat	3.09	2.01	1.97	4.65	4.65	5.40	5.48	6.40	6.38
Wool	10.24	7.54	8.77	8.83	10.00	10.70	12.88	15.25[a]	14.80[a]
Total	18.72	15.39	17.67	18.01	22.27	24.82	24.79	29.48	30.56

(a) Industry contributions to the Australian Wool Corporation for wool R&D.

Note: The Fishing Industry Rural Research Trust Fund is entirely funded by the Commonwealth.

A14.7 AUSTRALIAN MEAT AND LIVESTOCK RESEARCH AND DEVELOPMENT CORPORATION (AMLRDC)

(Primary Industry)

The aim of the Corporation is to improve the productivity and market performance of the meat and livestock industry. It is concerned with three broad areas of research and development:

. identifying more precisely areas of meat and livestock research and development that are relevant to the needs of the industry

. improving the efficiency and effectiveness of meat and livestock research and development

. encouraging the more effective use of resources and skills of the community in general, and of the scientific community in particular, in meat and livestock research and development.

Current priority areas are:

. acquiring knowledge about markets

. improving the efficiency of converting livestock to meat

. improving the efficiency of livestock production

. improving product range, quality and marketability

. improving management of research and development programs.

The AMLRDC superseded the Australian Meat Research Committee which had limited autonomy and operational flexibility and which was primarily interested in livestock.

A14.8 AUSTRALIAN WOOL CORPORATION (AWC)

On 1 July 1986 the responsibility for the administration of the Wool Research and Development Fund was passed to the Australian Wool Corporation. On the same date the Wool Research and Development Council was established to plan future Wool R&D and to recommend an R&D programme which would result in the maximum returns to the Australian woolgrower and to the national economy by improving the quality and performance of wool products and improving the efficiency of wool production, marketing and processing.

The Wool Research and Development Council has identified five major R&D objectives:

. increased efficiency of wool textile marketing and textile production

. maximise the net return to Australian woolgrowers from improved raw wool marketing procedures

. increase the efficiency of raw wool production

. determine the impact of the internal and external environment on the wool industry

. efficient management of the wool research and development programme

In 1986-87 research funded included:

. development of finer, lightweight worsted fabrics and soft cashmere-like fabrics

. the study of hydrophobic and antistatic fabric treatments and novel yarn and fabric coloration techniques

. techniques for the detection and elimination of contaminants during wool-processing

. the development of a new, continuous process for vigoureux printing of wool slivers

. application of enzyme treatments for scouring and vegetable matter removal.

. development of a low cost instrument for the measurement of staple length and staple strength

. development of improved pasture species

. control of blowfly strike and internal parasites and the eradication of footrot

A14.9 NATIONAL ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION (NERD&D) PROGRAM

(Resources and Energy)

The National Energy Research, Development and Demonstration Council (NERDDC) was established in 1978 to advise the then Minister for National Development and Energy on the development and co-ordination of a national energy R.D&D program and to recommend support for individual research, development and demonstration projects.

In developing its recommendations for support grants, NERDDC takes into account the existing level of research activity in Australia and identifies those areas where additional support is required to bring Australia's overall energy R,D&D effort into line with priorities.

Priorities for research are reviewed each year and approved by the Minister. The priorities are derived from the government's energy policy objectives. In addition NERDDC gives priority to those projects which aim to give practical and implementable results in the short to medium term. Current areas of high priority are:

. energy management comprising efficient use and conservation of energy

. production of liquid hydrocarbon fuels from natural gas or from synthesis gas derived from natural gas, including areas such as catalysts for production of middle distillates

. R,D&D leading to the substitution of diesel oil and gasoline by natural gas and LPG in internal combustion engines, whether stationary or mobile

. technology of exploration, assessment and recovery of oil and gas

. coal combustion technology, particularly with regard to Australian coals and conditions

. improvement of coal mining productivity and safety with particular reference to adverse and hazardous conditions

. improved efficiency of coal beneficiation particularly with regard to multiple products, dewatering and the treatment of fine coal

. novel coal evaluation techniques especially in support of exports.

To date over $175 million has been awarded in grants under the Program.

Outstanding results have been achieved in a number of areas, including:

. the development of improved gas chromatography mass spectrometry techniques for petroleum resource assessment

. evaluation of catalysts for natural gas based fuel conversion processes

. oil shale processing characterisation

. studies on refining coal derived liquids

. coal mine gas drainage

. underground coal transportation

. online coal analysis

. column flotation technology for recovery of ultrafine coal

. coal combustion testing

. fluidised bed combustion of coal washery wastes

. coal storage and pneumatic conveying of pulverised coal and fly ash

. solar collector technology and testing

. remote area power supplies

. leading edge research into production of photovoltaic cells

. energy conservation in buildings, industry and transport systems.

Reports on all projects are made publicly available. Details of these are contained in a booklet 'Technical Reports and Other Publications' which can be obtained from the Department.

In 1986, as well as the general round of grants, two additional rounds (a coal mine research round and a coal-only Round) were called. A second coal-only round will again be invited in 1987.

NERD&D projects are funded through the Energy Research Trust Account (ERTA) and the Coal Research Trust Account. ERTA is funded entirely by the Commonwealth Government but funds for the CRTA are raised through an excise on the production of coal.

A14.10 NATIONAL WATER PROGRAMS

(Resources and Energy)

The Water Research and Programs Branch of the Department of Primary Industries and Energy administers research grants and activities in support of programs and policies concerned with the planning, development and management of Australia's water resources.

Current activities include:

. Federal Water Resources Assistance Program (FWRAP)

. National Water Research Program.

Under the Federal Water Resources Assistance Program financial assistance is provided to the States to undertake studies and works of high priority.

Apart from major construction works, a number of studies have been undertaken as part of the program. These include studies into River Murray salinity and drainage control, dryland salinity control in Western Australia and floodplain management.

A considerable body of data on Australia's water resources has been amassed under the National Water Resources Program, which forms part of FWRAP. An AWRC (Australian Water Research Council) Water Research Program commenced in 1968 with the aim of filling gaps in current research efforts in areas of direct relevance to the activities of Australian water authorities. Research results are disseminated by reports, workshops and other activities. Information on the results is also available through our on-line national water database, STREAMLINE. The Australian Water Research Advisory Council (AWRAC) was established in June 1985, to advise on a national program of water research. A total of $5.8 million has been allocated for research activities recommended by AWRAC in 1987-88. Eighty-four research projects are current under the National Water Research Program.

Ongoing activities include:

. water research under the National Priorities Program

. research into the water resources management problems of the Murray-Darling Basin

. the establishment of twelve Water Research Centres

. joint funding of water research under the Partnership Research Program

. the establishment of industry research associations to encourage the various sectors of the water industry to fund research into common water problems

. the establishment of a Scientific Merit Program

. the establishment of a Post-graduate Fellowship Scheme

. the establishment of a Water Research Achievement Award

. the establishment of a Summer Student Vacation Scheme

the establishment of Water Industry Research Awards.

A14.11 BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS (BMR)

(Resources and Energy)

BMR, established in 1946, is a geoscientific research organisation within the Commonwealth Department of Primary Industries & Energy. Its objectives are threefold:

. to improve the effectiveness of exploration for, and assessment of, Australia's petroleum, mineral and groundwater resources, and to contribute to land-use planning and the mitigation of natural hazards, through the development of a publicly available, comprehensive integrated geoscientific understanding of the Australian continent, the Australian offshore area and the Australian Antarctic Territory, and through the provision and co-ordination of appropriate databases:

. to facilitate the formulation and implementation of policies necessary for the effective management of the land and its petroleum and mineral resources by the provision of scientific and technical assessments, advice and information to Government, industry and the public; and

. to contribute towards Australia's international policy objectives through provision of special national geoscientific capabilities and through participation in appropriate international multilateral and bilateral geoscientific programs.

BMR's activities in geoscience research and resource assessment are undertaken through six major programs:

. Fossil Fuels and Minerals Research

The Fossil Fuels and Minerals Research Program is designed to promote internationally competitive, successful exploration of Australia and its offshore areas for petroleum and mineral resources, by developing an integrated geoscientific knowledge base. The program also provides a basis for the assessment of Australia's petroleum and mineral resources and the impact of their development. Program components include controls on fossil

fuels occurrence; onshore sedimentary basins; offshore sedimentary basins; overseas basins; mineral deposits and provinces; regolith, related resources and remote sensing; regional structure and tectonics; and geophysical mapping (continental and offshore).

. Groundwater Research and Assessment

Investigations within the Groundwater Research and Assessment Program seek to promote the effective utilisation and conservation of Australia's groundwater resources through increased understanding of their occurrence availability and replenishment. Program components include basin hydrogeology.

. National Geophysical Observatories and Antarctic Surveys

Activities under the National Geophysical Observatories and Antarctic Surveys Program are designed to assess earthquake risk as a basis for the development of appropriate building and civil engineering standards, and to make a national contribution to the global understanding of the nature, magnitude and frequency of earthquakes; to assist the effectiveness of geophysical exploration, of surveying and navigation by modelling the geomagnetic field in the Australasian and Antarctic regions; to contribute to the verification of a comprehensive test ban treaty by monitoring nuclear explosions in the hemisphere centred on Australia and establishing an International Data Centre; to monitor volcanic activity and contribute to disaster management and assessment of geological hazards in the Australasian region; and to determine the geological composition, structure and evolution of the Australian Antarctic Territory as a contribution to Australia's Antarctic Research Program. Program components include earthquake and volcanic hazards; monitoring and nuclear explosions; geomagnetism; Antarctic onshore surveys; and Antarctic offshore basins.

. Petroleum and Minerals Resource Assessment

The aim of the Petroleum and Minerals Resource Assessment Program is to provide scientific and technical advice and information about the occurrence, exploration for, extraction and future availability of Australia's petroleum and mineral resources in a world context as a basis for policy formulation and administration by Government and industry. Program components include petroleum resource assessment and availability; and mineral resource assessment and availability.

. National Geoscience Databases

The objective of the National Geoscience Databases Program is to establish and maintain a national database so that appropriate scientific and technical data are readily available to government, industry and other geoscience organisations in order to enhance the efficiency of petroleum and minerals exploration and assessment and facilitate the preparation of scientific advice and information to Government. Program components includes databases coordination, research and operations; and geoscience maps, cartography and image processing.

. BMR Management and Information

The BMR Management and Information Program is designed to provide corporate management of BMR's geoscience research, resource assessment and database programs; to assist corporate management through the provision of information and procedures relevant to corporate strategic planning and resource management; and to provide geotechnical and administrative support to BMR's management, research, resource assessment and database programs.

BMR's average staffing level in 1987-88 is 580, with over 250 research and other scientists, 220 technical and cartographic staff, and 120 clerical and other support staff.

Recent developments in BMR's research and resource assessment activities for 1987-88 include:

. Continental Margins Program

BMR is continuing research on the continental margins of Australia aimed at providing the essential basis for future petroleum exploration of Australia's offshore sedimentary basins. The program is now in its third full year of operation. During 1987-88 BMR's research vessel, Rig Seismic, will collect new geological and geophysical data from surveys off northeastern Queensland, western Tasmania, Western Australia, and in the Gippsland and Bass Basins.

. Onshore Sedimentary Basins

During 1987-88, BMR will commence two new research programs in Australian onshore sedimentary basins. The first is a major research study designed to determine the tectonic evolution of the Canning Basin. The study, using seismic profiling, geological investigations and potential field data, will provide a basis for achieving a better understanding of the petroleum and mineral resources of the basin. The second new research study will focus on the sedimentary basins of eastern Australia (the Gunnedah, Clarence-Moreton and Surat Basins) with a view to developing models for the origin and evolution of the basins. The models will assist scientists in assessing the hydrocarbon potential of the basins and provide the basis for future exploration of the basins.

Studies will also continue in the McArthur, Canning and Amadeus Basins during 1987-88.

. Monitoring of nuclear explosions and earthquakes

The Australian Government is committed to developing an independent capability to identify and monitor underground nuclear tests. During 1987-88 BMR's Australian Seismological Centre (ASC) will strengthen its computing capacity and monitoring capabilities by establishing satellite telemetry links between the ASC and its key monitoring stations throughout Australia. This continued development is an essential part of the Government's objective of seeking a Comprehensive Test Ban Treaty worldwide.

. Kakadu Conservation Zone - research and resource assessment

BMR will commence a program of research and resource assessment within the Conservation Zone associated with Stage 3 of the Kakadu National Park. The BMR program will extend over five years and will comprise three major elements - ore deposit research, regional geoscience research, and mineral resource assessment. The research program is designed to complement the exploration and research undertaken by private exploration companies and will provide valuable information necessary for the resource assessment exercise. The resource assessment program will involve monitoring of company exploration programs and the collecting, compilation and analysis of geoscience data arising from the private company programs and BMR's research activities. At the end of the five year exploration period, a detailed assessment of the mineral potential of the Conservation Zone will be prepared as a basis for Government decisions concerning future land use.

. Geoscience database development

Effective minerals exploration research, resource assessment and the preparation of scientific advice for Government require ready access to all pertinent geoscientific and technical knowledge and information. BMR has the responsibility for coordinating

government geoscience database activities and developing suitable standards, and is currently developing the means of making available, in a coherent form, the vast amount of data generated by BMR, the exploration industry, and geoscientific institutions throughout Australia. Present activities include the transfer of existing databases to BMR's new ORACLE database management system and the development of database applications. Research is also underway aimed at integrating the many large spatial data sets already in existence in BMR, such as the continent-wide aeromagnetic and gravity databases.

A14.12 AUSTRALIAN SAFEGUARDS OFFICE (ASO)

(Resources and Energy)

The Australian Safeguards Office operates the national system of accounting for and control of nuclear material as required by the agreement between Australia and the International Atomic Energy Agency (IAEA) for the application of safeguards in connection with the treaty on the non-proliferation of nuclear weapons. It also implements the safeguards requirements of Australia's bilateral safeguards agreements and ensures that agreed physical protection measures are applied.

It provides technical advice on all aspects of safeguards application, both in Australia and overseas.

The ASO has contributed to Australian support of improved safeguards application by projects in the following areas:

. development of performance effectiveness assessment methodology and criteria assessment of procedures for safeguarding enrichment plants

. evaluation of advanced statistical techniques in safeguarding reprocessing plants

. study of the use of laser beams as a method of surveillance of nuclear activities

. development of uses for lap computers by safeguards inspectors in in-field data processing/evaluation

. development of non-destructive assay methods to provide improved, more timely safeguards and verification of nuclear materials

. application of computer technology to the checking of nuclear material accountancy data.

A.15 PRIME MINISTER AND CABINET

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
ASTEC	cur.	-	-	-	-	-	1.09	1.18
	cur.S	-	-	-	-	-	0.27	0.29
Australian Audit Office	cur.S	-	-	-	0.29	0.35	0.29	0.35
Office of Status of Women	ext.	-	-	-	-	0.02	-	0.02
Planning &	ext.	0.02	0.03	0.04	0.01	-	0.03	-
Statistical	cur.S	-	-	-	-	-	0.95	-
Services	ext.S	0.05	0.03	0.04	0.05	-	0.12	-
Office of Multicultural Affairs	ext.S	-	-	-	-	0.86	-	1.28
	Total	0.07	0.06	0.09	0.35	1.23	2.76	3.12

See page 51 for explanation of abbreviations.

A15.1 AUSTRALIAN AUDIT OFFICE

(Prime Minister and Cabinet)

Audit science and technology activities are conducted by full-time staff of the Office and are directed to:

. developing and implementing new audit methodologies and techniques including those related to ADP applications and efficiency/cost effectiveness audits

. reviewing developments in accounting and audit technology from all sources and where appropriate presenting these developments to other areas of the Office

. assisting national audit institutions in Asian and Pacific countries to develop and implement new audit methodologies and techniques appropriate to their needs.

A15.2 AUSTRALIAN SCIENCE AND TECHNOLOGY COUNCIL (ASTEC)

(Prime Minister and Cabinet)

Science and technology play an increasingly important part in Australia's development, and are basic to Australia's capacity to meet challenges in areas such as industrial productivity and competitiveness, energy and resource availability, and management of the environment.

The Government has recognised that high-level, high-quality independent science and technology advisory machinery is necessary if good decisions are to be made in formulating objectives, establishing the most effective and appropriate institutional means for achieving them, and assigning priorities on a rational and considered basis. The Government established the Australian Science and Technology (ASTEC) in 1977 with these considerations in mind. ASTEC became a statutory body in 1979.

The Council is the Government's principal independent source of advice on issues relating to science and technology, including:

. the advancement of scientific knowledge and the development and application of science and technology in relation to the national well-being

. the adequacy, effectiveness and overall balance of the national effort in science and technology in government, industry, education and other sectors of the community

. the assessment of gaps and overlaps in science and technology in Australia

. the identification and support of new ideas in science and technology likely to be of national importance

. the practical development and application of research discoveries and the fostering of technological innovation in industry

. the means of improving efficiency in the use of resources related to science and technology.

A standing committee of ASTEC, the Technological Change Committee, was established in 1981 to maintain a continuing review of the processes and trends in technological change in Australia and elsewhere, and evaluate and report on the direct and indirect effects at the national level.

ASTEC is placing increased emphasis on its tactical and strategic roles in assisting the Government to encourage Australian science and technology to meet the nation's needs and objectives. This role is discharged in the following ways:

. provision of briefing to the Government, through the Prime Minister, on any proposal with a significant science and technology content which comes before Cabinet

. advice to Budget Cabinet on the relative priorities of those proposals brought forward by Ministers which involve science and technology

. advice to the Government on current issues involving science and technology arising from any portfolio

. formal reports on subjects referred to the Council or initiated by ASTEC itself.

The Council has no executive responsibilities, but is able to advise on operational arrangements. As appropriate, it draws on government departments and agencies and other sources for the expertise, knowledge and assistance necessary to enable its functions to be discharged effectively.

A15.3 OFFICE OF THE PUBLIC SERVICE BOARD

(disbanded)

Responsibility for awards for postgraduate study formerly given by the Public Service Board, has now passed to individual departments.

A15.4 OFFICE OF THE STATUS OF WOMEN
(Prime Minister and Cabinet)

The Office of the Status of Women was established to advance the status of Australian women so that they have equal opportunity in all aspects of life and may realise their full potential.

Current research centres on child care for children below school age. A framework will be established for assessing the net benefits and costs of child care provided by employers to employees. The project will involve case studies, and only the centre-based and family care options will be considered.

The objectives of the project are:

. to raise the profile of employer provided child care

. to consolidate information on the requirements for approval of new child care centres

. to develop a child care kit to enable employers to assess the costs and benefits of providing child care

. to disseminate information to trade unions and relevant community organisations

. to identify areas where there is potential to review existing policies, regulations, incentives and tax concessions.

A15.5 OFFICE OF MULTICULTURAL AFFAIRS

The Office of Multicultural Affairs was created in March 1987 and will reach full operation during 1987-88. It is responsible, inter alia, for advising the Prime Minister and the Minister Assisting the Prime Minister on multicultural affairs. It has also been charged, together with the Australian Council for Multicultural Affairs (ACMA), with developing a National Agenda for a Multicultural Australia (a two year project designed to translate the multicultural objectives into a concrete plan of action for the Government to consider).

OMA's research program is designed to inform the development of policy options, concentrating in 1987-88 on the key areas of social mobility of immigrants and their children and on the economics of multiculturalism, including:

. language and cultural barriers to educational achievement, skill acquisition, labour market entry and/or occupational advancement

. training and retraining needs of older immigrant workers, particularly in the context of industry restructuring

. the economics of providing English as a Second Language (including English in the workplace)

. the economics of providing greater opportunities for acquiring second language skills

. small business enterprise and immigrant entrepreneurship

. recognition of overseas qualifications

. the relationship of multicultural objectives (eg language retention and development, cultural maintenance) to, inter alia, Australia's trade, tourism and foreign investment activities

. the socioeconomic mobility of immigrant groups

. industrial relations for a multicultural workforce.

The Natural Agenda project will include commissioning a major attitudinal survey, commissioning various policy research papers, conducting consultations and holding a number of conferences.

A.16 SOCIAL SECURITY

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Social Security	ext.S	0.59	0.68	0.64	0.73	0.78	0.73	0.78
	Total	0.59	0.68	0.64	0.73	0.78	0.73	0.78

See page 51 for abbreviations

A16.1 DEPARTMENT OF SOCIAL SECURITY

Welfare Research

The Department funds a Social Welfare Research Centre at the University of NSW. An agreement provides for continuation of the Centre for 5 years from 1 January 1985. Objectives of the Centre are:

- to undertake and sponsor research on social welfare issues in Australia;
- to provide opportunities for post-graduate studies on social welfare issues;
- to arrange seminars to foster understanding of social welfare issues; and
- to arrange for the publication of the results of research and studies carried out in or under the aegis of the Centre.

A.17 TRANSPORT AND COMMUNICATIONS

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
ABC	cap.	0.08	0.09	0.08	0.26	0.07	0.52	0.15
	cur.	0.21	0.23	0.20	0.22	0.26	0.43	0.53
Australian Broadcasting Tribunal	cur.S	0.14	0.07	-	-	-	0.05	0.05
	ext.S	-	-	-	-	-	0.03	0.00
Bureau of Transport and Communications Economics	cap.S	0.01	0.01	0.07	0.10	0.03	0.15	0.04
	cur.S	2.17	2.32	2.37	2.48	2.56	3.54	3.66
	ext.S	-	-	0.08	0.07	0.06	0.09	0.08
Other Communications	cap.	-	-	-	-	-	0.03	-
	cur.	-	-	-	-	-	0.10	0.07
	ext.	-	-	-	-	-	0.02	0.01
Aviation Airways Facilities	cap.	0.40	0.40	0.88	1.25	1.35	13.75	15.35
	cur.	0.30	0.30	0.32	0.62	0.65	1.85	1.95
	ext.	0.26	0.24	0.26	0.28	0.29	0.28	0.29
Provision of Meteorological Services	ext.	-	-	-	-	-	16.80	17.72
Bureau Air Safety Research	cur.S	0.06	0.06	0.06	0.11	0.15	0.15	0.18
Other Aviation	cur.	0.01	-	-	0.01	0.02	0.01	0.02
	ext.	0.14	0.15	0.12	0.08	0.01	0.15	0.08
	cap.S	-	-	-	-	0.02	-	0.02
	cur.S	0.02	0.02	-	-	0.04	0.72	0.64

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Other Transport	cap.	0.01	-	-	-	-	0.01	0.00
	cur.	0.02	-	-	-	-	0.01	0.01
	ext.	1.40	0.86	1.23	1.22	1.29	2.00	2.00
	cur.S	0.30	0.31	0.17	-	-	0.07	0.07
	ext.S	0.43	0.86	0.82	0.07	0.05	0.63	0.84
Australia Post (BE)	cap.	0.08	0.08	0.13	0.30	0.45	2.83	1.34
	cur.	1.03	1.04	0.66	0.93	0.97	2.86	3.01
	ext.	0.09	0.08	0.09	0.12	0.20	8.49	9.57
OTC (BE)	cap.	-	0.06	0.23	0.38	0.40	0.54	0.60
	cur.	0.05	0.45	1.49	1.10	1.21	3.70	4.01
	ext.	0.44	0.65	2.04	0.78	0.90	1.20	1.30
Telecom Australia (BE)	cap.	4.07	3.39	6.00	11.70	6.80	27.00	16.40
	cur.	35.33	39.69	45.00	42.00	37.30	96.70	90.40
	ext.	1.31	1.26	1.70	1.95	2.25	16.95	22.25
	cap.S	0.10	-	-	-	-	-	-
	cur.S	1.00	-	-	-	-	-	-
AUSSAT (BE)	cap.	0.65	0.17	0.30	0.45&	0.50&	0.45&	0.50
	cur.	0.05	0.07	0.10	0.10&	0.10&	0.10&	0.10
	ext.	-	-	0.01	0.09&	0.10&	0.09&	0.10
Total Commonwealth sector direct expenditure		50.15	52.89	64.43	66.67	58.16	202.33	193.35
B. Expenditure from other sources								
Telecom Australia (BE)	cap.	0.03	0.01	-	-	-	-	-
	cur.	0.27	0.11	-	-	-	-	-
Total Other sources		0.30	0.12	-	-	-	-	-
Total expenditure from all sources		50.45	53.01	64.43	66.67	58.16	202.33	193.35

BE = Business Enterprise. See page 51 for explanation of other abbreviations.

A17.1 Transport and Communications

The primary goal of the Transport and Communications portfolio is to foster the development of Australia's transport and communications systems through provision of an infrastructure and regulatory framework which promotes efficient and cost-effective air and surface transport, and communications services. The Department of Transport and Communications is an amalgamation of most elements of the former Departments of Aviation, Transport, and Communications.

A17.2 AVIATION ACTIVITIES

(Aviation)

Bureau of Air Safety Investigation

The Bureau of Air Safety Investigation is responsible for investigating all civil aircraft accidents and incidents occurring in Australia and its Territories. The Air Safety Research Group is engaged in ongoing projects to analyse accident patterns and factors in specific categories.

Current projects include:

. an implementation study for the introduction of an Australian confidential aviation incident reporting program

. a landing accident study

. a pilot experience study.

A program on fuel exhaustion and starvation aircraft occurrences has been completed.

Engineering Services Section, Airport Sytems Branch

The Airport Systems Branch is supporting the development of an airport pavement management database.

Provision, Operation and Maintenance of Airways Facilities

The Department has obligations under the Air Navigation Act and Regulations and commitments arising from Australia's membership of the International Civil Aviation Organisation (ICAO) which require the establishment, provision, maintenance and operation of air routes and airway facilities and associated services. The objective is to ensure the continued safe, efficient and economic performance of the national network of airways facilities and services and to ensure that the network expands or changes as necessary to meet Australia's future air transport needs.

The capital expenditure reported includes a large expenditure for the installation of earth stations in conjunction with the use of the national communications satellite when it became operational in 1985-86.

Regulation of Air Transport

- Environment and security

The Department is responsible for policy, standards and procedures on aircraft noise and other environmental matters associated with aircraft operations as well as aviation security policy and procedures. It also co-ordinates operational (airways/airports) protective security and related intelligence arrangements.

- Aviation medicine

The Department has a continuing commitment to discharge statutory obligations and responsibilities by establishing and enforcing medical standards for flight crew and air traffic controllers to ensure the maintenance of safe flying operations. Activities include:

. ARL (Aeronautical Research Laboratories) Crash Protection Program: knowledge of the effect of impact forces on aircraft structures and restraint device performance; diagnostic studies of simulated impacts to be made in conjunction with the Accident Injury Databank of General Aviation Crash Injuries and Fatalities. This program was discontinued in 1986-87, but will be re-initiated in 1987-88.

. Air Traffic Controller Hearing Test Development: to develop an occupationally-based speech test for use with hearing-impaired air traffic controllers, and eventual extension to flight crew hearing tests; formulation of licensing standards.

. Bifocal Contact Lenses: examination of likely problems in piloting; evaluation of new contact lenses designed for presbyopic pilots.

. Hypoxic effects on Psychomotor and Visual Performance: evaluation of the effects of mild hypoxia equivalent to 5000 to 1000 feet on psychomotor skills and performance and visual physiology.

. Survey of physiological working conditions in the agricultural aviation industry.

- Airworthiness

Support has been provided to:

. the Aeronautical Research Laboratories for research into various aeronautical safety areas, including fibre composite aircraft structures, fatigue life enhancement on materials and components, and safe life assessments of wings and fuselage. (This project has now been discontinued.)

. the Royal Melbourne Institute of Technology for full-scale fatigue testing of a Janus glass fibre composite construction glider wing, to determine the viable life of fibreglass gliders. (This project has now been discontinued.)

. the Australian Nuclear Science and Technology Organisation (A13.ll) to develop improved ways of presenting data derived from non-destructive test equipment, particularly from ultrasonic and eddy-current inspection equipment.

Provision of Meteorological Services (Aviation)

The Department is obliged to obtain meteorological services from the Bureau of Meteorology as part of the statutory responsibilities for the safety of aircraft operations. The services are provided in accordance with Air Navigation Regulations and working arrangements between the Department of Aviation and the Bureau of Meteorology.

Air Transport Forecasting and Evaluation (Aviation)

Science and technology activities include the collection and publication of aviation activity statistics, the forecasting of aviation activity by airports for the period 1985-2010 and aggregate short-term forecasts for policy formulation. Also included are costs associated with computer processing of statistical data collected by the Department's Central Statistical Section.

A17.3 OTHER TRANSPORT ACTIVITIES

Grants to Transport Research Bodies (Transport)

- Australian Road Research Board (ARRB)

  ARRB was established in 1960 by the National Association of Australian State Road Authorities as a national centre for road research. Projects carried out by ARRB include:

  . collection of information on road travel and vehicle ownership, and on freight transport

  . measuring of traffic loads

  . testing of heavy vehicle performance, materials and bituminous binders

  . development of standards for bridges and culverts, for design of residential streets, and for pavement design and performance

  . accelerated loading pavement trials

  . establishment of standards for control of construction procedures

  . research on traffic operations and road design standards, road user information and guidance, road user behaviour, and urban road system management

  . supply of instruments for road research.

- Australian Rail Research and Development Organisation (ARRDO)

  ARRDO was a national railway research organisation established in 1977 under the auspices of the Australian Transport Advisory Council, and was jointly supported by the Commonwealth-and State Government-owned rail systems of Australia. ARRDO's work program concentrated on the financial, operational and managerial problems of Australian railways. ARRDO has now been disbanded.

- Other land transport research will include funds for the Rail Industry Council, which will assess rail's past performance and its prospects for the future, and move towards developing an industry restructuring package.

Marine Navigational Aids (Transport)

The Department has an obligation to provide marine navigational aids in accordance with the requirements of enabling legislation, as described in the Marine Navigational Aids Corporate Plan. Research and development functions are undertaken to ensure the provision, review and upkeep of the most effective visual, audio and electronic aids, preparation of tidal predictions for shipping channels and associated activities. A long-range photometric laboratory was due for commission in 1986-87.

Road Safety Division (Transport)

The 1986-87 research program of the Federal Office of Road Safety as approved by the Minister aimed:

- to support the activities of the Office in providing policy advice to the Federal Government
- to support fundamental research which is likely to result in new knowledge and new road safety measures
- to share in research projects being conducted in the States and Territories which could have national value.

Policy issues in road safety currently being supported by research sponsored or carried out by the Federal Office of Road Safety include: continued development of the National Mass Data System on road crashes; heavy vehicle speed limits; road user behaviour. Major research projects currently underway or proposed include

- continued research into the role of various behavioural factors in road crashes, especially in young people
- analysis of rural road crashes
- driver training, licensing and testing
- surveys on community attitudes to road safety
- improved occupant protection
- continued development of a national road crash fatality and casualty data system.

A17.4 COMMUNICATIONS ACTIVITIES

The Department's responsibilities include the policy and technical aspects involved in developing and maintaining broadcasting and communications services, and the management and use of the radio-frequency spectrum.

During 1986-87 an extensive program of laboratory and field investigations continued into the FM receiving system specification, standards for the domestic television receiving systems, and the technical viability of transmitting more than one sub-carrier with the main FM broadcast sound carrier (FM ancillary communications service - FM ACS). A new project was also commenced, during 1986-87, into technical aspects of the Multipoint Distribution Service.

A17.5 BUREAU OF TRANSPORT AND COMMUNICATIONS ECONOMICS (BTCE)

The Federal Bureau of Transport and Communications Economics (BTCE) is a professional research body which reports directly to the Minister for Transport and Communications on its program of research work. For administrative purposes the Bureau is attached to the Department of Transport and Communications. The Bureau is responsible for independent applied economic research into Australian transport and communications systems. The BTCE analyses the nature, capacity, performance and financing of transport and communications systems. It also investigates the economic and resource allocation implications of such systems. Furthermore, the BTCE undertakes:

- analysis of the effects of specific pricing and regulatory policies, (including methods of rate and fare setting)
- evaluation of transport and communications investment proposals and programs

- collection, analysis and dissemination of information relating to transport and communications activities

- development of economic evaluation methods, transport planning procedures and operations research techniques

- application of inter-disciplinary approaches to analysis of transport problems.

The BTCE researches all issues relating to transport and communications and the topics range widely in both nature and scope. Accordingly, it is common for the Bureau's research program at any particular time to exhibit a high degree of diversity. Current research programs include:

- studies of the Australian road system, which include segments on national highways and rural arterials, future demand for road construction, life cycle analysis of pavements, local roads and urban development. The program was scheduled to be completed in September 1987 and a report released in November 1987.

- The development of a model for estimating operating costs of cargo vessels, the results of which are due for release in October 1987.

- a study on transport-trade interactions which will identify the regulatory and institutional problems which increase transport costs.

- final preparation of a report on the trends and prospects for Australian international air transport. The study examines trends in Australian markets in relation to global trends in traffic. An option paper is due for release in December 1987.

- an economic, social and financial assessment of the Tasmanian rail network

- a study of Australian international shippers and shipping practices

- an analysis of the determinants of modal shares in transport corridors.

A17.6 AUSTRALIAN BROADCASTING CORPORATION (ABC)
(Communications)

The ABC has the responsibility to provide adequate and comprehensive television and radio programs throughout Australia. To further this aim, its R&D activities cover the design, using innovative techniques where appropriate, of specialised equipment which is not otherwise available. Technical support is also given to facilitate the introduction of technological changes into the ABC's operations and to allow effective liaison with overseas and Australian organisations. Projects include a study of the spectral characteristics of light sources, camera and picture monitors to determine their effects upon the reproduction of colour television pictures; and development of equipment and provision of technical services to suit the requirements of the Australian Broadcasting Corporation. Recent achievements have included the development of an economical and reliable digital audio delay system which delays the ABC radio programs relayed via satellite to Australian cities in different time zones and a new signal generator developed for setting up inter-city and international sound circuits.

A17.7 AUSTRALIAN BROADCASTING TRIBUNAL
(Communications)

The Australian Broadcasting Tribunal (ABT) is responsible for matters relating to licensing and overseeing of public and commercial broadcasting and commercial television stations.

The Research Branch of the ABT provides the Tribunal with empirical research, background papers and statistical analyses.

The types of programs televised during sample weeks of 1986-87 were analysed as part of a continuing study. A new system of categorising program material was devised and employed. Two new projects were undertaken. The first provided an historical analysis of types of television programs, covering six representative metropolitan stations, between 1979-80 and 1986-87. This analysis was based on the new system of categorising programs. The second project was an investigation of the attitudes of viewers to the frequency and placement of advertisement.

A17.8 AUSTRALIAN POSTAL COMMISSION ('Australia Post')

(Communications)

The Postal Services Act requires that the Commission perform its functions in such a manner as will best meet the social, industrial and commercial needs of the Australian people. In providing these services, the commission is required to have regard to the need to operate its services as efficiently and economically as practicable. It must have regard also to the special needs for postal services of Australian people who reside or carry on business outside the cities and the desirability of improving and extending its postal services.

The Commission, which trades as 'Australia Post', carries out research and development aimed at providing new and improved products, services, management systems, procedures and techniques which have been identified as important for the achievement of its broad objectives. Current research is directed towards investigation, testing and application of knowledge acquired to areas of: materials handling, containerisation, physical mail processing, letter indexing and optical character reading, customer interface systems, and materials associated with the provision of postal services.

A relatively new endeavour is the exploitation of modern communications and computing technology to provide new types of postal services. These include electronic mail developments and the support of traditional post office counter services by the use of specialised computer networking and funds transfer technology. The adoption of newly emerging international standards for computer communications and the requirement for a highly distributed network design has resulted in a substantial S&T investment by Australia Post to develop these systems.

The important particular objectives of Australia Post's R&D and S&T activities are:

. introduction of specialised computer networking and funds transfer technology for post office counter services

. the introduction of optical character recognition reading technology for automated sorting of standard letter mail

. the provision of improved transport facilities for the carriage of mail to and between mail centres.

A17.9 AUSTRALIAN TELECOMMUNICATIONS COMMISSION ('Telecom Australia')

(Communications)

The general thrust of Telecom Australia's R&D and S&T activities is towards the timely adoption of appropriate technology to assist Telecom to fulfil its charter to provide, maintain and operate national telecommunications services which meet the social, industrial and commercial needs of people throughout Australia, with charges that are as low as practicable, and to keep these services up to date through the efficient and economic development and operation of the national network infrastructure.

Priority objectives of Telecom's S&T and R&D activities are:

- the introduction of new or improved customer services, facilities and products
- the provision of automatic telephone and data transmission services to customers in the remote parts of Australia
- improved service standards and a flexible network infrastructure which can evolve to provide an integrated services digital network, with international accessibility and quality, in the 1990s
- the maintenance of network integrity and survivability.

Telecom's R&D activities are primarily directed at the development of an independent competence within Telecom for the evaluation of world trends in telecommunications science and technology, to assist the planning and specification of new developments relevant to the Australian telecommunications environment. The development of such competence is especially important in the Australian context since Australia is relatively isolated from the world centres of telecommunications R&D. Telecom's R&D also provides specialist knowledge and facilities for the solution of unusual technical problems arising in the operation of its networks, and a basis for Telecom's contributions to the development of national and international standards for telecommunications.

Telecom's R&D activities provide an input to its wider S&T activities, which are concerned with technical innovation in the planning, development, implementation and operation of customer services and the networks over which the services are provided.

Telecom's R&D and S&T activities also involve the participation of local industry and academia, both on a formal contractual basis and via less formal mechanisms for technology and information transfer. Telecom's procurement contracts (total annual value of about $2,220 million in 1986-87) are let largely to local industry and often require the contractor to undertake adaptive design of overseas technology (estimated at about 1% of total annual contract expenditures). Telecom's Product Development Fund will provide about $5 million in 1987-88 to assist local industry initiatives to develop new telecommunications products. Telecom's Research Laboratories will expend about $2 million in 1987-88 on about 50 specific R&D contracts with local industry and academia and will contribute $0.25 million to the Australian Telecommunications and Electronics Research Board (ATERB) for the support of telecommunications R&D projects in academia.

Telecom's R&D and S&T activities range over the whole spectrum of telecommunications science and engineering. Projects cover:-

- new fundamental materials, devices, techniques and technologies with longer term potential for application in customer services or network systems
- investigations related to the planning, specification and adaptive design of customer services and network systems for medium term implementation
- solution of technical problems arising in the operation of network systems and equipment
- development of new or improved network management systems and operational and maintenance practices.

Some projects being pursued by Telecom in 1987-88 encompass:-

- voice coding and synthesis techniques, including test-to-speech conversion

- digital signal processing and modulation, detection and encryption techniques
- coherent single mode optical fibre transmission systems
- digital microwave radio transmission systems
- radiocommunications antennas and propagation techniques
- computer techniques for real time control of telecommunications systems
- common channel signalling techniques for computer controlled exchange networks
- communication protocols for multi-mode (voice, text, image, data) ? communications in multi-service network environments
- digital circuit and packet switching networks for voice and data
- computer-aided techniques for network dimensioning and dynamic management
- digital reticulation in the customer access network
- network interface standards for the evolution of an Integrated Services Digital Network
- advanced voice and non-voice, real-time and non-real-time business communications services and networks
- electronic directory services
- advanced semiconductor and optical materials and devices
- reliability studies of telecommunications plant and equipment
- scientific techniques for the assessment of hazards (chemical, electrical, etc) arising in telecommunications operations and for the protection of both personnel and plant from such hazards.

During 1986-87, Telecom:

- undertook the development, in association with Australian industry, of a new standard Touchphone telephone, having improved features and optional enhancements to suit customer requirements
- successfully trialled, in collaboration with STC and the ANZ Bank, its new Card Phone, scheduled to be introduced in 1987 which will allow customers to use credit cards issued by financial institutions to pay for calls from selected public telephones
- launched a new generation Cellular Mobile Telephone Service in Melbourne and Sydney, providing increased capacity to meet customer demand for the service and enhanced customer facilities
- introduced the Explorer range of mobile telephone sets to meet a variety of portable telephone environments (eg in-car, hand-held)
- introduced the Iterra Network Service over the AUSSAT National Communications Satellite to provide much-improved voice and data services to customers in Australia's outback

- introduced TRANSEND, Telecom's Electronic Funds Transfer at Point of Sale (EFTPOS) Access Service, for use by financial and similar organisations wishing to establish business transaction processing services (eg EFTPOS services to retailers)

- introduced its Teletex Service, a new high speed, high quality document and file transfer service for transfer of text between certified computer-based office equipment and personal computers

- launched its Securitel Service in Sydney and Melbourne, providing the security industry and its customers with a reliable efficient means of transmitting alarm signals to centralised monitoring stations

- provided modern automatic telecommunications services to a further 8,900 customers in Australia's more sparsely settled areas under its Rural and Remote Areas Program, relying heavily on the use of Telecom's Digital Radio Concentrator System and achieving the modernisation of over 60% of the estimated 43,500 services encompassed by the program

- continued to extend and upgrade the switched telephone and data networks, using modern digital switching systems to enhance customer facilities and provide more efficient network management

- increased the capacity of the trunk network, installing high capacity digital radio systems between Melbourne and Sydney and optical fibre cable systems from Darwin to Katherine and from Sydney to Canberra to Melbourne, and commencing installation of optical fibre cables between Perth and Port Augusta

- established pilot optical fibre networks in the central business districts of Melbourne and Sydney to evaluate means of meeting the future communications needs of business customers

- established a Product Development Fund ($5.0 million in 1987-88) to assist Australian industry to undertake entrepreneurial R&D leading to new telecommunications products, complementing its existing programs of contracting its own needs for research, development and design to Australian industry and academia.

A17.10 OVERSEAS TELECOMMUNICATIONS COMMISSION (Australia) (OTC)

(Communications)

The Overseas Telecommunications Commission Australia is responsible for the establishment, maintenance, operation and development of all public telecommunications services between Australia and other countries, between Australia and its external territories and with ships at sea. Its R&D activities, which encompass telecommunications, submarine cable and satellite technologies and systems, are funded from trading revenues.

OTC's R&D activities commenced in 1983 with the establishment of a Research and Development Board whose main objective is to advise on the scope and direction of research and development funded by OTC. Following the establishment of the R&D Board, an expanding R&D program is being undertaken by OTC directed towards servicing the future technological needs of the international telecommunications business, including research in physics, engineering and communications theory.

OTC's expenditure on R&D for 1987-88 will continue as in past years to be shared between internal investigations by OTC's own staff and external contracts placed with industry and research institutions.

Internally, an optical laboratory has been established for conducting experiments in submarine fibre optic communication and a systems laboratory has been established to carry out investigations into aspects of networks switching and services technologies.

Externally, contracts have been let for major programs in submarine optical communications and roof-top satellite earth stations. A major thrust in current and future years will be the support of a range of activities in the submarine optical communications field to support OTC's plans for procurement of major cable systems through the 1990s. Further projects are in the areas of teleconferencing, software engineering, teletraffic engineering and digital modulation techniques.

In the S&T category, OTC undertakes a range of internal studies to provide a firm basis for the planning of its networks and to assess future demand for telecommunicaitons services. Demand forcasting based on econometric techniques is included in the planning activities.

As well as direct OTC expenditure on R&D, as a member of the International Telecommunications Satellite Organisation (INTELSAT) and the International Maritime Satellite Organisation (INMARSAT) OTC contributes to the funding of R&D programs conducted by these organisations. This expenditure has been included in the extramural R&D activities, and is primarily expended outside Australia.

Research has recently been started into fast packet switching techniques and services as the expected technology for broadband services in the coming era of submarine optical fibre cable systems.

A17.11 AUSSAT PTY LTD
(Communications)

AUSSAT Pty Ltd was formed in 1981 to own and operate the Australian National Communications Satellite System. The main goals of the Company, from a service and technology perspective, include:

. to make available to all Australians a broader and improved range of telecommunications and broadcasting services

. to provide high quality service responsive to the full range of customer requirements

. to foster the concept, design and development of new types of telecommunications services making use of the special characteristics of satellite communications systems

. to be a centre of technical excellence in respect of satellite related activities and applications

The objectives of the R&D activities are to assist the Company to achieve these goals.

A.18 TREASURY

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Dept. of Treasury	cur.S	0.06	0.05	0.10	0.11	0.14	0.11	0.14
Industries Assistance C Commission								
IMPACT Project	cur.S	0.09	0.14	0.11	0.11	0.11	0.11	0.11
	ext.S	0.09	0.10	0.10	0.11	0.12	0.11	0.12
Australian Bureau	cap.	-	-	-	0.00	0.00	0.00	0.00
of Statistics	cur.	-	-	-	0.01	0.00	0.08	0.07
	cap.S	0.08	0.58	0.18	0.27	0.35	4.49	4.79
	cur.S	4.25	6.10	7.66	9.47	9.40	160.77	127.18
Commonwealth Banking Corporation	ext.	0.01	0.01	0.01	0.01&	0.01&	0.01&	0.01&
Reserve Bank of Australia								
CNRD Project	cap.	4.23	1.45	0.25	0.03	-	0.30	0.13
	cur.	-	1.16	1.29	0.32	0.25	1.10	0.27
	ext.	-	0.10	0.15	0.33	0.07	0.33	1.36
Special Projects	cur.S	0.19	0.15	0.33	0.03	0.05	0.59	0.70
Rural Credit	ext.	2.51	2.68	2.61	3.75	3.40	3.75	3.40
Economic and financial research	ext.S	0.20	0.34	0.08	0.12	0.05	0.12	0.05
	Total	11.71	12.85	12.88	14.28	13.86	171.38	137.5

See page 51 for abbreviations

A18.1. DEPARTMENT OF THE TREASURY

Modelling Section (Treasury)

The Section is developing and validating an econometric model of the Australian economy which is intended for use in short-term forecasting and policy analysis within the Treasury. Treasury's interest in forecasting is directly related to its macroeconomic policy advisory role and is thus concerned with all aspects of the aggregate economy.

A18.2 INDUSTRIES ASSISTANCE COMMISSION (IAC)

(Industry, Technology and Commerce)

The IAC is an independent statutory authority. Its main functions are to advise the Treasurer on the nature and extent of assistance which should be given to Australian industries, and to report annually to Parliament on the general structure of industry assistance in Australia and its effects on the economy.

The IAC is the coordinating agency for the IMPACT Project. The Project is a cooperative effort involving a number of Commonwealth Agencies (Industries Assistance Commission; Australian Bureau of Agricultural and Resource Economics (ABRE); Bureau of Industry Economics (BIE); Department of Employment, Education and Training; Department of Arts, Sports, Environment, Tourism and Territories; and Department of Immigration , Local Government and Ethnic Affairs) in association with the University of Melbourne, La Trobe University and the Australian National University.

The IMPACT Project involves the development of analytical frameworks, consisting of compatible economic and demographic models and associated databases and computing systems, which enable the implications of both policy-induced and naturally occurring changes to be studied systematically in an economy-wide perspective. The purpose is to improve policy analysis of inter-related economic and social issues, particularly in the areas of international trade, industry development and manpower.

A18.3 THE AUSTRALIAN BUREAU OF STATISTICS (ABS)

(Treasury)

The ABS is the central statistical authority for Australia. It provides statistical services for the Government and private sectors by collecting, compiling, analysing and disseminating social, demographic and economic statistics and related information. In addition, the ABS coordinates statistical operations of official bodies to ensure attainment of statistical compatibility and integration, avoidance of duplication, compliance with standards, and maximum utilisation of information. The Bureau also provides advice and assistance on statistical matters. All ABS activities are regarded as S&T activities (predominantly data collection in the social sciences), with a minor R&D component, particularly in the Economic Services and Welfare areas.

A18.4 COMMONWEALTH BANKING CORPORATION

(Treasury)

The Commonwealth Banking Corporation was established under legislation enacted by the Australian Parliament and comprises the Commonwealth Trading Bank of Australia, the Commonwealth Savings Bank of Australia, the Commonwealth Development Bank of Australia and their subsidiary and associated companies.

In general, the Corporation is concerned with two areas of research: increasing efficiency of banking operations; and funding university research in the field of agriculture.

A18.5 RESERVE BANK OF AUSTRALIA

(Treasury)

The Reserve Bank of Australia is involved in the following scientific and technological activities:

. research into the Australian financial system using econometrics and other analytical methods;

- through its Economic and Financial Research Fund, the Bank assists post-graduate research outside the Bank into economic and financial topics relevant to Australia. One recent project has been ‘Australian Financiers: Bibliographic Essays’.

- grants are awarded from the Rural Credits Development Fund for research, development or extension projects directed towards the promotion of primary production. In 1986-87 90 grants and 3 fellowships totalling $3.34m were allocated to projects to be undertaken in the next 3 years, including Australian houseplants for export, a nematode to control mice, development of novel anti-fungal and antiprotozoan agents, and disease studies in cultured prawns.

- The CNRD project is aimed at the development of a more secure and cost-effective banknote. This project will go into the final production phase in 1987-88.

A.19 VETERANS' AFFAIRS

($ million)		R&D					S&T (including R&D)	
		83-84	84-85	85-86	86-87	Proj. 87-88	86-87	Proj. 87-88
A. Commonwealth sector direct expenditure								
Central Health and Medical Services	cap.	0.05	0.04	0.10	0.10	0.10	0.10	0.10
	cur.	0.32	0.38	0.53	0.60	0.60	0.60	0.60
Repatriation Hospitals Pathology Services	cur.	-	-	-	-	-	11.85	13.00
Central Development Unit	cap.	-	-	-	-	-	0.01	0.26
	cur.	-	-	-	-	-	0.28	0.31
Total Commonwealth sector direct expenditure		0.37	0.42	0.63	0.70	0.70	12.84	14.27
Total expenditure from all sources		0.37	0.42	0.63	0.70	0.70	12.84	14.27

See page 51 for explanation of abbreviations.

A19.1. DEPARTMENT OF VETERANS' AFFAIRS (DVA)

Central Development Unit (CDU) (Veterans' Affairs)

The Unit follows a continuous program of improving artificial limbs and orthopaedic appliances. The program includes assessment of materials and components in use, testing of new materials and components, development of improved methods of fitting artificial limbs and appliances and evaluation in view of adoption of the results of overseas research. The current investigations were centered on the evaluation of the Iceland-Sweden-New York (ISNY) flexible socket for Above Knee (AK) prostheses, which offers increased comfort, especially when seated, improves total contact and adhesion with the stump and facilitates the dissipation of heat. As the ISNY socket was found wanting in durability and reliability a modified design was evolved for which new materials such as carbon fibre tapes and stockinette, surlyn and polyethylene were introduced and tested for making prostheses. The Unit follows a continuous program of education and dissemination of information.

Postgraduate courses in prosthetics and orthotics were conducted for orthopaedic surgery and rehabilitation medicine registrars, for therapists and prosthetists orthotists. The method evolved for manufacturing flexible A K sockets was communicated to the DVA prosthetists-orthotists in a hands-on workshop held at the CDU. A manufacturing manual was completed and is being published. Consultations were given and appliances

fitted on twenty three patients with amputations and/or other disabilities, for whom individual devices had to be designed and manufactured by the CDU.

Central Health and Medical Research Committee (Veterans' Affairs)

The prime function of the Department of Veterans' Affairs in the medical field is the diagnosis and assessment of incapacity and the treatment of eligible veterans and their dependants. Research, including the evaluation of methods of patient diagnosis, assessment and treatment, is relevant both to the quality of care of patients for whom the Department has a responsibility, and the effectiveness of Departmental clinical services. Medical research is an essential component of the Department's treatment function.

Repatriation Hospital Pathology Laboratories (Veterans' Affairs)

As part of its service to veterans and their dependants, the Department of Veterans' Affairs operates pathology laboratories to provide pathology services for its Repatriation General Hospitals.

APPENDIX B

BIBLIOGRAPHY OF RECENT GOVERNMENT PUBLICATIONS RELATING TO SCIENCE AND TECHNOLOGY

. Building Research and Development - Building Research and Development Advisory Committee 1986

. Compendium of Australian Energy Research, Development and Demonstration Projects, No 7 - Department of Resources and Energy 1986

. CSIRO Directory 1986 - CSIRO 1986

. Directory of Business Enterprise R&D in New South Wales - New South Wales Science and Technology Council 1987

. Directory of CSIRO Research Programs 1986 - CSIRO 1986

. Directory of Geoscience Research Facilities in Australian Tertiary Education Institutions 1985 - Bureau of Mineral Resources, Geology and Geophysics 1986

. Directory of Materials Research and Development Capabilities and Facilities in Australia - Department of Science 1986

. Directory of NSW Government, Commonwealth Government and Tertiary Education R&D in New South Wales - New South Wales Science and Technology Council 1987

. Directory of Research in Victoria (DRIV) - Victorian Department of Industry, Technology and Resources 1987

. Energy 2000, a National Energy Policy Review: Energy Research, Development and Demonstration Policy - Department of Resources and Energy 1986

. Foreign Control in Research and Experimental Development, Business Enterprises, Australia 1984-85 - Australian Bureau of Statistics Cat No 5330.0 1987

. Handbook of Research and Researchers in Artificial Intelligence in Australia - Department of Science 1986

. High Technology Industries in Australia - Economic Planning and Advisory Council 1987

. Improving the Research Performance of Australia's Universities and Other Higher Education Institutions - Australian Science and Technology Council 1987

. submissions to the ASTEC review into higher education R&D (various)

. Information Industries Strategy - Department of Industry, Technology and Commerce 1987

. Measures of Science and Innovation (Australian Science and Technology Indicators Report 1987) - Department of Industry, Technology and Commerce 1987

- Mechanisms for Technology Transfer into Australia - Australian Science and Technology Council 1986

- Research and Experimental Development, All-sector Summary, Australia 1984-85 - Australian Bureau of Statistics Cat No 8112.0 1987

- Research and Experimental Development, All-sector Summary, (Inter Year Survey), Australia 1985-86 - Australian Bureau of Statistics Cat No 8122.0 1987

- Research and Experimental Development, Business Enterprises, Australia 1984-85 - Australian Bureau of Statistics Cat No 8104.0 1987

- Research and Experimental Development, General Government and Private Non-profit Organisations, Australia 1984-85 - Australian Bureau of Statistics Cat No 8109.0 1987

- Research and Experimental Development, Higher Education Organisations, Australia 1984 - Australian Bureau of Statistics Cat No 8111.0 1986

- Reviews of National Science and Technology Policy, Australia - Organisation for Economic Co-operation and Development 1986

- Science and Technology Budget Brief 1987 - Department of Industry, Technology and Commerce 1987

- Science and Technology Databook 1987 - Department of Industry, Technology and Commerce 1987

- Science and Technology Indicators; an Annotated Bibliography - Department of Science 1986 (J Ronayne)

- Science Policy Directory 1987 - Department of Science 1987

- Selecting Technologies for the Future - Department of Industry, Technology and Commerce 1987

- Strategy Report for the Australian Aerospace Industry - Aerospace Industry Council 1986

- Technology and Innovation - Economic Planning and Advisory Council 1986

- Computerised Assistants - New Tools For Society, Australian Science and Technology Council 1987

NOTE - additions to this list are welcomed. It should be noted that many government agencies produce annual reports which will give details of scientific and technological activities.

APPENDIX C

REVIEW OF BILATERAL SCIENCE AND TECHNOLOGY COOPERATION AGREEMENTS

The Department of Industry, Technology and Commerce promotes Australia's interests through international cooperation in science and technology. International bilateral activities are promoted through formal government-to-government science and technology agreements and through informal arrangements. Formal agreements currently exist with Japan, the United States, the People's Republic of China, the Federal Republic of Germany, Mexico, India and the Soviet Union. The Department provides financial support for seminars, workshops, collaborative research and visits by experts. Additionally projects in specific fields are developed in collaboration with the partner country following the identification of priority areas generally after the exchange of scientific delegations.

Applications are sought twice a year from the research community. Program selection is on the basis of scientific or technological merit together with the likely contribution of proposals to economic and social development. The agreements are not intended as a primary source of research funds. It is expected that the collaborating institutions provide the bulk of the necessary funding while the program provides a contribution towards airfares, living allowances and the running of seminars and workshops. Support is not provided for attendance at international conferences, other than those developed from the outset as Agreement activities.

The following table shows funds outlayed by subject area.

Table 18: Summary of Australian support for bilateral science and technology cooperation agreements

$	81-82	82-83	83-84	84-85	85-86	86-87	Projected 87-88
US/Australia Agreement for Scientific and Technical Cooperation							
Physical and Chemical Sciences	22 793	19 377	28 685	20 239	55 195	8 690	12 000
Engineering and Applied Sciences	5 200	7 255	20 189	25 602	33 033	16 138	12 000
Biological and Agricultural Sciences	28 400	21 568	27 716	93 896	103 524	55 716	34 000
Earth Sciences	9 474	28 401	12 500	35 264	33 301	-	33 000
Social Sciences	11 050	2 875	26 612	5 602	-	-	9 000
Other	-	-	-	-	-	8 703	-
Sub-total	76 917	79 476	105 702	180 603	225 053	89 247	100 000

$	81-82	82-83	83-84	84-85	85-86	86-87	Projected 87-88
India/Australia Science and Technology Agreement							
Physical and Chemical Sciences	10 856	1 672	2 328	-	3 600	-	7 000
Engineering and Applied Sciences	1 200	-	1 600	-	-	-	20 000
Biological and Agricultural Sciences	2 790	800	2 800	-	3 000	-	3 000
Earth Sciences	23 160	10 422	7 560	-	7 302	-	4 000
Other	-	-	-	-	7 889	35 943	7 000
Sub-total	38 006	12 894	14 288	-	21 791	35 943	41 000
FRG/Australia Science and Technology Agreement							
Physical and Chemical Sciences	-	3 875	4 500	-	5 828	27 945	39 000
Engineering and Applied Sciences	2 994	-	18 365	6 000	6 000	10 965	3 000
Biological and Agricultural Sciences	21 999	16 195	-	30 000	33 000	13 600	16 000
Earth Sciences	9 000	8 070	-	5 200	7 020	-	-
Social Sciences	-	-	-	17 264	-	-	10 000
Other	-	-	-	-	-	-	20 000
Sub-total	20 975	36 993	16 195	44 704	51 878	52 510	89 000

$	81-82	82-83	83-84	84-85	85-86	86-87	Projected 87-88
Japan/Australia Science and Technology Agreement							
Physical and Chemical Sciences	-	13 400	-	2 000	12 281	22 255	50 000
Engineering and Applied Sciences	7 483	50 009	33 500	40 543	23 452	38 100	25 000
Biological and Agricultural Sciences	21 700	67 002	38 757	46 479	18 900	18 550	25 000
Earth Sciences	-	2 300	23 800	36 582	10 000	3 280	5 000
AAS/JSPS Exchange Program	-	-	-	-	40 000	40 000	40 000
Other	6 035	1 207	28 736	35 000	2 085	4 370	15 000
Sub-total	35 318	133 918	124 793	160 604	106 718	126 555	160 000
Mexico/Australia Science and Technology Agreement							
Physical and Chemical Sciences	-	3 000	-	-	-	-	-
Engineering and Applied Sciences	2 854	3 000	-	1 660	16 598	7 000	3 000
Biological and Agricultural Sciences	-	25 436	7 269	13 800	6 872	13 483	20 000
Earth Sciences	-	-	-	11 180	-	-	-
Other (Senior Scientific Delegations)	22 030	711	12 617	-	-	-	-
Sub-total	24 884	32 147	19 886	26 640	23 470	20 483	23 000

$	81-82	82-83	83-84	84-85	85-86	86-87	Projected 87-88
China/Australia Science and Technology Agreement							
Physical and Chemical Sciences	-	-	-	-	6 000	2 380	7 000
Engineering & Applied Science	-	-	-	3 414	45 986	9 143	5 000
Biological and Agricultural Sciences	-	-	960	-	7 744	17 437	20 000
Earth Sciences	-	2 820	-	-	9 420	-	12 000
Social Sciences	-	-	-	-	5 028	-	-
Other (Senior Scientific Delegations)	19 000	752	34 165	46 275	1 191	49 889	30 000
Sub-total	19 000	3 572	35 185	49 689	75 369	78 849	74 000
USSR/Australia Science and Technology Agreement							
Astrophysics	-	-	-	-	22 644	-	30 000
Earth Sciences	-	-	-	-	41 542	34 777	20 000
Other Sciences	-	-	-	21 762	8 353	8 978	10 000
Sub-total	-	-	-	21 762	72 539	43 755	60 000
GRAND TOTAL	215 000	299 000	318 804	509 000	576 818	447 342	547 000

APPENDIX D

TECHNICAL NOTES

D.I Background

The concepts and methodology employed in this Statement are based on or developed from international standard practices developed for science and technology statistics. The first Statement in this series, Science Statement 1978-79, was modelled on similar publications issued regularly by several other countries, including Canada, the Netherlands, and the United States. Tables for the Statement are prepared by the Science and Technology Indicators Section (STIS) of the Department of Industry, Technology and Commerce (formerly in the Department of Science). Further information is available from STIS.

D.2 Definitions and concepts

Research and development (R&D)

The definition adopted by the Organisation for Economic Cooperation and Development (OECD) (1) was used in the information collection:

> **Research and experimental development** (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this knowledge to devise new applications.

To clarify this definition the information collection guidelines included the following:

> Any activity classified as R&D should contain an appreciable amount of novelty, it should have investigation as a primary objective, and should have a potential to produce results that are sufficiently general for mankind's stock of knowledge (theoretical and/or practical) to be recognisably increased. The concept of novelty is not associated with the actual creation of something which, although new, is made by artistry or by application of techniques that have already been established for that class of object. For example, devising and validating a new econometric model is R&D, whereas the econometric modelling of economic systems for policy purposes, using established techniques, is not R&D.
>
> R&D ceases when work is no longer experimental. Once its primary objective is no longer investigation, an activity can no longer be considered as R&D even though it could be regarded as an important part of the total innovative process.
>
> Note that R&D extends to substantial modifications to existing processes, systems, services and products.

The above definition and guidelines are also used in the national R&D surveys (2) carried out by the Australian Bureau of Statistics#.

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(1) The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Experimental Development, "Frascati Manual" 1980 OECD Paris June 1980.

(2) Research and Experimental Development, All Sector Summary, Australia, 1984-85, Australian Bureau of Statistics Cat No 8112.0, June 1987.

In previous Science and Technology Statements the national R&D surveys carried out by the Australian Bureau of Statistics were referred to as "Project SCORE" surveys.

Science and technology (S&T)

The activities to be included, in addition to R&D, as science and technology were presented in the guidelines in the form of a descriptive list as follows:

Interpretation of S&T Activities (other than R&D)

- Demonstration of both technical and commercial viability: Demonstration projects and production and operation of pilot plant or equipment aimed at demonstrating both the technical and commercial viability of specific innovatory products or processes.

- Design for innovative production or service: Design engineering and 'tooling-up', often following either an experimental development or a successful demonstration phase, and aimed at establishing innovatory products or processes on a routine production basis or at providing an innovatory service. Includes products, processes or services new to Australia, regardless of whether or not these are well developed elsewhere.

- Technology transfer, extension services, other active diffusion of scientific and technological skills and know-how: regular routine work on advising clients, including other sections of an organisation and independent users, to promote use of scientific, technological and management information. This activity includes extension and advisory services organised for farmers and for industry. It involves the transfer of skills, capabilities and 'know-how' to clients.

- Advanced scientific or engineering services: consulting services to provide clients, including other sections of an organisation and independent users, with technologically advanced designs, products or processes, or with reports based on advanced scientific or technological analysis. Engineering feasibility studies are included in this category, except where they involve econometric techniques and/or operations research. The provision of products relying on advanced technology (e.g. isotopes) is also included.

- Policy-related studies using advanced techniques: policy-related studies using operations research and/or econometric techniques. This category includes feasibility studies involving such techniques.

- Testing, standardisation, metrology and quality control: regular routine work on the analysis, checking and testing, by recognised methods, of materials, products, devices and processes, together with the setting up and maintenance of standards, including standards of measurement.

- Patenting and licensing: activities relating to patents and licenses: systematic work of a scientific, legal and administrative nature on patents and licences.

- Data collection in the natural sciences: geodetic, topographical, geological and hydrological surveying (including prospecting and related activities designed to locate and identify oil and mineral resources); routine astronomical, meteorological and seismological observations; surveying of soils and of plants, fish and wildlife resources; routine soil, atmosphere and water monitoring and the routine monitoring of radioactivity levels.

- Data collection in the social sciences: the gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics, e.g. population censuses, production, distribution and consumption statistics, market studies, social and cultural statistics etc.

- Scientific and technological information and documentation: S&T services provided by libraries, archives, information and documentation centres, reference departments, scientific congress centres, data banks and information-processing departments. Such services include S&T bibliographic searches, provision of S&T documents, provision of access to organised S&T information systems and the management of any associated data bases. Support for S&T conferences is included in this category. Systematic work on the translation and editing of S&T books and periodicals (except for textbooks used in school and university courses) is also included.

- Services associated with scientific and technological collections: S&T services provided by museums of science and/or technology, botanical and zoological gardens and other S&T collections.

- Scientific and technical education and training: specialised non-university higher education and training, higher education and training leading to a university degree (except research training of (post) graduate students which is regarded as part of R&D), and organised lifelong training for scientists and engineers.

- Administration of S&T activities, policy, planning and other studies of S&T, n.e.i.: administrative, policy, planning and related activities concerned with S&T which are not an integral part of one of the other defined S&T activities. The Australian Science and Technology Council (ASTEC) and the Policy Division of the Department of Science are examples falling in this category.

D.3 S&T Data

S&T data should be used with caution in view of the lack of a statistically satisfactory definition of S&T and the corresponding wide discretion as to whether particular activities should be included. Reporting of these activities (other than R&D) for the present Statement remains uneven, particularly in the social sciences, where agencies often see their activities as having little or no relevance to a Statement on science and technology.

D.4 Expenditure definitions and guidelines

Definitions and guidelines used in the collection of financial data for this Statement are in harmony with those used in the ABS R&D surveys. Some key items are presented in this section.

. Intramural expenditure is expenditure for R&D or other S&T activities undertaken by the respondent organisation. Intramural expenditure is separated into the two categories, capital and current:

Capital expenditure includes expenditure for:

- Land, buildings and other structures (including major alterations but excluding repairs and maintenance, which are reported as "Other current expenditure"); includes relevant capital expenditures by the Departments of Housing and Construction, Local Government and Administrative Services, or Administrative Services on behalf of each agency;

- Vehicles, plant, machinery and equipment (expenditure incurred in the financial year on the acquisition (less disposal) of fixed tangible assets, either new or second-hand, with an expected life greater than one year.

A proportion of expenditure on assets used partly for R&D should be included, but no such allowance should be included for other S&T).

Current expenditure includes expenditure for:

- Wages, salaries and other labour costs (these refer to gross earnings before taxation and other deductions. Overtime earnings, shift allowances, penalty rates, bonuses and commission payments to employees, holiday pay, payments to employees absent on long service leave, sick pay and similar payments, and employer contributions to superannuation and pension schemes are included. The employer contributions to superannuation and pension schemes where the contributions are paid by another organisation are excluded.

- Other current expenditure (includes expenditure on items such as travel expenses, materials, fuels, rent and leasing, repairs and maintenance, data processing, reference materials and special services in support of the R&D, e.g. payments to outside organisations for use of specialised testing facilities); includes relevant expenditure by the Departments of Housing and Construction, Local Government and Administrative Services, or Administrative Services on behalf of each agency.

. Extramural expenditure is expenditure for R&D or other S&T activities funded by the respondent organisation but undertaken (i.e. performed) by other organisations. Extramural expenditure was classified by type of payment into the two categories, "contracts and commissions" and "grants and donations":

Contracts and commissions refer to funds disbursed specifically under contract or commission arrangements to other organisations to perform specified tasks.

Grants and donations refer to funds disbursed without contractual obligation on the part of the receiving organisation to perform specified tasks on behalf of the funding organisation (other than provision of a report describing the work performed).

For both intramural and extramural expenditure, respondents were previously asked to report the sources of funds to enable expenditures to be allocated to the "Commonwealth Budget sector", the "Commonwealth Non-budget sector" and "Other sources of expenditure". The reporting categories were as follows:

Own funds refers to funds available for use by the respondent Department or Authority, and may be received:

- via the Budget sector (consisting of all transactions relating to the Public Account i.e. the Consolidated Revenue Fund, Trust Fund and Loan Fund, as reported in the Budget Statements (4). All transactions of departments are recorded in the Public Account and are accordingly part of the Budget sector); and

- via the Non-Budget sector (consisting of all transactions of authorities which do not pass through the Public Account).

Other sources relate to funds other than "Own funds" which are only available for the specified activity, and include, for example, any levy component from research trust funds, and funding provided by other Commonwealth departments and authorities, State government departments and authorities, and private enterprises.

In this Statement, the distinction between "Budget" and "non-Budget" sector is no longer retained, and the two categories are combined. However, "other sources" remains the same. Note that according to OECD definitions for R&D surveys, Commonwealth business or financial enterprises (eg Telecom, Commonwealth Bank) are considered as business enterprises. In this Statement we distinguish between private business enterprises and Commonwealth (or other government) business enterprises.

D.5 Sources of expenditure from Research Trust Funds

The source of funds for expenditure by trust funds is determined by pro-rating the expenditure in a given year by the source of funds contributed to the fund in the same year. This method., over a period of years, provides an accurate representation of that part of the trust funds expenditure which was contributed by the Commonwealth Government.

D.6 Allocation of expenditure by socio-economic objective

The socio-economic objective classes used in the Statement represent an amalgamation of those used in the Australian national R&D surveys, as follows:

Science and Technology Statement	ABS R&D surveys (as updated for 1984-85 Survey)
Defence	Defence
Agriculture	Agriculture
Other Primary Industries	Other Primary Industries
Mining	Mining of non-energy minerals
Manufacturing	Manufacturing Industry
Construction	Construction
Energy	Production and Utilization of Energy Production and Utilization of Synthetic Fuels Conservation of Energy Other Energy R&D Mining of Energy Minerals
Transport	Transport
Communications	Communications
Economic Services N.E.I.	Commercial Activities Miscellaneous Public Services Economy
Environment (incl. Protection and Rehabilitation)	Environment
Urban and Regional Planning	Urban and Regional Planning

Health	Health: Pre and Para Clinical Health: Clinical Health: Public
Education	Education
Welfare	Social Development and Welfare Services
Community Services N.E.I.	Miscellaneous Community Services and Objectives
Earth, Ocean, Atmosphere and Space	Advancement of Knowledge of the Physical Environment
General Advancement of Knowledge	General Advancement of Knowledge Other R&D n.e.c.

Some particular cases requiring special note are:

All grants by the Department of Education, and those recommended by the Tertiary Education Commission, for research in the higher education sector have been allocated to the socio-economic objective "General advancement of knowledge". This accords with international practice as embodied in the biennial International Survey of the Resources Devoted to Research and Experimental Development by OECD Member Countries, where the guidelines for the 1979 survey include the following:

"Please include in General Advancement of Knowledge all R&D financed by general public university grants from the Ministry of Education although, in certain Member countries, some of these programs may be relevant to other objectives. This is a convention dictated by the difficulty of distributing these funds by objective in many Member countries."

Should a distribution of these grants over other socio-economic objectives be required, the Australian national R&D survey data may be used as a rough guide. Percentages of Commonwealth funded higher education sector R&D expenditures by broad socio-economic objective category reported for 1984 were advancement of knowledge, 47%; community welfare, 30%; and economic development 23%.

. In the Science Statement 1979-80, the ABS R&D survey mining objectives relating to energy minerals were included in the category "Mining". In subsequent Statements, as noted above, they are included in the category "Energy".

. In Science Statement 1979-80, expenditures of Commonwealth Serum Laboratories (CSL) were classified to the objective "Manufacturing" in accordance with the location of "Pharmaceuticals" in the classification scheme. In subsequent Statements, taking account of the objectives of CSL, these expenditures have been classified in the category "Health".

D.7 Distinction between "advancement of knowledge" and basic research

For details of the distinction between "advancement of knowledge" and basic research, see the 1986-87 Science and Technology Statement (pp 196-197). The Statement does not attempt to distinguish between basic research, applied research, and experimental development.

D.8 Estimation of trends in real terms

Expenditures in Statements prior to 1983-84 were presented only in current prices i.e. in actual money terms. It is of course desirable to examine trends in real

terms, taking account of changes in prices. The most acceptable presentation is to provide estimates of all expenditures at constant prices (1). In the absence of known price variations for all goods and services purchased, it is usual for such estimates to be constructed using price indices for various broad categories of expenditure and quantity weights representing the relative contributions of these categories to the total expenditure.

Implicit price deflators are obtained by dividing aggregate flows of goods and services measured at current prices by the corresponding estimates at constant prices. Thus they are derived measures (hence the term 'implicit') and are not direct measures of price changes by which current price estimates are converted to estimates at constant prices. When calculated from the major national accounting aggregates, such as expenditure on gross domestic product (giving the GDP implicit price deflator), implicit price deflators relate to a generally broader scope of goods and services in the economy than that represented by any of the individual retail and wholesale price indexes that are published by the Australian Bureau of Statistics. The usefulness of implicit price deflators as indicators of price change is greatly limited by a number of factors. Nevertheless, because of the difficulty of constructing accurate R&D deflators, the Gross non-farm IPD has been the deflator most commonly used for this purpose.

There is an extensive literature on this subject and readers are cautioned that while studies have shown that at the national and broad sector levels the GDP implicit price deflator has often given acceptable estimates of constant price R&D expenditures, there are many examples where it has not. In these cases the estimated R&D price deflators have usually increased more rapidly than the GDP implicit price deflator. At the individual program and ministry levels, there can be marked variations from the price rises indicated by one or more of the broad aggregate deflators, due both to phasing of expenditures and the phasing and magnitudes of individual price changes of the goods and services actually purchased.

A major inhibiting factor in the presentation of estimated constant price expenditures in earlier Statements was the absence of a fully satisfactory salaries index appropriate to Commonwealth research personnel. A simple research scientists and engineers salaries index was constructed for the Statement on a basis adequate for establishing trends using data at two- or three-year intervals, but this index (which took salaries at a fixed time in each year) did not adequately account for variations in the timing of new awards from year to year and was unsuitable for use with data at annual intervals. Using Public Service Board data on the timing of all salary adjustments for selected grades since 1976, we have developed a Commonwealth research salary payment index as a replacement. This is based on the total annual salary payments attributable to a fixed 'basket' of personnel relevant to a research organisation. The personnel grades selected, and the weighting given to each in the construction of the index, were based on a study of the staff structure of CSIRO. This index, and others used in the derivation of constant price estimates used in this Statement, are presented in Table 20. Table 11 illustrates the application of the deflators to expenditure classified according to socio-economic objectives.

TABLE 20: Deflator series relevant to Commonwealth-funded R&D

Price Index or Deflator	Index Values for Year (1979-80 = 100)									
	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	Proj* 87-88
A. GDP implicit price deflator (IPD)	90.0	100.0	110.4	121.8	134.8	145.0	153.8	164.6	177.7	190.1
B. Gross non-farm IPD	91.0	100.0	110.6	123.5	137.1	147.6	157.0	168.2	181.7	194.4
C. Government final consumption expenditure IPD	91.5	100.0	112.3	127.2	140.9	149.7	158.6	169.3	180.6	193.2
D. Consumer price index	90.8	100.0	109.4	120.8	134.7	144.0	150.1	162.7	177.9	190.4
E. Commonwealth research salary payment index	92.9	100.0	114.0	133.4	145.2	152.3	159.9	168.8	176.5	185.4
F. Private non-dwelling construction IPD	90.3	100.0	112.2	126.6	143.9	151.1	161.3	180.4	195.9	207.6
G. Private enterprise intramural R&D expenditure IPD	91.1	100.0	115.3	132.9	139.5	151.1	164.1	174.9	187.0	200.1
H. Universities aggregate price deflator	92.2	100.0	114.2	126.9	139.3	147.5	157.8	167.5	177.0	187.7
I. ABS R&D other capital expenditure deflator	86.0	100.0	103.5	111.8	126.6	135.5	143.1	160.7	189.9	201.3
J. ABS R&D non-salary current expenditure deflator	91.5	100.0	110.2	122.8	137.2	147.0	155.6	165.8	176.7	189.1
K. Commonwealth extramural R&D payments deflator	92.2	100.0	112.4	129.9	142.1	150.1	157.9	168.0	178.4	188.4
L. Private Equipment IPD	90.8	100.0	109.6	117.7	129.4	139.1	145.6	166.1	189.6	201.0

Sources : Budget papers, ABS bulletins and unpublished data, Commonwealth Tertiary Education Commission data, DITAC unpublished data based on Public Service Board salaries information.

* DITAC estimates based on assumptions in the Budget Papers for 1987-88 (ie, GDP non-farm deflator to increase 7%, CPI to increase by 7%).

A,B,C,F,L:
Derived from ABS Catalogue No 5206.0, June Quarter, 1987. See 5207.0 (6 May 1987) for historical data.

D Figures derived by DITAC from original series having a 1980-81 base (ABS Catalogue 6401.0, June Quarter, 1987).

E This index is based on the total annual salary payments attributable to a fixed 'basket' of personnel relevant to a research organisation. The personnel grades selected, and the weighting given to each in the construction of the index, were based on a study of the staff structure of CSIRO.

G Estimated by DITAC using the constant 1979-80 price figures for the years 1978-79, 1981-82, 1984-85 and 1985-86 published by ABS (Catalogue No 8122.0 and others). The deflator for 1982-83 and 1983-84 was estimated by extrapolation from data on R&D expenditures by registrants for the 150% tax concession (see "Measures of Science and Innovation", 1987, Table 4.3). Values for other missing years were interpolated on the basis of constant annual percentage changes between the given years. In addition to noting the uncertainty introduced by using an interpolated figure for the base year, 1979-80, readers should be aware that the ABS regards these constant price estimates as less reliable than most published ABS constant price data.

H This deflator is based on indices maintained by CTEC for adjusting recurrent grants to higher education institutions for cost increases. See Appendix 11, Vol. 4 of the CTEC Report for the 1982-84 triennium. The index is the weighted average of three indices: university academic salaries (0.49), general salaries (0.35) and non-salary costs (0.16). Neither equipment nor capital costs are included.

I,J These series are unpublished working estimates made available by ABS.

K Used to deflate extramural payments made by agencies to other Commonwealth bodies. Based on weighting factors derived from an analysis of 'Other Source' expenditure from the survey data used for the S&T Statement.

Outline of the application of indices in the derivation of the constant price estimates

. For capital land and building expenditure - series F.

. For capital equipment expenditure - series I.

. For wages and salaries - series E.

. For other current expenditure - series J.

. For extramural expenditures - series B, D, G, H or K were used according to the destination of the funds.

APPENDIX E
ACRONYMS, ABBREVIATIONS AND SYMBOLS

AAEC	Australian Atomic Energy Commission (now ANSTO)
AAECP	Asean Australian Economic Co-operation Program
AAHL	Australian Animal Health Laboratory
AAHQS	Australian Agricultural Health and Quarantine Service
AAO	Anglo-Australian Observatory
AAT	Anglo-Australian Telescope
AAT	Australian Antarctic Territory
AATB	Anglo-Australian Telescope Board
ABARE	Australian Bureau of Agriculture and Resource Economics
ABC	Australian Broadcasting Commission
ABIS	Australian Biogeographic Information System
ABN	Australian Bibliographic Network
ABRS	Australian Biological Resources Study
ABS	Australian Bureau of Statistics
ABT	Australian Broadcasting Tribunal
ACC	Australia-China Council
ACER	Australian Council for Educational Research
ACET	Australian Council for Employment and Training
ACIAR	Australian Centre for International Agricultural Research
ACMA	Australian Council for Multicultural Affairs
ACT	Australian Capital Territory
ACTU	Australian Council of Trade Unions
ADACS	Australian Development Assistance Courses
ADP	Automatic Data Processing
AFL	Australian Fertilizers Limited
AFP	Australian Federal Police
AFS	Australian Fisheries Service
AGAL	Australian Government Analytical Laboratories

AHRC	Australian Housing Research Council
AIA	Automotive Industry Authority
AIAS	Australian Institute of Aboriginal Studies
AIDAB	Australian International Development Assistance Bureau
AIDC	Australian Industry Development Corporation
AII	Australian Industry Involvement (Defence)
AIMA	Australian Institute of Multicultural Affairs
AIMS	Australian Institute of Marine Science
AINSE	Australian Institute of Nuclear Science and Engineering
AIRDIB	Australian Industrial Research and Development Incentives Board
AIRDIS	Australian Industrial Research and Development Incentives Scheme
AITC	Australian Industry and Technology Council
AIUS	Australian Institute of Urban Studies
AMC	Australian Manufacturing Council
AMEC	Australian Minerals and Energy Council
AMEP	Adult Migrant Education Program
AMEX	Australian Monsoon Experiment
AMLRDC	Australian Meat and Livestock Research and Development Corporation
AMSTAC	Australian Marine Sciences and Technologies Advisory Committee
ANARE	Australian National Antarctic Research Expeditions
ANPWS	Australian National Parks and Wildlife Service
ANSTO	Australian Nuclear Science and Technology Organisation
ANU	Australian National University
ANZAAS	Australian New Zealand Association for the Advancement of Science
A of K	(general) Advancement of Knowledge
APC	Australian Productivity Council
APS	Australian Public Service
AQIS	Australian Quarantine Inspection Service
ARC	Australian Research Council

ARGC	Australian Research Grants Committee
ARGS	Australian Research Grants Scheme
ARL	Aeronautical Research Laboratories
ARL	Australian Radiation Laboratory
ARR	Alligator Rivers Region
ARRB	Australian Road Research Board
ARRDO	Australian Railway Research and Development Organisation
ARRRI	Alligator Rivers Region Research Institute
ASC	Australian Seismological Centre
ASCA	Association for Science Cooperation in Asia
ASCO	Australian Standard Classification of Occupations
ASEAN	Association of South-East Asian Nations
ASETT	Department of Arts, Sport, the Environment, Territories and Tourism
ASO	Australian Safeguards Office
ASRRF	Australian Special Rural Research Fund
ASTCON	Australian Science and Technology Counsellor Network
ASTEC	Australian Science and Technology Council
ATERB	Australian Telecommunications and Electronics Research Board
AUBRCC	Australian Uniform Building Regulations Coordinating Council
AUSINET	Australian Information Network (Data Base Network)
AUSSAT	Australian (telecommunications) Satellite
Australia Post	Australian Postal Commission
AUSTREC	Australian Science, Technology and Research Co-operation (ADAB)
AVHRR	Advanced Very High Resolution Radiometer
AWC	Australian Wool Corporation
AWRAC	Australian Water Research Advisory Council
AWRC	Australian Water Research Council
BAE	Bureau of Agricultural Economics

BE	Business Enterprises
BERD	Total Intramural R&D Expenditure in the Business Enterprise Sector
BIE	Bureau of Industry Economics
BLMR	Bureau of Labour Market Research
BMR	Bureau of Mineral Resources, Geology and Geophysics
BMRC	Bureau of Meteorology Research Centre
BRIAN	Barrier Reef Image Analysis
BRS	Bureau of Rural Science
BTEC	National Brucellosis and Tuberculosis Eradication Campaign
BTE	Bureau of Transport and Communications Economics
CAD	Computer Assisted Design
CAE	College of Advanced Education
CAI	Council of Australian Industry
CAM	Computer Assisted Manufacture
CAP	Common Agricultural Policy
cap.	Intramural capital expenditure, mainly in the NSE
cap.S	Intramural capital expenditure, mainly in the SSH
CCAMLR	Convention on the Conservation of Antarctic and Marine Living Resources
CCD	Charge coupled device
CCRD	Consultative Committee on R&D (ADAB)
CEDA	Committee on the Economic Development of Australia
CEP	Community Employment Program
CERI	OECD Centre for Educational Research and Innovation
CDU	Central Development Unit (Veteran's Affairs)
CFF	Commission for the Future
CFI	Commonwealth Forestry Institute (UK)
CGIAR	Consultative Group on International Agricultural Research
CHOGRM	Commonwealth Heads of Government Regional Meeting
CILES	Central Information, Library and Editorial Section (CSIRO)

CIM	Computer Integrated Manufacturing
CIMDP	Computer Integrated Manufacturing Demonstration Program
CIRC	Centre for International Research Cooperation (CSIRO)
CITCA	Committee of Inquiry into Technological Change in Australia
CMRAC	Department of Veterans' Affairs Central Medical Research Advisory Committee
CNRD	(a project of the Reserve Bank of Australia aimed at producing a more secure and cost-effective Bank note)
COALSCAN	(a CSIRO-developed on-line coal ash analyser)
COSSA	Central Office of Space Science and Application
COST	ASEAN Committee on Science and Technology
CPI	Consumer Price Index
CPO	Capital Procurement Organisation (Defence)
CS&H	Department of Community Services and Health
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSIRONET	National Computer Network Operating within Australia
CSL	Commonwealth Serum Laboratories
CTBT	Comprehensive Test Ban Treaty
CTEC	Commonwealth Tertiary Education Commission
CTHC	Capital Territory Health Commission
cur.	Intramural current expenditure, mainly in the NSE
cur.S	Intramural current expenditure, mainly in the SSH
CWLTH	Commonwealth Government (i.e., Australian Federal Government)
DEET	Department of Employment, Education and Training
DILGEA	Department of Immigration, Local Government and Ethnic Affairs
DISCON	Defence Integrated Secure Communication Network
DITAC	Department of Industry, Technology and Commerce
DNA	Deoxyribonucleic Acid
DOS	Department of Science
DPI	Domestic Product of Industry

DSS	Department of Social Security
DST	Department of Science and Technology
DSTO	Defence Science and Technology Organisation
EBS	Experimental Building Station
EET	Department of Employment, Education and Training
EFTPOS	Electronic Funds Transfer at Point of Sale
EMEX	Equatorial Mesoscale Experiment
EP	Employee Participation
EPG	Education Planning Group
ERDC	Education Research and Development Committee
ERS	European Resources Satellite
ESCAP	Economic and Social Commission for Asia and the Pacific
ESL	English as a Second Language
ext.	Extramural expenditure, mainly in the NSE
ext.S	Extramural expenditure, mainly in the SSH
FE	Commonwealth Financial Enterprise
FFT	Fast Fourier Transform
FM	Frequency Modulation
FMACS	Frequency Modulation Ancillary Communications Service
FRAN	Flight-data Recorder Analysis (Station)
FRG	Federal Republic of Germany
FWRAP	Federal Water Resources Assistance Program
GATT	General Agreement of Trade and Tariffs
GBRMPA	Great Barrier Reef Marine Park Authority
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
GIRD	Grants for Industrial Research and Development
Govt.	Government
HACBSS	Homestead and Community Broadcast Satellite Service

HACC	Home and Community Care
HE	Higher Education
HF	High Frequency
HIAF	Heavy Ion Analytical Facility
HIFAR	High Flux Australian Reactor
IAC	Industries Assistance Commission
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organisation
ICI	Imperial Chemical Industries
ID	Industrial Democracy
IDC	International Data Centre
IDCA	Industrial Design Council of Australia
IDP	International Development Program
IEA	International Association for the Evaluation of Educational Achievement
ILGEA	Department of Immigration, Local Government and Ethnic Affairs
IMPACT	A project of analysis of economic and social issues
INMARSAT	International Maritime Satellite Organisation
INPACT	US International Partnership for the Commercialisation of Technology
INTELSAT	International Telecommunications Satellite
IOC	International Oceanographic Commission
IPD	Implicit Price Deflator
IPS	Ionospheric Prediction Service
IR	Industrial Relations
IRAS	Indicators and Resource Analysis Section. (Department of Science)
IR&D	Industrial Research and Development
ISCED	International Standard Classification of Education
JIT	Just in Time
JPL	Jet Propulsion Laboratory (USA)
KW	Kilowatt

LADS	Laser Airborne Depth Sounder
Landsat	NASA Remote Sensing Satellite
LMC	Large Magellanic Cloud
LPG	Liquid Petroleum Gas
Ltd	Limited
MATPAK	Materials Handling Program
MCB	Metric Conversion Board
McIDAS	Man Computer Interactive Data Acquisition System
MEDLINE	U.S. National Library of Medicine (Database Network)
MELTFLOW	(a CSIRO-developed technology for metal-resting control)
MERLCO	Minerals (Exploration) Research Liaison Committee
MICs	Licenced Management and Investment Companies
MLS	Australian Microwave Landing System (INTERSCAN)
MP	Member of (the lower house of) the Parliament (of Australia)
MW	Megawatt
N	Natural Sciences and Engineering
n.a.	not available
NACES	National Advisory Committee on Extension Services
NAL	National Acoustic Laboratory
NASA	United States National Aeronautics and Space Administration
NASIS	North-East Australian Satellite Imagery System
NATA	National Association of Testing Authorities
NATmap	Division of National Mapping (Department of Resources and Energy)
NBSL	National Biological Standards Laboratory
NBTC	National Building Technology Centre
NCDC	National Capital Development Commission
n.e.c.	not elsewhere classified
n.e.i.	not elsewhere included
NERD&D	National Energy Research, Development and Demonstration

NERDDC	National Energy Research, Development and Demonstration Council
NERDDP	National Energy Research, Development and Demonstration Program
NH&MRC	National Health and Medical Research Council
NHTAP	National Health Technology Advisory Panel
NIES	National Industry Extension Service
NITC	National Information Technology Council
NMC	Nuclear Monitoring Centre
NMR	Nuclear Magnetic Resonance
NMRI	Nuclear Magnetic Resonance Imaging
NPAAC	National Pathology Accreditation Advisory Council
NPRU	National Police Research Unit
NRF	National Research Fellowship
NSC	National Standards Commission
NSE	Natural Sciences and Engineering
NSW	New South Wales
NT	Northern Territory (of Australia)
NWRAP	National Water Resources Assessment Program
OOP	Office of Defence Production
OECD	Organisation for Economic Co-operation and Development
OMA	Office of Multicultural Affairs
OTC	Overseas Telecommunications Commission (Australia)
OYA	Office of Youth Affairs
PABX	Priority Automatic Branch Exchange
PEP	Participation and Equity Programs
PhD	Doctor of Philosophy
PI	Primary Industry
PM	Prime Minister (of Australia)
PM&C	Department of the Prime Minister and Cabinet
PROLOG	A language for 5th Generation Computers

PSB	Public Service Board
PSZ	Partially-Stabilized Zirconia
Pty	Proprietary
QEII	(Her Majesty) Queen Elizabeth the Second
QEM*SEM	(a CSIRO-developed system for mineral analysis)
QLD	Queensland
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RCF	(Ministerial) Review of Commonwealth Functions (April 1981)
R&D	Research and (Experimental) Development
R,D&D	Research, Development and Demonstration
RIC	Railway Industry Council
RIRF	Rural Industry Research Trust Fund
RRB	Radio Research Board (now in ATERB)
RV	Research Vessel
S	Social Sciences and Humanities
SA	South Australia
SAAP	Support Assistance Accommodation Program
S&T	Science and Technology
SCORE	Survey and Comparison of Research Expenditure
SEAMEO	South East Asian Ministers for Education Organisation
SIROTECH	(an incorporated company for pomoting CSIRO inventions and technology in industry)
SISC	Scientific Industries Steering Committee
SMEC	Snowy Mountains Engineering Corporation
SPC	South Pacific Commission
SSH	Social Sciences and Humanities
STEP	Stratosphere Troposphere Exchange Project
STET	Scientific and Technical Education and Training
STIU	OECD Science and Technology Indicators Unit

STS	Scientific and Technological Services
TAFE	Technical and Further Education
TAS	Tasmania
T&C	Department of Transport and Communications
TCC	Technological Change Committee
TEAM	Towards Excellent Australian Manufacturing
Telecom	Australian Telecommunications Commission
TIRE	Total Identifiable Research Expenditure
TTC	Technology Transfer Council
UHF	Ultra High Frequency
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USPA	United States Patent Office
WA	Western Australia
WELSTAT	Welfare Statistics Collection Project
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation
Vic.	Victoria (Australia)
VLSI	Very Large Scale Integrated Circuits

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