

OCTOBER 1986



SCIENCE AND TECHNOLOGY STATEMENT 1986-87

The Minister for Science The Honourable Barry O. Jones



SCIENCE AND TECHNOLOGY

STATEMENT

1986 - 1987

by

The Minister for Science The Honourable Barry O. Jones, M.P.

A statement on the Commonwealth Government sector prepared by the Department of Science on the basis of information provided by agencies of the Commonwealth Government

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PREFACE

BY THE MINISTER FOR SCIENCE

THE HON. BARRY O. JONES, M.P.

This Statement details the research and development, and science and technology, activities carried out by, or supported by, the Commonwealth Government. It records the Government's continuing commitment to these activities and indicates the Government's areas of priority.

For some years now I have been commenting on the poor level of performance of R&D in Australia, and particularly the lack of research oriented to the needs of Australian industry. Australian society seems to have viewed research and development as rather aberrant activities, carried out in the main by isolated groups of academics, but with little relevance to the real world. There has also been a lack of appreciation of the importance of industry and the role of science-based innovation.

My Cassandra-like warnings were confirmed by the rapid deterioration in Australia's trading position, due largely to the decline in prices for our major primary commodities. The economic health of our nation is increasingly dependent on manufacturing and service industries which generally have a low level of technological awareness and capability and a very poor record in innovative activities in product and process development and in management.

It has been a major theme of the Government that Australian industry must become more export-oriented and internationally competitive. We need a strong base in research and development, and science and technology, activities to do this; not only to develop inventions and innovations ourselves, but also to have available the pool of expertise necessary to evaluate, adapt and incorporate technology transferred from overseas. While our government and higher education institutions have a generally adequate level of R&D activity, our business sector does not. Hence a major thrust of the Government's initiatives has been directed towards increasing the level of R&D and technological awareness of the industrial sector. These initiatives include:

- . 150 per cent tax concession scheme for industrial R&D
- . introduction of the Grants for Industry Research and
 - Development Scheme
- . establishment of the National Industry Extension Scheme.

In addition, the Government has seen the need to increase the support for excellent research, and research in particular areas. Accordingly, there has been an expansion in the major research grant programs, such as the Australian Research Grants Scheme, the National Research Fellowships Scheme and the National Health and Medical Research Council.

This increased support for R&D in the present stringent budgetary conditions evidences the Government's firm commitment to improving Australia's R&D base.

Such a program is necessarily long term and there are few immediate results. However there are pleasing indications that the Government's policies are having the desired effect. For example, R&D carried out in the business sector in 1984-85 increased by more than 40 per cent in real terms over the 1981-82 level.

I note the increased discussion of R&D by the media. I hope this reflects a real change in the public perception of the role of science and technology in the Australian economy.

Australia has slipped off the metaphorical sheep's back and we all now must work together to develop a better, more reliable, mode of transport for the future.

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R&D expenditure by country - 1984 or nearest year.

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Trade per head of population in selected technology-based products 1984.

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

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

of Expenditure.

DEVELOPMENT OF THE STATEMENT

This is the eighth 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 Science 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). This was one of the factors which led to the separate presentation of NSE and SSH in the tables of the Statement.

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 Indicators and Resource Analysis Scientific Development Division Department of Science PO Box 65 BELCONNEN ACT 2616

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 Science acknowledges the close co-operation of other Commonwealth agencies and the work of their staff in the prompt provision of information for this Statement. Department of Science officers principally responsible for preparing this edition were Diane Nash, David Fayle, Ian McMahon, Salvatore Nasca 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

1.1 General

A number of recent developments of broad implication are outlined below. Developments of a more specific nature are detailed in the chapter "R&D Trends and Developments by Socio-economic Objective".

Recent initiatives taken by the Commonwealth in the science and technology area show a continuing emphasis on the high technology/high employment sectors of the economy, mostly related to manufacturing industry. National (Australian Bureau of Statistics) and international (OECD) indicators show that the Australian manufacturing industry lags far behind its trading partners in terms of resources devoted to R&D.

The decrease in prices for primary commodities and consequent deterioration in Australia's trade balance and balance of payments have highlighted the need for Australia to compete more effectively internationally, particularly in the manufacturing and services industries. A strong underpinning of R&D and S&T activity is necessary for this to be achieved.

1.2 Grants for Industrial Research and Development (GIRD) Scheme

A new funding program aimed at stimulating Australian industry R&D spending commenced operation on 1 July 1986. Grants for Industry Research and Development (GIRD) Scheme is the successor to the Australian Industrial Research and Development Incentives Scheme (AIRDIS) and will operate for five years.

The GIRD scheme is designed to complement the 150 per cent tax concession scheme for eligible research and development. The tax concession scheme, estimated to cost \$100 million in revenue foregone in 1986-87, provides the bulk of the Government's assistance to industry's R&D, while the GIRD scheme is design to provide assistance to

- . new start-up firms which are unable to benefit from the tax concession scheme and which need assistance in carrying out their R&D projects
- . projects of national significance which are unlikely to be undertaken by industry.

Three elements constitute the scheme:

- Discretionary Grants: a grant of up to 50 per cent of eligible R&D expenditure conducted either in-house or under contract for the company.
- Generic Technology Grants: these will cover emerging technologies such as biotechnology and advanced materials which are considered to have fundamental significance for industry competitiveness in the 1990's but are unlikely, to develop if left to the market alone
- National Interest Agreements: for projects of significant national interest.
- 1.3 Australian Research Grants Scheme (ARGS) Directions

The Government is realising its commitment to increase support for excellent research. In the 1986-87 Budget, ARGS received a funding increase of ten percent in real terms, for the third time in the last four years. A major part of this year's increase will be used to provide new and improved research equipment for Australia's best academic researchers.

1.4 National Industry Extension Scheme (NIES)

NIES is a joint Commonwealth/State and Territories initiative designed to rationalise and more effectively coordinate the provision of extension (information and advisory) services, and to

improve industry's awareness of and access to these services. It aims to facilitate technology transfer, productivity development, and technological development, invention and innovation.

Current priorities, identified by the National Advisory Committee on Extension Services (NACES) are:

- improving awareness of NIES and its services
- . improving access to extension services by establishing a single access point in each State and Territory for NIES services
- . establishing a diagnostic counselling and referral service to help enterprises diagnose and solve their business problems
- . development and provision of a range of specialist extension services, and in areas such as best management practices, improved manufacturing and production processes, product innovation and development and human resources management.

1.5 Reviews of Publicly Funded Research

The Government is concerned with monitoring the direction and effectiveness of publicly funded research, and has requested the Australian Science and Technology Council (ASTEC) to review research in CSIRO, the Defence Science and Technology Organisation (DSTO) and the higher education sector. ASTEC has completed its review of CSIRO, and the broad thrust of its report ("Future Directions for CSIRO") was accepted by the Government.

The Government re-affirmed that CSIRO's primary role is applications oriented research in support of major industry sectors and selected areas of community interest, with a commitment to the effective transfer of its results to users. CSIRO will place more emphasis on the application of its research, while maintaining a major emphasis on strategic research.

CSIRO will be maintained as a single entity to provide maximum efficiency and flexibility in responding to changing national priorities in research. However, the organisational structure will be changed, with a separation of the top-level policy and management functions.

Changing the organisational structure will be an important element in building closer links between CSIRO and industry and the community. The current CSIRO Executive will be replaced by a new Board having part-time non-executive Chairman and six to eight part-time members.

The Chief Executive will be the only full-time member of the CSIRO Board. The Board will be responsible for setting the broad policy context established by the Government. The Chief Executive of CSIRO will be the most senior member of the Organization, and will have responsibility for the management of the activities of CSIRO within the directions established by the Board.

The new Board will implement, or give further consideration to, a number of other ASTEC recommendations on the use of resources, conditions of service for research staff, funding and financial arrangements.

Reviews by ASTEC on research in the DSTO and the higher education sector are still being carried out.

CHAPTER 2

RECENT TRENDS IN COMMONWEALTH FUNDED S&T

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 C 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 11 (socio-economic objective aggregates) are presented in Table 29 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 Budget sector expenditure of \$1084m on R&D for 1986-87 shows an increase of 6.5% relative to the 1985-86 total of \$1018m (Table 1). In real terms the increase is about 0.2%.

When the non-Budget sector is added in, the projected figure for all direct Commonwealth funding of R&D for 1986-87 is seen to be \$1194m, showing an increase of 7.9% relative to the 1985-86 total of \$1107m (Table 1). In real terms the increase is about 1.6%.

Over the period 1978-79 to 1986-87 the average real growth rate in all R&D expenditure directly funded by the Commonwealth is 2.2% per annum.

Direct Commonwealth funding of R&D excludes significant support for R&D through the general teaching-and-research expenditure of the higher education sector. It also excludes the costs of tax incentives for R&D. When these factors are added, the approximate cost of all Commonwealth support for R&D in 1986-87 is estimated to be about \$1770m (Table 1).

(\$ IIIIIOII)		R&D				S&T (including R&D)					
	81-82	82-83	83-84	84-85	P 85-86	rojected 86-87	82-83	83-84	84-85	P 85-86	rojected 86-87
Identifiable*	Commor	nwealth	Governr	nent Bu	dget sec	tor funds e	expended o	n S&T			
(\$m current) % Total Comm	693 Ionwealt	823 h	874	936	1018	1084	1430	1551	1657	1852	2003
outlays (%) % GDP (%)	1.68 .454	1.69 .493	1.55 .462	1.47 .447	1.46 .439	1.45 .427	2.93 .857	2.75 .820	2.60 .791	2.65 .798	2.68 .789
Identifiable* C Budget Sector)	ommon	wealth (Governn	nent fun	ds exper	nded on S&	&T (includ	ing Nor	1-		
- excluding Cw	lth-own	ed BE									
(\$m current) % GDP (%)	701 460	847 508	886 469	956 456	1040	1111	1462 876	1567 829	1696 809	1890 815	2048 807
/0 GDI (///)		.500	.+07	.+50	.++0	.450	.070	.027	.007	.015	.007
- excluding Cw	lth-own	ed BE	041	1012	1107	1104	1600	1710	1002	2072	2254
% GDP (%)	.489	.537	.498	.483	.477	.470	.965	.909	.898	.893	.888
(\$m constant											
85-86 prices)	977	1072	1064	1080	1107	1124	1924	1941	2006	2071	2122
Approximate c	ost of al	l Comm	onwealt	h suppor	t for R8	2D**					
(\$m current)	1030	1210	1270	1420	1560	1770					
Total Common Outlays (\$m)	wealth 41188	48792	56430	63712	69917	74764					
GDP (\$m)	152499	166826	189110	209541	232046	253910*					

Table 1:	Summary of trends	in Commonwealth C	Sovernment support for S&T,
	1981-82 to project	cted 1986-87.	

BE Wholly Commonwealth-owned business enterprises.

- 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.
- * The data shown do not contain estimates for the research components of higher education sector teaching-and-research expenditures see A.10.4, p 87.
- ** Includes estimates for higher education teaching-and-research and tax incentives see Table 2.
- # DoS estimate, September 1986.

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





2.2 <u>S&T Expenditure by Ministry</u>

Table 2 is a presentation of aggregate Commonwealth funds expended on S&T by ministry. The division between Budget and non-Budget sectors mainly serves to indicate where S&T activities are supported by Parliamentary appropriation and where they are supported by the trading revenues of government business enterprises. Further dissections of S&T expenditure by ministry 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 Project SCORE R&D survey. Further explanation is given in Appendix C. Fig 2 below is a visual display of the data for direct Commonwealth funding presented in Table 2, for 1986-87.

Added to the 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 A.10.3, p. 88), 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). (Arguably, there are components of other costs, such as assistance under the <u>Bounty (Computers) Act 1984</u>. which might also be added.) Estimates for these additional costs are given in Section D of Table 2 and used to derive approximate costs for all Commonwealth support for R&D. These totals should be regarded as indicative only.



Fig. 2 Commonwealth Funding of R&D by Ministry

(\$ million)			R	&D		S&T (including R&D)					
	81-82	82-83	83-84	84-85	85-86	Projecte 86-87	d 82-83	83-84	84-85	85-86	Projected 86-87
A.	Common	nwealth B	udget sect	or							
Aboriginal											
Affairs	0.62	0.66	0.52	0.65	0.53	0.39	3.10	3.46	3.55	3.72	3.80
Arts, Heritage											
& Environment	4.88	6.94	5.90	6.27	6.40	7.15	27.02	31.29	31.81	32.56	34.23
Attorney-											
General's	2.82	3.46	4.08	5.52	5.58	4.43	4.48	5.24	7.33	7.50	6.22
Aviation	1.33	1.01	1.20	1.18	1.65	1.73	24.33	23.44	22.64	30.05	31.8
Communications	0.52	0.36	0.43	0.39	0.40	0.67	1.21	1.74	1.48	1.13	1.33
Community											
Services	0.96	1.08	0.82	0.77	0.84	0.82	1.61	1.99	1.74	2.96	1.98
Defence	103.39	114.43	121.21	132.07	146.00	146.00	211.25	227.64	228.55	255.56	279.30
Education Employment & Indust	98.17	113.04	126.65	151.48	155.43	115.54	130.13	137.77	140.80	154.55	159.41
Relations	1 71	0.75	1 18	2 1 5	5.04	476	1.81	2 14	3 73	6.09	5 7 5
Foreign	1.71	0.75	1.10	2.10	5.01	1.70	1.01	2.1 1	5.75	0.07	5.75
Affairs**	20.03	30.25	32.62	40.27	40.14	33.20	149.89	176.30	192.34	203.02	188.56
Health	38.24	46.21	56.03	65.97	71 33	80.12	70.15	82.89	94 19	106.68	116 35
Housing &	00.2	10121	20102	00177	, 1100	00112	/0110	02.07	//	100.00	110.00
Construction	1.96	2.10	2.10	2.24	1.92	2.43	3.93	7.93	6.58	9.53	10.27
Immigration &											
Ethnic Affairs	0.38	0.43	0.18	0.32	0.35	0.34	3.70	4.74	4.18	2.76	1.92
Industry, Technol	ogy										
& Commerce	26.86	53.22	64.83	60.86	67.50	67.37	70.80	91.09	87.47	110.82	119.31
Local Govt. &											
Admin.Services	0.04	0.05	0.02	-	-	-	16.22	17.67	17.74	17.74	18.18
Primary											
Industry	18.54	20.77	24.17	35.46	38.65	44.30	37.17	41.58	75.61	83.10	92.60
P.M. &											
Cabinet	0.07	0.08	0.15	0.10	0.17	0.26	1.53	2.20	2.34	2.88	2.93
Resources &											
Energy	50.80	49.18	54.79	65.25	70.50	80.40	93.29	99.44	113.79	134.65	147.90
Science	314.31	366.09	366.33	364.64	401.87	439.11	472.25	478.10	482.36	539.77	591.26
Social											
Security	0.55	0.59	0.68	0.68	0.64	0.75	0.68	0.77	0.68	0.64	0.75
Special Minister											
of State	0.22	0.51	0.41	0.43	0.26	0.13	1.20	0.93	0.60	0.70	0.58
Territories	0.48	0.30	0.45	0.35	0.42	0.47	2.23	2.96	2.74	2.73	3.05
Transport	1.86	4.46	4.32	4.37	4.74	4.61	6.92	6.59	7.09	7.33	6.87
Treasury	3.99	6.16	4.39	6.73	7.94	8.40	99.40	99.42	116.00	122.90	165.78
Veterans'											
Affairs	0.32	0.40	0.37	0.42	0.63	0.60	9.84	11.20	12.15	12.45	12.85
Total (Budget											
sector)	693.0	822.5	873.8	935.8	1018.0	1083.8	1429.6	1550.9	1657.5	1851.8	2003.0

Table 2: Estimated Commonwealth Government funds expended on S&T by ministry with prime responsibility for planning the expenditure*

(\$ million)			R	&D	S&T (including R&D)						
	81-82	82-83	83-84	84-85	85-86	Projected 86-87	82-83	83-84	84-85	85-86	Projected 86-87
B. <u>Commonwealth Non-Budget sector, BE excluded</u>											
Affairs Arts, Heritage	-	-	-	-	-	-	0.17	0.21	0.29	0.28	0.25
& Environment	-	-	-	-	-	-	0.03	-	-	0.07	0.08
General's	0.03	0.09	0.07	0.03	0.07	0.03	0.11	0.13	0.04	0.13	0.08
Education	0.17	0.06	0.04	0.05	0.22	0.09	0.84	0.35	0.33	0.22	0.09
Construction Immigration &	0.05	0.06	0.02	0.27	0.36	1.00	0.07	0.02	0.30	0.40	1.07
Affairs	0.01	0.02	-	-	-	-	0.04	0.02	0.06	0.09	0.02
& Commerce Local Govt.	logy -	-	-	-	-	-	-	0.01	0.03	-	-
& Admin. Services Primary	0.05	0.12	0.05	0.09	0.12	0.13	0.15	0.07	0.93	1.03	1.25
Industry Resources &	-	-	-	-	0.17	0.01	-	-	-	0.20	0.12
Energy Science Territories Treasury	7.62 0.03	11.69 12.08 0.01	1.08 11.03 0.04	19.58 0.02	21.17 0.06	25.71 0.08	16.28 14.25 0.17	3.56 11.56 0.22	4.09 25.52 0.21 0.91	3.36 22.10 0.26 1.17	3.50 26.78 0.36 0.96
Total (Non-Budg BE)	et, exclud 7.96	ing 24.14	12.33	20.03	22.17	27.04	32.09	16.15	38.34	38.36	45.04
Total (Direct Con funding,	nmonweal	lth									
excluding BE)	701.0	846.7	886.2	955.8	1040.2	1110.9	1461.7	1567.1	1695.8	1890.2	2048.1

(\$ million)			R	&D	S&T (including R&D)							
	81-82	82-83	83-84	84-85	85-86	Projecte 86-87	d 82-83	83-84	84-85	85-86	Projected 86-87	
C.	Commonwealth Non-Budget sector, BE only											
cations Health Housing &	39.7 2.43	44.1 2.70	44.2 3.46	47.0 3.63	57.6 4.09	65.7 5.58	90.4 3.06	96.1 3.82	110.9 4.12	135.1 4.25	155.7 5.81	
Construction Treasury (Financi Enterprise	al)	-	-	-	-	54.20	52.07	44.23	64.81	37.27	32.52	
sector)	2.47	2.09	7.14	5.89	4.73	11.7	2.33	7.90	7.00	5.10	12.1	
Total (BE only)	44.6	48.9	54.8	56.5	66.5	83.0	147.9	152.0	186.9	181.7	206.2	
Total (All Non-Budget)	52.5	73.0	67.1	76.5	88.6	110.0	179.9	168.2	225.2	220.0	251.2	
Total (All direct Commonwealth funding)	745.6	895.5	941.0	1012.3	1106.7	1193.9	1609.5	1719.0	1882.7	2071.9	2254.3	
D.	Estimate	s of addit	ional cost	s incurred	by the Co	ommonwe	alth in suj	pport of R	<u>&</u> D			
Estimated R&D C of General Univer Funding	Componen rsity 284	nt 310	330	406	430	460						
Estimated Costs o Relevant Industria Incentives	of al Tax -	-	-	-	20	120						
Approximate cost	of all Co	mmonwea	alth suppo	ort for R&	D							
	1030	1210	1270	1420	1560	1770						

* See Tables 3 and 4 for more detailed dissections of expenditure by ministry.

** Mostly represented by the S&T component of Australia's development assistance program (see A. 12).

2.3 Overview of Major R&D agencies and granting programs

Tables 3 and 4 (which combine the Budget and Non-Budget sectors) show intramural S&T expenditure within Commonwealth bodies (Table 3), with the larger agencies separately identified, and extramural payments (Table 4) with major R&D granting programs shown.

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

(\$ million)			R	&D	S&T (including R&D)						
	81-82	82-83	83-84	84-85	85-86	Projected 86-87	82-83	83-84	84-85	85-86	Projected 86-87
Aboriginal Affairs Arts, Heritage and Environment	-	-	-	-	-	-	2.34	2.57	2.41	2.70	2.81
Scientist Other	3.71 0.14	5.67 0.47	4.26 0.60	4.40 0.57	4.28 0.54	4.93 0.51	5.67 19.12	4.26 23.36	4.40 23.07	4.28 23.79	4.93 24.93
-General's Aviation	2.51 0.98	3.19 0.73	3.99 0.80	5.24 0.79	5.44 1.26	4.33 1.37	4.22 7.96	5.20 7.37	6.89 6.35	7.33 13.35	6.18 14.63
. Telecom . Other Community	38.0 0.87	41.7 1.14	40.5 2.29	43.1 2.28	51.0 3.19	56.0 4.84	81.1 3.53	82.1 5.30	93.0 5.13	114.04 4.92	129.2 6.92
Services Defence Education Employment & Ind	0.72 102.64 0.81	0.61 113.38 0.30	0.68 120.30 0.45	0.66 131.88 0.56	0.70 137.99 0.77	0.67 144.87 0.60	0.87 191.86 0.92	0.86 205.29 1.21	0.95 230.22 0.66	1.20 255.89 0.87	$1.20 \\ 280.49 \\ 0.69$
Relations Foreign Affairs	1.60 -	0.69 -	0.79 -	1.34 -	1.39 -	1.60 -	1.48 2.72	1.54 3.58	2.21 3.45	1.66 4.82	1.82 5.09
Health . Aust. Radiation Lab. Inst. of	2.11	2.78	2.41	2.58	2.96	2.92	4.03	4.02	4.30	4.93	4.9
Health . Comm. Serum Lab. . National Biol.	2.06 3.87	2.37 5.00	2.62 5.50	3.02 6.22	2.49 7.22	2.32 8.89	3.47 5.79	3.84 6.37	4.39 6.91	3.59 7.60	3.4 9.4
Standards Lab	2.27	2.69	3.14	3.55	3.98	4.30	5.53	6.48	7.19	11.81	12.8
. Other	1.86	2.32	3.36	2.34	2.80	3.03	19.33	22.08	23.31	26.51	27.1

(\$ million)			R	&D			S&T (including R&D)					
	81-82	82-83	83-84	84-85	85-86	Projected 86-87	82-83	83-84	84-85	85-86	Projected 86-87	
Housing &												
Construction	1.88	2.01	2.01	2.34	1.96	2.60	54.11	52.06	71.53	46.82	43.0	
Immigration & El	thnic											
Affairs	0.12	0.20	0.04	0.10	0.12	0.11	3.09	3.94	3.18	2.28	1.5	
Industry Technolo	ogy	1.62	2.01	2.24	2.01	2.20	0.00	11.20	0.00	0.77	0.2	
& Commerce	1./2	1.63	2.01	2.34	2.01	2.30	8.86	11.30	9.88	8.67	9.3	
Administrative	it and											
Services	0.07	0.09	0.05	0.09	0.12	0.13	14 80	15 79	16.82	17.62	183	
Primary	0.07	0.07	0.00	0.07	0.12	0.15	11.00	15.77	10.02	17.02	10.5	
Industry	1.56	1.79	2.13	2.43	2.30	2.04	12.08	13.09	21.17	21.57	22.5	
P.M. &												
Cabinet	-	-	0.01	0.01	-	-	1.34	1.91	2.13	2.59	2.6	
Resources & Ener	rgy											
. AAEC	25.65	30.51	24.53	28.02	29.89	31.99	43.96	39.07	44.54	50.04	57.1	
. BMR	13.63	16.56	16.29	23.98	26.76	29.25	21.90	21.81	30.30	38.99	44.1	
. Other	0.03	0.10	0.13	0.08	0.04	0.04	15.41	13.77	14.18	17.32	21.3	
Science												
. AATB (Australi		1 00	1 72	1 57	1 6 4	1 62	1.00	1 72	1 57	1 6 4	1.62	
Antarctic	1.02	1.02	1.75	1.57	1.04	1.05	1.02	1.75	1.57	1.04	1.05	
Division	12.08	17 45	18 61	21.29	23.04	25 70	32.03	35 21	37.09	41 99	46.0	
AIMS	5 76	6 54	7.02	7 50	23.04	8.63	6 54	7 02	7 50	7 77	8.6	
CSIRO	273.2	326.6	321.1	318.8	349.8	382.8	341.0	341.2	335.8	363.7	397.8	
. Other	7.98	2.45	2.52	2.81	3.54	3.80	79.46	76.37	89.50	104.7	115.8	
Social												
Security	-	-	-	-	-	-	0.09	0.09	-	-	-	
Special												
Ministry	0.03	0.41	0.28	0.28	0.11	0.08	0.97	0.60	0.33	0.17	0.1	
Territories	0.34	0.29	0.46	0.35	0.48	0.55	2.92	2.87	2.66	2.61	3.0	
Transport	0.07	2.39	2.50	2.65	2.61	2.68	3.84	3.83	3.58	3.81	4.0	
Treasury	• • • •	6.00	4.00				00.40			100.04		
. ABS	3.89	6.08	4.33	6.68	7.84	8.28	99.19	99.35	116.38	123.96	166.6	
. Other	0.41	0.26	4.48	2.81	1.98	8.28	0.60	5.24	4.40	2.34	8.7	
Veterans Affoirs	0.22	0.40	0.27	0.42	0.62	0.60	0.84	11.20	12.15	12.45	12.0	
Allalis	0.32	0.40	0.37	0.42	0.03	0.00	9.04	11.20	12.15	12.45	12.9	
Total (Direct Con	nmonweal	lth										
funding of intran	nural											
expenditure)	514.5	600.6	602.3	633.1	688.6	752.9	1113.1	1142.9	1249.5	1360.3	1518.5	

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

(\$ million)	R&D							S&T (including R&D)				
-	81-82	82-83	83-84	84-85	85-86	Projecte 86-87	d 82-83	83-84	84-85	85-86	Projected 86-87	
Aboriginal Affairs	0.62	0.66	0.52	0.65	0.53	0.39	0.92	1.10	1.43	1.30	1.24	
Environment	1.02	0.80	1.04	1.31	1.56	1.70	2.26	3.67	4.33	4.56	4.44	
General's Aviation	0.34 0.34	0.36 0.29	$\begin{array}{c} 0.16 \\ 0.41 \end{array}$	0.31 0.39	0.21 0.38	0.13 0.36	0.36 16.38	0.17 16.06	$\begin{array}{c} 0.48\\ 16.28\end{array}$	0.30 16.70	0.13 17.24	
Communi- cations	1.33	1.58	1.84	1.99	3.85	5.50	6.98	10.40	14.31	17.24	20.91	
Services Defence	$0.24 \\ 0.74$	$0.46 \\ 1.05$	0.14 0.91	0.12 1.12	$0.14 \\ 1.08$	0.15 1.13	0.73 19.40	1.14 22.35	0.78 3.97	1.76 8.73	0.78 9.30	
Education . Post-grad. awards	8.54	11.17	14.60	15.42	17.56	19.11	12.57	16.48	17.21	19.27	20.97	
. Special Research Grants Special Research	85.0	94.0	104.0	114.0	126.0	128.0	94.0	104.0	114.0	126.0	128.0	
Centres . Other	1.50 2.64	5.90 1.73	5.70 1.93	5.70 2.14	5.90 1.47	6.00 1.81	5.90 2.99	5.70 3.10	5.70 3.55	5.90 2.73	6.00 3.85	
Employment & I.R. Foreign Affairs	0.11	0.06	0.39	0.80	3.65	3.16	0.33	0.61	1.53	4.43	3.94	
. ACIAR . ADAB . Other	19.82 0.21	0.96 28.92 0.37	4.75 27.49 0.38	8.62 31.21 0.44	8.59 31.53 0.02	9.78 23.39 0.03	1.11 144.8 1.26	7.00 164.4 1.32	9.46 178.1 1.33	8.59 189.5 0.11	9.78 173.6 0.09	
. NH&MRC . Other	25.65 2.86	29.56 4.20	37.98 4.48	44.18 7.72	51.24 4.71	58.95 5.31	29.56 5.49	37.98 5.93	44.18 8.03	51.24 5.25	58.95 5.66	
Construction Immigration	0.14	0.15	0.12	0.16	0.33	0.83	1.95	0.12	0.16	0.37	0.89	
& E.A Industry Technolog	0.27 gy	0.25	0.14	0.23	0.23	0.23	0.65	0.82	1.06	0.57	0.39	
& Commerce . AIRDIB . GIRD	3.39 21.75 -	3.72 47.87 -	5.02 57.80 -	4.14 54.39 -	13.53 51.96 -	13.90 40.86 10.31	14.07 47.87 -	21.99 57.80 -	23.24 54.39 -	50.18 51.96 -	58.83 40.86 10.31	
and Admin Services Primary Industry	0.02	0.08	0.03	-	-	-	1.57	1.95	1.84	1.15	1.10	
. Rural Research . Other	16.27 0.72	18.53 0.45	21.53 0.51	29.43 3.59	32.78 3.74	38.16 4.09	21.99 2.91	24.79 3.47	31.80 22.51	37.81 23.66	44.08 25.80	
P.M. & Cabinet	0.07	0.08	0.13	0.09	0.17	0.26	0.19	0.29	0.21	0.29	0.35	

 Table 4:
 Extramural Commonwealth Government expenditure on S&T by ministry, showing major extramural R&D funding programs

(\$ million)	R&D							S&T (including R&D)				
	81-82	82-83	83-84	84-85	85-86	Projected 86-87	82-83	83-84	84-85	85-86	Projected 86-87	
Resources & Ener	.gy											
. Energy R,D&D												
grants	9.27	11.69	13.72	12.29	12.46	15.10	13.87	16.29	15.21	13.19	15.98	
. Other	2.21	2.01	1.21	0.88	1.35	4.01	14.42	12.06	13.66	18.48	15.90	
Science												
. AMSTAC-NRF												
fellowships	3.80	3.04	3.27	6.23	8.84	9.31	3.04	3.27	6.23	8.84	9.31	
. ARGC	16.99	18.74	21.24	23.14	25.70	30.00	18.74	21.24	23.14	25.70	30.00	
. Other	0.53	1.57	1.87	2.84	2.75	2.74	3.91	3.58	7.04	7.54	8.72	
Social												
Security	0.55	0.59	0.68	0.68	0.64	0.75	0.59	0.68	0.68	0.64	0.75	
Special Minister												
of State	0.19	0.11	0.13	0.15	0.15	0.06	0.23	0.33	0.27	0.54	0.45	
Territories	0.01	0.02	0.02	0.02	-	-	0.14	0.31	0.29	0.3	0.39	
Transport	1.79	2.07	1.83	1.72	2.14	1.93	3.08	2.76	3.51	3.51	2.92	
Treasury												
. Reserve Bank												
grants	1.96	1.72	2.51	2.68	2.61	3.10	1.72	2.51	2.68	2.61	3.10	
. Other	0.20	0.20	0.21	0.45	0.25	0.45	0.22	0.22	0.45	0.25	0.45	
Total (Direct Con funding of extram	imonweal ural	th	220.7	270.0	410.1	441.0	10.6.1	57.6.1	(22.2	711 5	705.0	
expenditure)	231.1	294.9	338.7	379.2	418.1	441.0	496.4	576.1	633.2	/11.5	735.8	

2.4 Destination of extramural S&T 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 S&T purposes by sector of recipient. Table 6 is a similar summary of contracts.

Table 5:	Commonwealth S&T	grants by recipient sector,	1981-82 to projected	1986-87
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(\$ million)		R&D							S&T (including R&D)				
		81-82	82-83	83-84	84-85	85-86	Projecte 86-87	d 82-83	83-84	84-85	85-86	Projected 86-87	
Private Enterprise	N S	26.53 0.02	54.62 0.02	67.66 0.07	63.75 0.01	64.45 0.15	65.14 0.18	59.93 0.02	74.39 0.09	70.83 0.08	88.81 0.80	92.90 0.92	
	N+S	26.55	54.64	67.73	63.76	64.60	65.32	59.95	74.48	70.91	89.61	93.82	
Commonwe Agencies	ealth N S	9.82 0.32	11.53 0.10	12.64 0.01	15.86 0.01	11.23	13.62	13.68 0.10	14.98 0.01	16.56 0.01	12.66 0.03	15.10 0.06	
	N+S	11.51	11.63	12.65	15.87	11.23	13.62	13.78	14.99	16.57	12.69	15.16	
Higher Education	N S	85.5 32.6	116.2 35.63	131.6 39.20	151.5 42.8	185.3 45.5	197.7 47.2	129.7 48.7	152.1 50.6	179.8 56.3	216.6 58.8	222.6 64.3	
	N+S	131.4	151.8	170.8	194.2	230.7	244.9	178.4	202.7	236.1	275.3	286.83	
Other Bodies	N S	25.57 7.92	49.67 9.33	55.49 10.48	65.58 12.37	53.02 11.83	53.46 12.21	89.21 26.19	94.12 25.88	110.91 25.72	93.04 31.53	90.06 25.16	
	N+S	33.48	58.99	65.97	77.95	64.85	65.67	115.40	120.00	136.63	124.58	115.22	
Total (Direct funding all)	ct Com grants)	monweal 188.2	th 277.0	317.2	351.8	371.4	389.7	367.5	412.1	460.2	502.2	511.2	

N Natural sciences and engineering
 S Social sciences and humanities
 N+S Total natural sciences and engineering, social sciences and humanities





(\$ million)		R&D							S&T (including R&D)				
	-	81-82	82-83	83-84	84-85	85-86	Projected 86-87	82-83	83-84	84-85	85-86	Projected 86-87	
Private Enterprise	N S	1.71 0.67	2.40 0.46	1.65 0.50	1.83 0.94	5.86 2.04	11.58 2.09	58.47 2.81	90.32 3.16	78.38 6.28	94.87 6.10	95.87 7.29	
	N+S	2.38	2.86	2.15	2.77	7.87	13.87	61.28	93.48	84.66	100.97	103.16	
Commonwo Agencies	ealth N S	3.46 0.06	3.92 0.11	5.44 0.14	8.80 0.15	13.72 0.33	14.01 0.91	28.87 2.00	25.84 2.08	30.31 2.35	35.52 2.62	37.71 1.74	
	N+S	3.51	4.03	5.58	8.95	14.04	14.92	30.87	27.92	32.65	38.14	39.44	
Higher Education	N S	4.80 0.72	6.63 0.81	7.72 1.33	9.61 1.55	14.86 1.17	12.84 0.77	9.62 2.48	14.68 2.75	15.62 2.92	24.60 2.16	23.43 2.87	
	N+S	5.52	7.44	9.05	11.17	16.03	13.61	12.10	17.43	18.54	26.76	26.30	
Other Bodies	N S	2.72 3.18	3.37 0.19	4.49 0.24	4.18 0.35	6.23 2.45	6.41 2.48	24.07 0.55	23.15 2.00	35.23 1.86	38.13 5.32	47.88 7.77	
	N+S	3.18	3.55	4.73	4.53	8.68	8.90	24.61	25.15	37.09	43.46	55.65	
Total (Dired funding all	ct Comi contrac	nonwealt ts)	ih										
-		14.59	17.89	21.50	27.43	46.63	51.30	128.86	163.97	172.94	209.33	224.55	

Table 6: Commonwealth S&T contracts by recipient sector, 1981-82 to projected 1986-87

 N
 Natural sciences and engineering

 S
 Social sciences and humanities

 N+S
 Total natural sciences and engineering, social sciences and humanities

2.5 Commonwealth S&T expenditures by discipline-related categories

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, however, an ad hoc system of classification was derived for the Science and Technology Statement 1985-86. Some minor revisions have been made this year, but the results, in Table 7, should be used with caution. See C.9 for further details.

Table 7: Commonwealth Expenditures (Budget only) on S&T by discipline-related categories 1981-82 to 1986-87 (projected).

			R&D		S&T (including R&D)			
	82-83	83-84	84-85	85-86 \$m	Projected 86-87	85-86	Projected 86-87	
Engineering & Technology -								
Defence Application	115	122	133	139	146	225	279	
Engineering & Technology -								
Resources Application	20	22	22	22	24	27	28	
Engineering & Technology -								
Technology-intensive	104	107	1.4.4	164	171	220	259	
Industry	124	137	144	164	1/1	239	258	
Engineering & Technology -	22	24	26	20	22	80	76	
Physics and Mathematics	25 51	24 54	20	29 77	52 90	80 70	02	
Atmospheric and Space	51	54	50	11	70	1))2	
Science	2	2	2	3	3	82	92	
Energy Disciplines	58	67	63	59	64	93	102	
Chemistry (NEI)	21	23	25	28	30	37	40	
Earth Resources	51	59	51	55	60	116	128	
Water Resources &								
Physical Environment	37	31	29	27	32	37	36	
Marine Science	28	34	35	37	39	43	47	
Health & Medical Sciences	53	62	76	85	93	137	145	
General Biology (NEI)	31	35	39	43	46	56	59	
Rural Sciences	146	135	156	164	167	291	299	
Subtotal NSE	760	805	856	932	995	1573	1678	

			R&D			S (includi		
	82-83	83-84	84-85	85-86 \$m	Projected 86-87	85-86	Projected 86-87	
Business & Information Sciences	23	23	28	32	32	198	242	
Humanities & Social Sciences	39	45	50	52	54	79	81	
Subtotal SSH	63	69	80	86	89	279	325	
TOTAL (budget expenditure only)	823	874	936	1018	1084	1852	2003	

2.6 <u>Commonwealth Contribution to Gross Domestic Expenditure on R&D (GERD)</u>

Table 8, 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 substantially between 1968-69 and 1973-74 and again rose in real terms between 1973-74 and 1976-77; and between 1976-77 and 1978-79. The sharp initial rise was due primarily to changed administrative arrangements between the Commonwealth and States for funding higher education. The 1981-82 survey results (when adjusted to remove certain expenditure for that year which did not correspond to an increased level of activity) show the level of Commonwealth support remaining at approximately the same level as in 1978-79. 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. State Government funding of R&D as a percentage of GERD has undergone a small steady decrease since 1978-79. Table 12 (section 4.1) giving some Australian trends as % GDP, rather than % GERD, shows a more accentuated decrease.

In contrast to the relative stability of support by government, private enterprise funding of R&D fell sharply between 1973-74 and 1976-77. This reduced the private enterprise share of funding of the gross domestic expenditure on R&D (GERD) from 28% to 17%, and correspondingly increased the Commonwealth Government share from 58% to 66%. The share of R&D funded by private enterprise remained at about the same level until 1984-85, when it showed a marked recovery, matched by a corresponding fall in the relative contributions of Commonwealth and State Governments.

Sector of Funding	1968-69	1973-74	1976-77	1978-79	1981-82	Estimated** 1984-85
			(\$	m)		
Commonwealth Government - General Government - Public Enterprise*	n.a. n.a.	n.a. n.a.	541 38	666 29	938# 39	1287 50
Sub-total	173	383 ##	579	695	977#	1337
State Government - General Government - Public Enterprise*	n.a. n.a.	n.a. n.a.	111 6	140 8	179 16	240 20
Sub-total	61	67 ##	117	148	195	260
Private Enterprise Other Australian Overseas	116 9 10	186 7 11	152 10 14	180 18 13	291 32 16	500 40 27
Total (GERD)	369	654	872	1054	1511*	2164
Commonwealth Government funding as % GERD (%)	47	59 **	66	66	65	62
State Government funding as % GERD (%)	17	10 **	13	14	13	12
Private Enterprise funding as % GERD (%)	31	28	17	17	19	23

Table 8:Commonwealth Government and other sector funding contributions to Australia's gross
domestic expenditure on R&D (GERD): 1968-69 to 1984-85

- Note: Table 7 is based on national R&D surveys and includes the imputed research component of higher education teaching-and-research expenditures. All other tables exclude this imputed component (see A.10.2). For consistency with later practice some other adjustments have been made to figures for the first three surveys.
- # A downward adjustment of \$37m has been made to allow valid trend comparisons on the level of support for R&D activities. The adjustment allows for changed superannuation arrangements (\$27m) and an additional pay period in 1981-82 (\$10m) for Commonwealth bodies.
- ## Much of the large rise in Commonwealth funding between 1968-69 and 1973-74 is due to changed funding arrangements for universities from States to Commonwealth.
- * The attribution of public business enterprise funding between Commonwealth owned and State owned enterprises is based on estimates by the Department of Science.
- ** Estimates made by DOS, based on the "Science and Technology Statement 1985-86" and ABS publications "Research and Experimental Development, Business Enterprises - 1984-85, preliminary" (8109.0) and "Research and Experimental Development, Higher Education Organisations, 1984, preliminary" (8115.0).

Sources : see page 23.

Fig 4. Gross Expenditure on R&D by Sector of Funding DOS Estimates for 1984-85 (\$million)



Sector of Performance	1968-69	1973-74	1976-77	1978-79	1981-82	Estimated** 1984-85
			(\$	m)		
Commonwealth Government - General government - Public business enterprise*	n.a. n.a.	n.a. n.a.	289 37	321 32	478* 42	577 56
Sub-total	117	208	326	353	520#	633
State Government - General government - Public business enterprise*	n.a. n.a.	n.a. n.a.	126 6	149 8	194 13	235 14
Sub-total	41	76	132	157	207	249
Private business enterprise Higher education Private non-profit	119 89 2	191 174 6	160 244 11	206 326 13	312 453 21	590 666 25
Total (GERD)	368	655	873	1055	1512*	2164
General Government Performance as % GERD	n.a.	n.a.	48	45	45	38
Business Enterprise (including Public) Performance % GERD	n.a.	n.a.	23	23	24	31
Higher Education Performance as % GERD	24	27	28	31	30	31

Table 9: Sectoral Performance of Gross Domestic Expenditure on R&D (GERD) : 1968-69 to 1984-85

A downward adjustment of \$37m has been made to allow valid trend comparisons on the level of support for R&D activities. The adjustment allows for changed superannuation arrangements (\$27m) and an additional pay period in 1981-82 (\$10m) for Commonwealth bodies.

* The attribution of public business enterprise funding between Commonwealth owned and State owned enterprises is based on estimates by the Department of Science.

** Estimates by DOS.

Note : An estimate of university overheads attributable to R&D activities is included for all years, in accordance with ABS practice from 1978 onwards. For 1968-69 and 1973-74 the addition is estimated to be 31%.
Sources: Data for Tables 8 and 9 are based on:

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- 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, 1981-82 (1 March 1984)
 8105.0, Business Enterprises, 1984-85 (preliminary) (27 May 1986)
 8114.0, Business Enterprises, 1983-84 (Inter-year survey) (7 June 1985)
 8109.0, General Government Organisations, 1981-82 (27 January, 1984)
 8111.0, Higher Education Organisations, 1981 (6 October 1983)
 8115.0, Higher Education Organisations, 1984, preliminary (15 August 1986)
 8112.0, All Sector Summary, 1981-82 (3 April 1984)

Science and Technology Statement 1985-86.

Fig 5. Gross Expenditure on R&D by Sector of Performance DOS Estimates for 1984-85 (\$million)



CHAPTER 3

R&D TRENDS AND DEVELOPMENTS BY SOCIO-ECONOMIC OBJECTIVE

3.1 <u>Presentation of Trends</u>

The discussion of trends is subject to a number of problems and associated choices. The period of time over which the trend is taken is obviously a major determinant of any percentage increase/decrease which may be derived. Then, should one estimate the trend overall simply by looking at the expenditure level at the beginning and end of the period, or should some smoothing procedure be utilised so that all the data are used? Further, are there some expenditure components which may perhaps confuse rather than enlighten?

There is no generally accepted procedure for dealing with these issues. Usually, the problems are avoided either by not discussing trends at all, or by presenting year-on-year percentage changes.

In this Chapter both long- and short-term trends 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 two years for the category "urban and regional planning".

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 7, page 29.)

3.2 <u>Recent Developments</u>

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 <u>Summary Data</u>

Table 10, which combines the Budget and Non-budget sectors, shows Commonwealth R&D expenditures at current prices directed towards the various socioeconomic objective categories. Table 11 presents the same data as Table 10, but in real terms (constant 85-86 dollars). Figure 6 shows constant dollar trends for four of the largest categories of socio-economic objective.

Objective Category	78-79**	79-80**	80-81**	81-82 ^{(\$}	m) 82-83	83-84	84-85	85-86	Projected 86-87
National security . Defence	79.18	85.42	98.06	103.39	114.43	121.21	132.99	138.65	145.6
Economic developme	ent								
. Agriculture	68.98	91.83	108.99	120.63	128.79	115.09	133.71	145.04	155.7
. Other p.i.	12.47	14.47	14.76	17.40	19.72	26.13	25.09	25.84	28.1
. Mining	15.35	13.41	17.38	23.12	20.46	22.37	22.51	22.87	24.5
. Manufacturing	66.62	77.45	101.03	86.90	114.27	113.19	128.40	157.63	164.4
. Construction	8.02	7.65	7.63	7.73	8.36	8.27	10.33	14.33	16.3
. Energy	28.88	33.74	42.20	52.51	69.24	67.40	63.65	59.52	65.3
. Transport	4.80	5.02	4.64	3.50	5.71	5.59	5.61	6.57	6.6
. Communications	27.62	28.48	37.65	40.30	47.30	46.84	50.14	59.31	67.9
. Econom serv nei	12.69	14.84	17.71	17.34	18.17	22.73	30.44	21.25	30.4
Sub-total	245.43	286.88	351.98	369.42	432.01	427.61	469.87	512.36	559.1
Community welfor									
Linh & Dag Di	1 4 4	1 70	1 4 1	1 70	2.05	262	2.59	0.12	0.1
. UID & Keg .F1. Environment*	16.34	10.00	20.36	24.85	2.95	2.02	2.50	28 70	31.5
Health	26.78	30.24	20.50	24.85	55.42	66 13	78.65	20.79	00.2
Education*	20.76	3 20	4.00	3 85	2 56	2.08	3 50	3 18	31
Welfare	0.00	1 10	1.76	2.04	2.30	1.96	2.50	3.10	4.0
. Commun serv n.e.i.	0.71	1.17	1.70	2.04	5.52	1.70	2.07	5.70	4.0
assistance	12 47	12.43	15 23	20.00	30.22	32 58	40.24	40 14	33.2
- Oth Comm Serv	2.33	2.55	3.07	3.44	4.12	5.34	6.58	6.73	5.3
Sub-total	63.92	71.48	81.58	100.86	135.23	143.45	165.19	170.92	176.4
Advancement of know	wledge		·			•	•	•	•
& Atmosphere	27.94	32.36	42.27	45.99	61.72	68.22	63.21	67.30	75.4
. General advanceme of knowledge	nt 94.63	100.14	112.69	125.92	152.12	180.46	181.03	217.43	237.4
							0		
Sub-total	122.57	132.50	154.95	171.91	213.84	248.68	244.24	284.73	312.8
Total	511.10	576.28	686.56	745.58	895.50	940.96	1012.29	1106.66	1193.9

Table 10: Total Commonwealth Government expenditure on R&D by socio-economic objective* Current Prices

- * Sec of Appendix B.I for more detailed dissections of expenditure by socio-economic objective. See Table 13 for international comparisons of R&D expenditure by OECD objective category. See Table 11 for 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.

Objective Category	78-79**	79-80**	80-81**	81-82 ^{(\$}	Sm) 82-83	83-84	84-85	85-86	Projected 86-87
National security . Defence	144.77	143.15	145.76	133.07"	135.50	136.23	142.30	138.65	137.7
Economic developme	ent								
. Agriculture	127.50	157.16	166.29	161.16	155.33	129.88	142.49	145.04	147.0
Other p.i.	22.66	24.15	21.87	22.57	23.41	29.66	26.67	25.84	26.5
Mining	27.92	22.47	25.94	29.93	24.23	25.12	23.98	22.87	23.1
Manufacturing	124.41	132.89	153.09	113.82	138.90	129.39	137.20	157.63	154.8
Construction	14.69	12.83	11.34	9.93	9.84	9.23	10.98	14.33	15.4
Energy	52.73	56.66	63.04	68.35	82.45	76.06	68.05	59.52	61.6
Transport	8.79	8.40	6.93	4.64	6.80	6.30	5.97	6.57	6.2
Communications	50.08	47.30	56.61	52.61	56.22	52.68	53.41	59.31	63.9
Econom serv	22.11	24.92	26.42	22.42	21.40	25.70	20.45	21.25	29.7
nei	23.11	24.82	26.42	22.42	21.40	25.70	32.45	21.25	28.7
Sub-total	451.94	486.87	531.54	485.43	518.58	484.04	501.20	512.36	527.4
Community welfar : . Urban & regional									
planning	2.63	2.99	2.10	2.29	3.50	2.92	2.74	0.12	0.1
. Environment*	29.85	33.54	30.39	32.31	43.50	35.70	32.91	28.79	29.8
. Health	48.94	50.72	52.76	58.75	66.19	74.84	83.55	88.28	93.1
. Education*	6.62	5.49	6.02	5.05	3.05	3.36	3.72	3.18	3.0
. Welfare	1.66	2.00	2.60	2.64	3.92	2.21	2.86	3.70	3.7
. Community service	es n.e.i.								
- O/seas developme	ent	20.05	22.00	24.74	26.72	27.01	12 00	10.1.1	21.1
assistance	22.77	20.85	22.80	26.76	36.72	37.01	42.90	40.14	31.1
serv	4.22	4.26	4.56	4.44	4.89	5.98	7.00	6.73	5.0
Sub-total	116.69	119.84	121.22	132.24	161.77	162.06	175.68	170.92	165.8
Advancement of kno	wledge						-	-	
atmosphere	50.87	54.27	63.04	60.10	74.06	77.64	67.85	67.30	71.0
. General advanceme	ent of								
knowledge	171.64	167.28	165.65	166.15	182.51	204.38	192.65	217.43	222.0
Sub-total	222.51	221.54	228.68	226.24	256.56	282.01	260.50	284.73	293.0
Total	935.91	971.20	1027.21	976.99	1072.41	1064.31	1079.69	1106.66	1123.8

Table 11:Total Commonwealth Government expenditure on R&D by socio-economic objective*
Constant (1985-86) Prices

- * See Table 13 for international comparisons of R&D expenditure by OECD objective category. See Table 20 and comments (Appendix C.10) 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.



Fig 6. Commonwealth Expenditure on R&D by Socio-economic Objective.

3.4 **DEFENCE** (\$145.6m projected for 1986-87)

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 1986-87): -0.5% pa
- Short-term trend (1984-85 to projected 1986-87): -1.6% pa

Recent Developments

R&D activity during 1985-86 has included:

- . Under project Kariwara, research is being conducted to identify the technologies, risks and plans for subsequent engineering development of a low cost, slim line, reelable towed hydrophone array for surface ship application.
- . Advances in optoelectronics 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 have been studied successfully using scanning electron microcopy.
- 3.5 **AGRICULTURE** (\$ 155.7m projected for 1986-87)

Major programs

CSIRO accounts for about 72% of R&D expenditure under this heading with the Rural Research Trust Funds administered by the Department of Primary Industry accounting for most of the balance (wool, 6%; meat, 4%; wheat, 5%; and others, 13%).

Fig 7 Commonwealth R&D Expenditure on Agriculture by Type of Expenditure



Growth trends

- long-term trend (1978-79 to projected 1986-87): -0.3% pa
- short-term trend (1983-84 to projected 1986-87): +1.6% pa

Recent developments

- . During 1985-86 the Rural Industry Research Fund 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. It provides Government contributions to rural research outside the scope of the industry-specific Commonwealth rural research funding arrangements.
- . The CSIRO Division of Animal Health has successfully demonstrated experimental immunisation of sheep and cattle against mastitis caused by infection with the bacterium <u>Staphylococcus aureus</u>. This form of mastitis costs the Australian dairy industry some \$50 million each year. An industry partner is being sought to produce the vaccine for testing in dairy herds and ultimately for marketing.
- . For the first time, scientists at CSIRO's Division of Animal Production successfully transplanted a sheep growth hormone gene, an achievement that is a major step towards creating faster-growing, larger and leaner sheep. The first 'transgenic' sheep was born on 25 April, Anzac Day, 1986. Copies of the sheep growth hormone gene were introduced into a one-cell-stage embryo by micro-injection. The embryo containing the injected genes was transferred into a surrogate mother and normal foetal development followed.
- . The Australian Animal Health Laboratory (AAHL) of CSIRO developed an improved diagnostic test for foot-and-mouth disease (FMD) that does not require the use of live virus. The test will be used by AAHL to test for the presence of FMD when outbreaks of diseases suspected to be exotic occur in Australia. The improved test is expected to be of considerable value in contributing to the control of the disease in South East Asia.
- AAHL has developed the capability to diagnose other exotic diseases including Newcastle disease, avian influenza, rabies, Aujeszky's disease, swine fever and contagious bovine pleuropneumonia. It has also developed a diagnostic technique that differentiates between bluetongue virus, epizootic haemorrhagic disease of deer virus, and other closely related Australian viruses. The lack of specificity of conventional tests was resulting in animals giving false positive results and being barred from export.
- . CSIRO's Division of Tropical Animal Science has bred three chimera calves at the Division's field station near Rockhampton, Queensland. These calves, containing Brahman and British-breed type cells, were produced by splitting embryos from Brahman and British cows and then rearranging the split embryos to produce embryos with a mixture of the genetic material of the two breeds. It is believed that only three other similar calf chimeras have been produced in the world.
- Previously, the CSIRO Division of Entomology has carried out research in Papua New Guinea into the feasibility of developing a control system against screw-worm fly based on the use of sterile males. The successful outcome of that research has now resulted in the formation of a special laboratory in Papua New Guinea to mass produce enormous numbers of sterile males of the screw-worm fly. The laboratory is a joint facility of CSIRO and the Commonwealth Department of Primary Industry. A campaign of control has been drawn up under the oversight of the Department for immediate implementation should the fly be found in Australia. The screw-worm fly is a major pest of livestock in PNG, and would seriously damage Australia's livestock industries if it entered the country.
- CSIRO plant breeders continue to produce improved varieties of crops for Australian agriculture. The Division of Plant Industry has released the latest in its series of new cotton varieties. Siokra is an early-maturing, high yielding variety bred at Narrabri, NSW, especially for the industry in New South Wales and Queensland. The Division has had success with linseed, as well. Until now, the use of linseed oil was confined to the paint industry, but by using a chemical mutagen, a plant breeder has bred a linseed mutant suitable for human consumption by greatly reducing the content of the offending fatty acid, linoleic acid. The Centre for Irrigation Research has released new safflower varieties resistant to root rot organisms. This now increases the range of winter/spring oilseed crops from which cereal farmers may choose alternatives to their traditional grain crops.

- . Scientists in the Division of Protein Chemistry carried out the identification and structural characterization of the sulphur-rich protein from pea seeds which allowed the Division of Plant Industry to identify and transfer the corresponding gene to produce sulphur-rich plants for animal feedstuffs which have the potential to increase wool growth.
- . South Australia has an important barley-growing industry. For some time, many barley crops have not looked healthy and have given depressed yields. Research within the CSIRO Division of Soils has identified boron toxicity as the causal agent and now wheat has been identified as a victim as well. These discoveries have given added impetus to the launching of breeding programs to develop new resistant barley and wheat varieties.
- . CSIRO (Divisions of Animal Health, Protein Chemistry and Molecular Biology) in collaboration with the University of Sydney have successfully produced a prototype vaccine against sheep footrot by genetic engineering. Two commercial companies, Arthur Webster Pty Ltd and Biotechnology Australia, have undertaken to support the development of this pili-based sub-unit vaccine.

3.6 **OTHER PRIMARY INDUSTRIES** (\$28.1m projected for 1986-87)

Major programs

About 77% of R&D here is accounted for by CSIRO. Programs administered by the Department of Primary Industry account for the balance.

Growth trends

- long-term trend (1978-79 to projected 1986-87): +2.5% pa
- short-term trend (1984-85 to projected 1986-87): -0.3% pa

Recent developments

. Some positive answers to the controversial question of whether aircraft can provide a cost-effective means of fighting bushfires in Australia are contained in a 300-page report "Aerial Suppression of Bushfires" released in April 1986 by CSIRO. The computer simulation study, by CSIRO's National Bushfire Research Unit, has highlighted three kinds of aircraft -

a Douglas DC6, a Thrush crop duster and a Bell helicopter - which clearly could have 'earned their keep' during a five-year period of bushfires in Victoria. However, several other types of aircraft, including the Hercules, Neptune, Grumman Tracker and the 'water scoopers' such as the Canadair CL-215, would have cost a good deal more to operate, than they would have saved in fighting fires. The cost-benefit study incorporated results from Project Aquarius, a major CSIRO research program on bushfires. It evaluated a range of aircraft and ground suppression techniques.

- . CSIRO is strengthening its research on tropical rainforests at Atherton in north Queensland. A new research leader has been appointed, a new building erected and the scientific staff increased in number, mainly by redeployment from other centres.
- . A joint exploratory and experimental fishing program by CSIRO's Division of Fisheries Research and the Tasmanian Department of Sea Fisheries has revealed a promising prawn fishery in deep waters off Tasmania's West Coast. Further studies of the prawn ground will be carried out in collaboration with commercial fishermen.

3.7 **MINING** (\$24.5m projected for 1986-87)

Major programs

CSIRO accounts for about 72% of R&D expenditure directed towards this objective. The Bureau of Mineral Resources, Geology and Geophysics (BMR) accounts for most of the remainder.

Growth trends

- Long-term trend (1978-79 to projected 1986-87): -1.7% pa
- Short-term trend (1984-85 to projected 1986-87): -1.8% pa

Recent developments

- . A CSIRO borehole logging system SIROLOG has been licensed for manufacture to Geosource Inc. an Australian company.
- . CSIRO and Hamersley Iron Pty Ltd have developed an on-stream analyser to monitor continuously the iron content of iron ore on a moving conveyor belt. A commercial prototype, made by Mineral Control Instrumentation Pty Ltd, is undergoing industrial trials.
- 3.8 **MANUFACTURING** (S 164.4m projected for 1986-87)

Major programs

For R&D expenditure reported for this objective, Grants for Industrial Research and Development Scheme accounts for 7%, commitments under the Australian Industrial Research and Development Incentives Scheme accounts for 27%, at the National Space Program for 3%. CSIRO, 56%, accounts for the balance.



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

Growth trends

- long-term trend 1978-79 to projected 1986-87): +2.2% pa;
- short-term trend (1984-85 to projected 1986-87): +6.2% pa

Recent developments

The National Space Program was inaugurated in July 1985, to help position industry to participate in space technology. The program will introduce the stimulus necessary for

industry to develop the new technological, managerial and production skills essential in this high technology area.

The second stage of the Computer Integrated Manufacturing Demonstration Program (CIMDP), under the aegis of the Department of Industry, Technology and Commerce, is now underway. The Program is designed to assist in improving the international competitiveness of Australian manufacturing industry by developing and providing information on the benefits of adopting appropriate advanced manufacturing techniques and technologies. Major features of the Program include feasibility studies and demonstration projects in industry, Commonwealth-State Technology Application Centres, case studies which will document the CIM experience of Australian companies and a dissemination program which will market the knowledge gained in the Program to industry, in a way which maximises the chances of its successful adoption.

- . The ICI Australia Ltd CSIRO project on zirconia manufacture has resulted in the establishment of a joint company, Z-TECH Pty Ltd. The company aims to penetrate overseas markets for high technology ceramic materials produced by a zirconia manufacturing plant to be built by ICI in Western Australia.
- . CSIRO has developed an instrument, now being manufactured by Chemtronics Ltd of WA, that will analyse liquids for trace metals in very small quantities (parts per billion). The Portable Digital Voltammeter is simple and cheap and can be used in mineral exploration, environmental surveys, pollution control and in analysis of industrial processing solutions.
- . Research and development, by the Division of Protein Chemistry, has led to the Sirolime process for unhairing cattle hides. This process has been taken up by the Australian industry and has been cited, by tanneries in Europe, as a major breakthrough in leather processing.
- . Research on biomembranes at the Division of Chemical and Wood Technology has led to the establishment by Betatene Ltd of a plant at Whyalla, South Australia to extract beta-carotene from the marine alga <u>Dunaliella salina</u>. The plant was recently commissioned and the Company has already made shipments of beta-carotene to the USA against a contract worth more than \$2 million. Exports of beta-carotene and other algal products are expected to grow to \$10-20 million per annum.
- . The CSIRO Division of Food Research's Meat Research Laboratory at Cannon Hill, Qld, developed a technique for extending the shelf-life of vacuum-packed carcasses or cuts of meat by acetic acid surface treatment of the meat. The treatment consists of a ten-second dip or spray with dilute acetic acid to reduce the surface bacteria count. Shelf-life is extended by up to 50%. This allows penetration of overseas markets with chilled products transported by sea instead of air as is necessary in the absence of this treatment. Commercial shipments have already been made to Europe and the Middle East.
- . CSIRO has taken an active role in establishing the Victorian CAD/CAM Centre. This Centre is providing industry awareness, training, assistance in introducing systems and project assistance to companies in the computer aided design and manufacturing fields. The CSIRO Division of Manufacturing Technology is temporarily accommodating the Centre within its Preston buildings. The Executive of CSIRO has agreed to the construction of a new building on the CSIRO land at Preston.
- . The lifetime of cutting and forming tools can be increased substantially by depositing hard wear-resistant coatings onto the surface of the tool. At the CSIRO Division of Applied Physics, a pilot plant has been constructed for depositing titanium nitride (TiN) by electric arc evaporation. The project, in collaboration with Sutton Tools Pty Ltd, has reached the stage where some 600 1000 6mm drills can be coated with TiN to a thickness of 2-5 micrometres in an automatically controlled deposition system containing 4 arc evaporators. The performance of the coated tools is being assessed by computer controlled drilling tests by Sutton Tools and the data used to optimise the deposition process.
- . A project on industrial statistics has begun in the CSIRO Division of Mathematics and Statistics. Initial work will concentrate on the vital issue of quality control in manufacturing.

The recently instituted Mathematics-in-Industry study group, a forum during which a number of specific industrial processes are examined and involving CSIRO and industry, now seems to be established as a mechanism for fostering the effective use of mathematics in Australian industry.

- . The discovery overseas of the remarkable magnetic properties of the rare-earth compound neodymium-iron-boride (Nd₂Fe₁₄B) has opened up many new opportunities for Australian industry, in areas ranging from refinement of rare-earth minerals to the manufacture of new kinds of electric motors for domestic appliances. To provide a foundation for Australian industry in this field, the CSIRO Division of Applied Physics has developed the techniques required to manufacture rare-earth supermagnets. The Division is now in a position to provide magnets for research purposes and, moreover, is currently transferring the fabrication technology to an Australian manufacturer.
- . The experience gained by the CSIRO Division of Radiophysics and engineering consultants Macdonald Wagner in designing antennas for the Australian Telescope has led to the awarding of contracts worth \$20 million to Australian industry for the construction of antennas for the OTC (telecommunications) and the Australia Telescope (radio-astronomy). Construction of large antennas for use in telecommunications and radio-astronomy is a new venture for the companies concerned. The award of these contracts will give Australian industry experience in a market which will expand rapidly with the growing use of satellite communications.
- . The National Measurement Laboratory of the CSIRO Division of Applied Physics has exchanged statements with the corresponding UK and USA Laboratories to give formal recognition to the equivalence of six of the most basic primary standards of measurement: length, time, temperature, volt, capacitance and resistance. The mutual recognition of equivalence will assist many Australian businesses, particularly manufacturers of high technology products who are required to satisfy stringent technical specifications set by UK or US partners.
- . A joint venture company, Dunlena Pty Ltd, has been formed between CSIRO and a major international partner, Du Pont, to develop novel crop protection chemicals for manufacture in Australia for the world market. The CSIRO Division of Applied Organic Chemistry has committed research resources to the extent of \$1.75 million this year to design and produce trial quantities of these chemicals for field and toxicology testing by Du Pont. The accrued commitment of resources will be credited to multi-million dollar equity in Dunlena on behalf of CSIRO.

3.9 **CONSTRUCTION** (\$16.3m projected for 1986-87)

Major programs

CSIRO accounts for about 73% of R&D expenditure under this heading. Elements of the Department of Housing and Construction (Central Investigation and Research Laboratory, National Building Technology Centre, etc) account for the balance.

Growth trends

- Long-term trend (1978-79 to projected 1986-87): +0.6% pa;
- Short-term trend (1984-85 to projected 1986-87): +18.5% pa

Recent Developments

. The National Building Technology Centre (NBTC) has succeeded in obtaining international acceptance of its core radiator as the basic component of apparatus for a suite of materials tests based on radiant heat flux. In addition, the ignitability test developed by NBTC has been ratified by the International Standards Organisation for publication as an international standard. Such successes facilitate the export of Australian building and furnishing materials.

- . Field tests in such large buildings as the Commonwealth Offices in Adelaide and Jupiter's Casino on the Gold Coast provided NBTC with the opportunity to evaluate methods of smoke-control developed through applied research.
- . Research in the NBTC acoustic laboratories into the mechanism of sound transmission through masonry walls has revealed that the 'acoustic porosity' of the materials is a significant determinant. Whereas it was believed that the application of plaster or render to a wall improved its sound insulation by virtue of the additional weight, NBTC has shown that the improvement is due largely to the 'sealing' of the wall. This has revealed a useful direction for development: the formulation of relatively cheap methods for improving sound insulation.
- . To assist people in local government to make planning decisions regarding housing, infrastructure and services a suite of interactive programs based on microcomputers has been developed by CSIRO Building Research. This has presented local government with a major opportunity at a cost within reach of small units to enhance productivity in the face of growing demands upon its human resources and advances its capacity for innovative decision making. The relevant software has been widely disseminated and accepted in the local government sector throughout Australasia. This is producing substantial changes in the way local government operates, the services they can offer, the nature of the tasks performed, and the quality of the decisions made.
- . CSIRO Building Research has combined new technology with traditional practices to produce a microcomputer based cost-estimation system for use by builders when quoting for alterations and additions to houses. It greatly reduces the time and effort needed with no loss in accuracy and consistency. The system identifies 20 cost centres within the construction process and evaluates the task by using material and labour input coefficients. The Housing Industry Association has chosen this system from many others for use by its members through the HIATEX videotex network, and in a microcomputer version.
- 3.10 **ENERGY** (\$65.3m projected for 1986-87)

Major programs

CSIRO accounts for 42% of the research expenditure on energy, but other major activities are supported by AAEC (21%), the National Energy Research Development and Demonstration Program (19%) and BMR (18%).

Growth trends

- Long-term trend (1978-79 to projected 1986-87): +1.7% pa;
- Short-term trends (1984-85 to projected 1986-87): -4.8% pa

Recent developments

- . A non-radioactive pilot plant is being developed by the Australian Atomic Energy Commission at Lucas Heights. The plant is designed to demonstrate all steps in the production of SYNROC filled cannisters and to commence the related testing procedures.
- . Significant advances in coal exploration techniques and in disposal of coal wastes resulted from two recent research projects funded under the National Energy Research, Demonstration and Development Program.

These advances are:

- a seismic technique for detecting faults in underground coal seams (carried out by BHP with a \$750 000 contribution from the Commonwealth)
- development of a new method for treatment and disposal of wastes from coal preparation plants (developed by the Joint Coal Board, with a grant of \$1.25m from the Commonwealth and in partnership with CSIRO).

- . CSIRO and the State Electricity Commission of Victoria have developed an instrument to detect poor quality coal as it is being mined in open-cut seams. Commercial prototypes, built by Mineral Control Instrumentation Pty Ltd, are being tested on dredgers at the Loy Yang mine in the Latrobe Valley, Victoria.
- . CSIRO has begun a major project to help safety in underground coal mines. The work, which is funded by the Australian Mineral Industries Research Association, will investigate rock and roof reinforcement in underground coal mines so that roof support systems can be improved.
- . A program of work on catalytic partial oxidation has been initiated in the CSIRO Division of Materials Science. This program is aimed at converting methane, available from Australia's abundant natural gas resources, directly to liquid fuel in the form of methanol or lower aliphatics.

3.11 **TRANSPORT** (\$6.6m estimated for 1986-87)

Major programs

R&D activities contributing to this objective include support for the Australian Road Research Board (25%), Department of Aviation programs (44%) and the Office of Road Safety (17%).

Growth trends

-Long-term trend (1978-79 to estimated 1986-87): -3.5% pa -Short-term trend (1984-85 to estimated 1986-87): +1.8% pa

3.12 **COMMUNICATIONS** (\$67.9m projected for 1986-87)

Major programs

The R&D activities of Telecom (89%) account for most of this objective. An important contribution is also made by the Overseas Telecommunications Commission (8%). It is worth noting that over 99% 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 1986-87): +2.6% pa;
- Short-term trend (1984-85 to projected 1986-87): +9.4% pa

Recent developments

- . In the area of submarine optical communications, the Overseas Telecommunications Commission (OTC) has placed a number of R&D contracts with the objective of upgrading the capability of local industry to participate in the supply of future submarine systems. Emphasis has been placed on innovative cable design and submarine repeater technology.
- . The communications satellites AUSSAT-1 and AUSSAT-2 were successfully deployed. These satellites are greatly enhancing communications links across the country.

3.13 **ECONOMIC SERVICES** (\$30.4m projected for 1986-87)

<u>Major Programs</u>

CSIRO provides 61% of R&D expenditure under this heading. Other supporting agencies include the Reserve Bank (19%), Australian Bureau of Statistics (12%), Bureau of Industry Economics (7%), and Department of Employment at Industrial Relations.

Growth trends

- Long-term trend (1978-79 to projected 1986-87): +1.6% pa;
- Short-term trend (1984-85 to projected 1986-87): -5.9% pa

Recent developments

- . The new CSIRO Division of Information Technology, has been established in leased premises in Sydney and Melbourne close to existing strengths of information technology endeavours. A third centre on the ANU campus should be established soon in line with a policy to build up the Division in close collaboration with industrial and academic partners. The Division has established close links and begun collaborative research projects with a number of industrial companies and tertiary educational institutions. Research projects are now underway in the Division in the areas of computer networking; communications standards and conformance testing (including participation in the formation of the National Standards Protocol Centre); the design of integrated circuits; software reliability; knowledge-based systems; geographic information systems; and image processing and advanced graphics.
- . In the CSIRO Division of Radiophysics, increased emphasis is being placed on work in core areas of information technology, such as gallium arsenide devices and microwave integrated circuits, VLSI chips for signal processing, and software for image reconstruction from sparse data, which will find application in medicine, geology, non-destructive testing, and remote sensing.

3.14 **URBAN AND REGIONAL DEVELOPMENT** (\$0.1m projected for 1986-87)

Major programs

CSIRO accounts for about 87% of R&D expenditure under this heading. The Department of Territories and ABS cover the remainder.

<u>Growth trends</u> (See note in Section 3.1, p. 24)

- Long-term trend (1978-79 to projected 1986-87): -29.7% pa;
- Short-term trend (1984-85 to projected 1986-87): -78.8% pa

Recent Developments

. The CSIRO Division of Water and Land Resources has developed and marketed a computerised land use planning system called LUPLAN. A number of resource and land management agencies in the States have used the package which can be handled by microcomputers. Well over one hundred copies of the package have been distributed, of which nearly half went to overseas users. Distribution is now being handled by a CSIRO-linked company, SIROMATH Pty Ltd.

3.15 **ENVIRONMENT** (\$31.5m projected for 1986-87)

Major programs

Two thirds of the activities directed to this objective are conducted by CSIRO. Other agencies include the Office of the Supervising Scientist for the Alligators Rivers Region (18%), and AAEC (11%). The balance is given by activities under the Arts, Heritage and Environment Portfolio.

Growth Trends

- Long-term trend (1978-79 to projected 1986-87): -0.3% pa;
- Short-term trend (1984-85 to projected 1986-87): -4.9% pa

Recent developments

- . A five year survey of the flora of Cape York Peninsula was completed. The survey was carried out by the Queensland Department of Primary Industries using funds from the Australian Biological Resources Study. It revealed 2532 species of native plants and 121 species of naturalised exotic plants. At least three previously unknown genera and many new species were discovered.
- . Technology developed by CSIRO to de-water industrial wastes containing fine particles, such as those from coal or sand washing operations, is to be commercialised worldwide by Davy McKee Pacific Pty Ltd.
- A new system for treating sewage has been patented by the CSIRO Division of Chemical and Wood Technology, in association with Melbourne University. The alternating aerobic/anaerobic (AAA) completely mixed activated sludge system removes the nitrogen compounds present as well as reducing both the aeration energy and sludge production normally associated with sewage treatment. Field trials carried out on a 21 000 person equivalent sewage plant at Brushy Creek, Victoria, have demonstrated that the AAA system is capable of producing effluent of significantly improved quality, while the aeration energy saving and the sludge reduction was found to be in the order of 30% and between 15 to 40% respectively.
- . In the Kakadu National Park in the Northern Territory, detailed surveys by the CSIRO Divisions of Wildlife and Rangelands Research and Forest Research have been carried out on the fauna species in relation to vegetation, abundance of buffaloes, fire effects and human disturbance. This has provided a sound objective basis for the Australian National Parks and Wildlife Service to draw up management plans for the Park, which has international status as a unique area.
- . The microcomputer version of CSIRO's original Barrier Reef Image Analysis (BRIAN) system was launched in February 1986. The new system is being marketed in Australia and overseas by Melbourne based company, MPA Pty Ltd. The fast, accurate and relatively inexpensive system for processing satellite images looks set to win a big share of the world's computerised image analysis market. BRIAN was designed to survey the Great Barrier Reef and has saved the Government over \$20 million and 10 years of survey effort. In an agreement drawn up by Sirotech, CSIRO and MPA have transferred the system to a microcomputer and packaged it for commercial release at around half the price of its nearest competitor. For \$33 000 any company or authority concerned with managing large areas of natural resources will be able to process commercially available satellite data on its own facility.
- . Scientists at the CSIRO Division of Environmental Mechanics are helping to introduce to Australia a new technique for the rapid, in situ, non-destructive determination of soil water content. The technique, Time Domain Reflectometry (TDR), is based on the measurement of the travel time of a high frequency electromagnetic wave moving through a known path in the soil. Because TDR responds to the electrical conductivity of the soil, it can also be used to determine the relative salt concentrations in saline soils. The speed and precision of TDR promise significant advances in the application of soil physics to challenging environmental problems. For example, knowledge of water content near the surface of a soil is important for erosion prediction and control. Another novel application is the use of TDR to measure the water content of large stored coal heaps, leaching from which can cause serious pollution in nearby streams.

3.16 **HEALTH** (\$99.2m projected for 1986-87)

Major programs

The National Health and Medical Research Council grants program (60%) provides the major support for health R&D. Various elements of the Department of Health provide most of the balance, while the Commonwealth Serum Laboratories (7%), CSIRO (7%) AAEC (4%) and the Australian Institute of Health (3%) also contribute to this objective.

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



Growth trends

- Long-term trend (1978-79 to projected 1986-87): +9.4% pa;
- Short-term trend (1984-85 to projected 1986-87): +5.5% pa;

Recent developments

- . Preliminary design of the Cyclotron project, funded through AAEC, has begun. The project comprises a cyclotron facility and Positron Emission Tomograph camera facility to be constructed at the Royal Prince Alfred Hospital, Sydney, plus extensions to the isotope production facilities at the Lucas Heights Research Laboratories. These facilities will be used to produce medical radioisotopes for national distribution as well as for research at Royal Prince Alfred Hospital using the technique of Positron Emission Tomography.
- . Epidemiology research in the CSIRO Division of Human Nutrition identified certain eating patterns that are strongly associated with, and may give rise to, cancer of the colon the cause of 6% of all deaths in Australia. The most consistent factor identified was high dietary protein. Excess calories, frequent meals and the excessive consumption of alcohol were other significant correlates.
- . The CSIRO Division of Human Nutrition has found that certain unsaturated fatty acids (especially those occurring in fish oils) afforded great protection against abnormal heart rhythm when fed to animals in which the coronary circulation was reduced. Abnormal heart rhythm is a major cause of sudden death and this finding has implications for the diet of the nation where coronary disease is the greatest single cause of death.
- . CSIRO's Division of Applied Physics, working in association with industry, produced new electrodes for heart pacemakers having the dual properties of stimulating the heart muscles and determining if the heart is functioning correctly.

. The CSIRO Division of Applied Physics has derived a method of measuring the flexibility of ear (cochlear) implant devices manufactured in Australia for the profoundly deaf. Flexibility is critical in the implantation process. The device was approved for sale in the USA.

3.17 **EDUCATION** (\$3.1m estimated for 1986-87)

Major programs

A variety of programs undertaken within the Department of Education contribute the major part (39%) 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'.) Research on curriculum development, now under the aegis of the Commonwealth Schools Commission, makes up the bulk of the remaining R&D into educational matters (44%).

Growth trends

-Long-term trend (1978-79 to estimated 1986-87): -9.9% pa -Short-term trend (1984-85 to estimated 1986-87): -11.0% pa

3.18 **WELFARE** (\$4.0m projected for 1986-87)

Major programs

Major elements include the Departments of Community Services (32%), Social Security (18%), Immigration and Ethnic Affairs (8%), and the Australian Bureau of Statistics (41%).

Growth trends

- Long-term trend (1978-79 to projected 1986-87): +8.9% pa;
- Short-term trend (1984-85 to projected 1986-87): +14.4% pa
- . It was announced that the University of New South Wales is to be the site of a national centre of excellence in research into drug abuse, treatment and rehabilitation. University Centres of excellence refunded through the Commonwealth Tertiary Education Commission. Research at the National Campaign Against Drug Abuse Research Centre of Excellence in Drug and Alcohol Studies in NSW will focus mainly on the search for more effective treatment and rehabilitation of individuals with problems relating to alcohol and drugs.

3.19 **OVERSEAS DEVELOPMENT ASSISTANCE** (\$33.2m estimated for 1986-87)

Major Programs

About 73% of R&D support under this heading is provided by the Australian Development Assistance Bureau. The balance is mostly provided by the Australian Centre for International Agricultural Research.

Growth Trends

-Long-term trend (1978-79 to estimated 1986-87): +8.3%pa -Short-term trend (1984-85 to estimated 1986-87): -14.9%pa

3.20 **OTHER COMMUNITY SERVICES** (\$5.3m estimated for 1986-87)

<u>Major Programs</u>

The R&D supported by the Law Reform Commission (46%), the Australian Institute of Criminology (15%), and ABS (12%) constitute most of the activities for this objective.

Growth Trends

-Long-term trend (1978-79 to estimated 1986-87): +5.5% pa -Short-term trend (1984-85 to estimated 1986-87): -15.3% pa

3.21 EARTH, OCEAN and ATMOSPHERE (\$75.4m projected for 1986-87)

<u>Major programs</u>

R&D activities towards this objective are undertaken or supported by CSIRO (28%); the Antarctic Division of the Department of Science (34%), the Australian Institute of Marine Science (12%); BMR (13%); the marine science grants and fellowships programs (5%); the Bureau of Meteorology (4%); minor contributions are provided by the Water Division of the Department of Resources and Energy, AAEC and the Department of Territories.

Growth Trends

- Long-term trend (1978-79 to projected 1986-87): +4.0% pa;
- Short-term trend (1984-85 to projected 1986-87): +2.3% pa

Recent developments

Earth Sciences

- . The Bureau of Mineral Resources seismic processing centre opened in Canberra. This centre provides the highly specialised, sophisticated instrumentation necessary for research by seismic methods into the structure of the Earth's crust, and in particular into the structure of petroleum bearing sedimentary basins.
- . Electromagnetic survey techniques, previously applied by the CSIRO Division of Water and Land Resources to the detection of underground saline deposits, are now being used to locate relatively shallow water-bearing sandy deposits underground. Although subsequent drilling is required to determine the actual depths of the sands, electromagnetic survey does remove much of the guesswork from drilling surveys and can significantly reduce water exploration costs.
- . The CSIRO Division of Soils has established research projects in key soil landscapes in eastern Australia where there are land use issues involved. Landscapes with soils having strong texture-contrast profiles (duplex soils) have been designated by the Division for intensive research effort. Duplex soils are used intensively for agriculture, forestry and urban purposes and they are very susceptible to erosion. Further research is needed to promote their conservation and management.
- . A NASA C-130 aircraft equipped with the latest remote sensing equipment was flown over 54 test sites in Australia in October 1985. The major goal of the project was to develop practical remote sensing technologies for use in mapping, exploration, monitoring and management of land, mineral and water resources. CSIRO managed the project, which involved a consortium of seven Australian companies, eight Commonwealth and State agencies, a university and a British agency together with NASA and JPL of the USA.

Oceanography

. The Oceanographic Research Vessel Franklin, operated by the CSIRO Division of Oceanography, completed a most successful first year of operations. Researchers on the vessel investigated sea mounts in the Tasman Sea, the origins of water masses in the thermocline of the Coral Sea, deep bottom fauna of the Barrier Reef Shelf and adjacent Coral Sea, and

hydrothermal venting on the seafloor of the western Woodlark Basin spreading system. A joint Australian-American Western Equatorial Pacific Circulation Study (WEPOCS) to investigate the variability of the upper ocean during monsoon peaks was undertaken during which the Franklin and two American research vessels made two cruises to collect data, which are now being processed and analysed at the CSIRO Division of Oceanography in Hobart and in the United States. During its first year of operations, the Franklin was used by researchers from the CSIRO Divisions of Oceanography, Mineral Physics-and Mineralogy, and Atmospheric Research; James Cook, Sydney, New South Wales and Australian National Universities; the Australian Institute of Marine Science; the Universities of Toronto, Hawaii and Miami; the Scripps Institution and the US National Oceanographic and Atmospheric Administration. Franklin was also used for the PACLARK Expedition in April 1986, which surveyed hydrothermal vents on the ocean floor off Papua New Guinea, where mineral deposits are currently being formed. Scientists from Australia, Canada and Papua New Guinea took part.

Research in the region north of Australia has enabled scientists from the CSIRO Division of Oceanography to identify a process that controls variability of ocean temperatures in the region. By measuring the heat stored in the tropical oceans and the heat fluxes on the sea surface (solar radiation and evaporation), they demonstrated that evaporation by anomalous winds is a dominant process in ocean temperature variability, affecting not only the climate but ultimately also the economies of Australia, South America, Africa and India.

Atmosphere

The CSIRO Division of Atmospheric Research has collaborated with the Antarctic Division of the Commonwealth Department of Science to investigate air bubbles trapped in Antarctic ice. These air bubbles contain air trapped hundreds, even thousands, of years ago. Since an important question in atmospheric chemistry concerns the level of trace gases in the global atmosphere - and their effect on the earth's climate - the air bubbles allow scientists to establish past levels of these trace gases. CSIRO and Antarctic Division scientists have compiled data for carbon dioxide, methane and nitrous oxide from the 17th century to the present day. The results confirm that the level of carbon dioxide in the atmosphere before the industrial revolution was about 250 parts per million (the present level is 345 ppm), and that the level of methane has risen by 90%. The measurements for nitrous oxide - the first ever taken - show that increases in this trace gas have taken place only since the industrial revolution. Using the carbon dioxide results in their subsequent investigations, the scientists have found that carbon dioxide currently released through the destruction of forests is being matched by an almost equivalent compensatory amount taken up by the remaining vegetation, and that the increases in atmospheric CO₂ are due to human use of fossil fuels.

3.22 **GENERAL ADVANCEMENT OF KNOWLEDGE** (\$237.4m projected for 1986-87)

Major programs

R&D activities under this heading are supported through grants to universities (61%), the Australian Research Grants Scheme (12%), Commonwealth Postgraduate Research Awards (8%), Commonwealth Special Research Centres (3%), CSIRO (11%), AAEC (4%) and Anglo-Australian Telescope Board (1%).

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



Growth trends

- Long-term growth (1978-79 to projected 1986-87): +4.0% pa;

- Short-term growth (1984-85 to projected 1986-87): +7.3% pa

Recent developments

Contracts have been awarded for the construction of antennas for the Australia Telescope to be operated by CSIRO. The Telescope, scheduled for completion in 1988, will consist of an array of antennas in NSW - six at Culgoora, one at Siding Spring and the existing CSIRO radiotelescope at Parkes. When operating as one, the antennas will simulate a giant telescope 300km in diameter.

CHAPTER 4

INTERNATIONAL COMPARISONS AND TRENDS⁽¹⁾

4.1 <u>Total resources devoted to R&D</u>

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 5 and Table 12 show some details of R&D expenditure of OECD countries, for the latest year for which data is available, grouped according to gross expenditure on R&D (GERD). Data is given both by source of funding ("who pays for it?") and by sector of performance ("who does it?").

The figure 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. 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, 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. From 1976 to 1983, the level of business enterprise R&D in Australia stabilised. The most recent survey data⁽²⁾ (1984-85) indicate that performance of R&D in the business enterprise sector increased by 43% in real terms over the 1981-82 level. However, details on funding are not yet available.

(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. Source documents for this section were:

- . Recent Results Selected S&T Indicators 1979-1986, Paris, September 1986
- . OECD Science and Technology Indicators, Resources Devoted to R&D, OECD, Paris 1985
- OECD, Science and Technology Indicators. Basic Statistical Series-Volume A, The objectives of Government R&D funding 1974-1985 (May 1983).
- (2) Research and Experimental Development Business Enterprises, Australia, 1984-85 (Preliminary). Australian Bureau of Statistics Catalogue No 8105.0 (27 May 1986).

Country	% workforce	GERD/	R&D in Sector* as % GDP							
	in R&D	GDP (%)	Source Business Enterpr.	of Funds* Governme Civil De	ent BusinessG fence Enterpr	Performatiovernment	nce* High I	er Education		
Large R&D Performers										
U.S.A. (1985)	(1.31)	2.90	1.42	0.46	0.97	2.07	0.36	0.38		
Japan (1984)	<1.23#	2.65	1.77	0.58	0.01	1.73	0.24	0.58		
F.R. Germany (1983)	(1.35)	2.57	1.46	1.00	0.11	1.79	0.36	0.41		
(Group Median)	<u>1.23</u>	<u>2.54</u>	<u>1.42</u>	0.58	0.40	<u>1.73</u>	<u>0.36</u>	0.38		
U.K. (1983)	(1.13)	2.28	0.96	0.58	0.57	1.39	0.50	0.31		
France (1984)	(1.10)	2.24	0.91	0.80	0.40	1.28	0.61	0.33		
Medium R&D Performer	<u>'S</u>									
Sweden (1983)##	1.05	2.46	1.49	0.71	0.19	1.66	0.13	0.66		
Switzerland (1981)	(1.18)	2.29	1.56	0.43	0.06	1.70	0.14	0.45		
Netherlands (1984)	0.99	1.99	0.92	0.91	0.03	1.07	0.38	0.49		
(Group Median,										
excluding Australia)	0.90	1.70	0.91	0.66	0.06	1.01	0.26	0.39		
Canada (1984)	(0.60)	1.40	0.54	0.69	0.05	0.66	0.39	0.33		
Belgium (1979)	0.78	1.40	0.89	0.42		0.95	0.13	0.28		
Italy (1984)	(0.52)	1.24	0.51	0.63	0.06	0.67	0.36	0.21		
AUSTRALIA (1983) (est)	(0.65)	0.96	0.19	0.66	0.08	0.22	0.43	0.29		
Small R&D Performers										
Norway (1985)	(0.85)	1.54	0.74	0.66	0.07	0.91	0.26	0.36		
Finland (1983)	0.79	1.32	0.73	0.55	0.01	0.75	0.28	0.28		
Austria (1981)	0.56	1.17	0.59	0.55	0.00	0.65	0.11	0.38		
Denmark (1982)	0.64	1.07	0.51	0.58	0.00	0.59	0.25	0.29		
New Zealand (1981)	(0.65)	0.96	0.17	0.77	0.01	0.21	0.58	0.15		
(Group Median)	0.62	0.87	0.28	0.52	0.01	0.31	0.25	0.18		
Ireland (1984	0.47	0.77	0.33	0.37	0.00	0.38	0.25	0.13		
Iceland (1983)	0.67	0.74	0.23	0.49	0.00	0.13	0.38	0.20		
Spain (1983)	0.23	0.44	0.22	0.20	0.01	0.23	0.13	0.08		
Portugal (1982)	0.20	0.35	0.11	0.22	(0.00)	0.11	0.15	0.07		
Greece (1981)	(0.13)	0.21	0.03	0.17	0.01	0.05	0.13	0.03		
Australian Trends										
Australia (1968-69)	0.80	1.36	0.48		0.79	0.49	0.53	0.32		
Australia (1973-74)	0.85	1.28	0.42		0.79	0.42	0.50	0.33		
Australia (1976-77)	0.70	1.07	0.24		0.78	0.24	0.50	0.29		
Australia (1978-79)	0.68	1.05	0.21		0.79	0.24	0.46	0.32		
Australia (1981-82)	0.65	1.01	0.21		0.73	0.23	0.44**	0.30		
Australia (est 83-84)	na	0.96	0.19		0.74	0.22	0.43	0.29		
Australia (est 84-85)	na	1.03	0.29		0.73	0.31	0.39	0.32		
/usuana (Usi 0+-03)	11a	1.00	0.27			0.01	0.07	0.02		

Table 12: Comparisons between OECD nations - R&D employment as % Total Workforce and
gross domestic expenditure on R&D (GERD) as % GDP (latest available year)

* 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. Workforce figures in brackets are estimates by DOS based on previous data.

- ** The figures are adjusted for trend comparison purposes (to remove the effect of changed superannuation arrangements and the additional pay period in 1981-82 for Commonwealth bodies). For unadjusted figures (more appropriate for international comparisons) see under "Medium R&D performers"
- # Overestimate, as not expressed in full-time equivalents.
- ## Excludes social sciences and humanities.



Fig. 11 R & D Expenditures by Country - latest available year.

GERD -- Gross domestic expenditure on R&D *At purchasing power parity -- not current exchange rate

4.2 <u>Government R&D funding for R&D socio-economic objectives</u>

Table 13 shows the distribution of Government funds to R&D in selected OECD socioeconomic objective categories for twelve countries. The funding levels are expressed as parts per 10 000 of GDP. By comparison with the median values for countries other than Australia and for which data are available, it can be seen that Australian Government funding in 1981-82 was high for agriculture (2.7 times the median), and environment (2.4 times); close to the median for industrial growth, advancement of knowledge; and low for energy health, defence and social development and services (all less than half of the respective median values).

These comparisons need to be taken with some reservation, as the data are only broadly comparable between countries. In particular all general university funds devoted to R&D have been included under advancement of knowledge. Thus, in Australia for example, a considerable amount of medical R&D is included in advancement of knowledge, thereby considerably understating the total Government support for the health objective.

Note:

In addition, some categories for a number of countries contain S&T (other than R&D) categories as well as R&D, as they are based on "science budgets" or similar analyses for the countries concerned. Some R&D outside the science budgets may be omitted. Moreover, each country has its own spectrum of needs which is reflected in differing funding priorities. The observed differences must therefore be interpreted in the context of additional information about the countries concerned.

Table 13:	Government R&D funding by OECD socio-economic objectives*,	(1983 or nearest year)
	(Cents expended per \$100 of gross domestic product)	-

Country	Agr.	Ind.	Energy	Env.	Health	Soc.	A. of K.	Def.	Other
U.S.A.	2.6	0.3	6.2	0.5	12.6	1.4	4.6.	80.0	22.5
F.R. Germany	2.4	14.1	19.0	2.1	4.7	4.7	47.9	10.5	12.6
U.K.	5.2	9.2	8.1	1.4	1.4	1.5	31.1	68.2	4.8
France	5.6	17.9	10.2	1.5	6.3	1.7	33.7	50.3	16.4
Sweden	2.5	5.6	13.0	2.2	8.9	9.5	48.0	23.9	11.1
Netherlands	7.5	10.8	4.5		4.9	4.6	51.2	3.1	13.7
Canada	9.7	6.4	7.1	0.6	3.5	2.7	10.4	3.2	5.1
Belgium	2.9	10.8	6.1	1.9	9.2	7.3	19.3	0.2	7.8
Italy	1.6	7.2	11.6	1.1	1.8	0.7	21.5	3.6	4.8
Australia	17.5	8.6	3.4	2.0	3.3	2.4	28.0	7.4	3.1
Norway	7.7	9.7	3.3	2.1	3.4	5.5	32.0	3.0	12.2
Finland	6.7	14.0	3.4	0.6	0.8	4.5	25.7	1.3	6.0
Denmark	4.6	9.1	5.2	0.9	4.9	3.9	18.3	0.1	5.0
New Zealand	26.0	10.0	4.3	-	4.9	3.2	12.2	0.4	13.2
Median									
(excl. Aust.)	<u>6.5</u>	<u>9.6</u>	<u>7.9</u>	<u>1.2</u>	<u>5.2</u>	<u>3.9</u>	<u>29.6</u>	<u>19.6</u>	<u>10.4</u>

4.3 <u>Technology-based export performance</u>

Figure 6 and Table 14 give 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.

Interpretation of this indicator may differ according to the economic philosophy adopted. 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 this paper adopts the viewpoint that trade in these product groups represents demonstrated technological capability. 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. However, if they are not involved in producing a technology-based product competitive on the export market it is fair to assume that in most cases they will not be current in the state-of-the-art for that product.

Figure 6 shows that Australia's position in regard to both technology-based exports per capita and ratio of technology-based exports to imports declined from 1978 to 1980, and had declined even further by 1982. There was a small recovery in the export/import ratio in 1983, but it fell again in 1984.

- (1) <u>"Technology</u> 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 1984
 - (ii) OECD Trade by Commodities Market Summary: Imports 1984
 - (iii) United Nations "Monthly Bulletin of Statistics" Vol XXXIX, No 10 October 1985.





Country	Population (Million persons)	Exports (US \$m)	Imports (US \$m)	Ratio of exports to imports	Per Capita exports (US \$ per person)
Large R&D Perfor	mers				
U.S.A.	236.68	84780.5	88780.5	0.956	358.4
F.R. Germany	61.18	65496.8	34180.0	1.916	1070.6
Japan	120.02	80303.6	16913.1	4.748	669.1
U.K.	56.49	32331.7	30991.2	1.043	572.3
France	54.95	28160.7	26448.8	1.065	512.5
Medium R&D Per	formers				
Switzerland	6.44	14946.7	8257.1	1.81	2320.9
Sweden	8.34	8922.0	8298.0	1.075	1069.8
Netherlands	14.42	16567.6	15100.6	1.097	1148.9
Canada	25.13	13041.0	24605.2	0.530	518.9
Belgium	9.88	9310.2	10674.4	0.872	942.3
Italy	56.98	22036.4	17310.9	1.273	386.7
AUSTRALIA	15.54	1014.2	8360.4	0.121	65.3
Small R&D Perfor	mers	·	ŕ	ŕ	
Finland	4.88	2326.9	3681.2	0.632	476.8
Norway	4.14	1733.5	4015.1	0.432	418.7
Denmark	5.11	4409.5	4287.9	1.028	862.9
New Zealand	3.23	381.6	1958.9	0.195	118.1
Ireland	3.54	4072.5	3335.9	1.221	1150.4
Iceland	0.24	2.3	202.7	0.011	9.6
Portugal	10.01	872.3	2325.8	0.375	86.4
Austria	7.55	4389.8	5573.7	0.788	581.4
Greece	9.90	250.6	1928.9	0.130	25.3
Spain	38.72	3551.2	7153.6	0.496	91.7
Turkey	48.27	1170.0	8480.0	0.138	24.2
Yugoslavia	22.96	3047.1	3574.2	0.853	133.7

Table 14: Trade in selected Technology - Based Products - OECD Nations, 1984

In general the countries exporting large volumes of technology-based products are also large importers. The average relationship for all 24 OECD countries suggests that imports are roughly proportional to the square root of the exports. Japan has a much higher than average ratio of exports to imports in these product groups, because its imports are only about 40% of the average level corresponding to its export figure. This is probably due to a high level of self sufficiency combined with difficulties experienced by other countries in penetrating the Japanese market.

APPENDIX A

MINISTRY ACTIVITIES

A.I 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 C for definitions and further details).

The tables for the ministries are presented in three categories (not all the categories apply for particular ministries): Commonwealth Budget sector net expenditure, Commonwealth Non-Budget sector, and expenditure from other sources. Figures listed under Commonwealth Budget sector net expenditure correspond to expenditure on S&T from amounts appropriated by Parliament under the Appropriation Acts, less any relevant recoveries or income received by the Commonwealth in respect of particular activities. Commonwealth Non-Budget sector figures represent the S&T funded by Commonwealth bodies from their own funds (other than direct appropriations). These consist mainly of trading revenues of government enterprises, disposals of plant and sales of publications. They also include residuals of appropriations retained from previous years. The sum of the Budget and Non-Budget sectors constitutes all direct funding by the Commonwealth Government. Expenditure from other sources covers S&T activities funded by recoveries (and hence excluded from the Budget sector) plus amounts received by the Commonwealth from sources such as industry and State or foreign governments in respect of particular activities of a non-commercial nature.

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. Unless stated otherwise, sources for the information presented in the tables are the agencies listed.

A.2 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 Science. In a few cases (notably for ADAB) there are special data collection procedures. Validity of the data is checked, as far as possible, by staff of the Department of Science (DOS) who refer to Annual Reports, Budget documents, departmental explanations of estimates and other material for this purpose. (For the definitions used see Appendix C).

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 DOS 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.

(\$ million)				R&D			S (includi	&T ng R&D)
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget s	sector net	expenditure	e					
Department of Aboriginal Affairs	ext.S	0.06	0.10	0.15	0.08	0.01	0.08	0.01
Australian Institute of Aboriginal Studies (AIAS)	cap.S cur.S ext.S	- 0.60	0.42	- - 0.50	- 0.45	- 0.38	0.19 2.23 1.22	0.09 2.47 1.23
Total (Budget sector)		0.66	0.52	0.65	0.53	0.39	3.72	3.80
B. Commonwealth Non-Bud	dget secto	or						
Australian Institute of Aboriginal Studies (AIAS)	cap.S cur.S	- -	- -	- -	- -	- -	0.02 0.26	0.01 0.24
Total (Non-Budget sector)	-	-	-	-	-	0.28	0.25
Total (Direct Commonwe funding)	alth	0.66	0.52	0.65	0.53	0.39	4.00	4.05

A.3 ABORIGINAL AFFAIRS

See page 53 for explanation of abbreviations.

A.3.1 DEPARTMENT OF ABORIGINAL AFFAIRS

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.

A.3.2 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.

(\$ million)				R&D			Sa (includit	&T ng R&D)
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget sec	ctor net e	expenditure						
Department of Arts. Heritage an	nd Enviro	onment						
. Bureau of Flora and Fauna	cap.	-	-	0.04	0.02	0.02	0.02	0.02
	cur.	0.13	0.14	0.06	0.06	0.06	0.57	0.61
Environmental Activities	ext.	0.36	0.47	0.53	0.01	-	0.93	0.74
- Australian Environment								
Council Trust Fund	ext.	-	-	-	-	-	0.07	0.07
- Other	cur.	-	-	-	-	-	2.72	2.71
	ext.	-	-	-	-	-	1.24	1.35
Australian National	can	0.01	0.01	_	0.04	0.03	0 99	0.90
Botanic Gardens	cur.	0.01	0.35	0.32	0.36	0.36	3.24	3.72
Australian Film, Television	~	0.00	0.40	0.44			0.10	0.05
and Radio School	cur.S	0.09	0.10	0.11	-	-	0.19	0.37
	ext.5	0.01	-	-	-	-	-	-
Australian National Parks								
and Wildlife Service								
(ANPWS)	ext.	0.07	0.19	0.36&	0.31	0.33	0.61	0.66
Graat Barriar Paaf Marina								
Park Authority	cur.	-	-	0.04	0.06	0.05	0.18	0.28
	ext.	0.03	0.08	0.07	1.02	1.06	1.34	1.28
	cur.S	-	-	-	-	-	0.07	0.06
	ext.S	-	0.04	0.01	0.02	-	0.14	0.04
National Library of								
Australia*	cap.	-	-	-	-	-	1.31	1.33
	cur.	-	-	-	-	-	0.36	0.37
	cap.S	-	-	-	-	-	2.55	2.70
	cur.S	-	0.01	-	-	-	11.54	11.80
Office of the Supervising	ext.S	0.01	0.02	-	-	-	-	-
Scientist for the Alligator								
	cap.	2.86	0.99	0.53	0.91	1.64	0.91	1.64
	cur.	2.81	3.26	3.87	3.37	3.30	3.37	3.30
	ext.	0.31	0.25	0.35	0.23	0.30	0.23	0.30
Total (Budget Sector)		6.94	5.90	6.27	6.40	7.15	32.56	34.23

A.4 ARTS, HERITAGE AND ENVIRONMENT

(\$ million)				R&D			S (includi	&T ng R&D)
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
B. Commonwealth Non-Budge	et sector							
Australian Film, Television and Radio School	cur.S	-	-	-	-	-	0.07	0.08
Total (Non-Budget Sector)		-	-	-	-	-	0.07	0.08
Total (Direct Commonwealth funding)		6.94	5.90	6.27	6.40	7.15	32.63	34.30
C. Expenditure from other sour	rces							
Department of Arts, Heritage and . Environmental Activities	d Enviro	nment						
- Australian Environment Council Trust Fund ANPWS	ext. cur.	- -	-	-	0.05	0.06	0.07 0.05	0.07 0.06
National Library of Australia	ext.S	-	-	-	0.02	0.02	0.02	0.02
Total (Other sources)		0.01	0.01	0.01	0.07	0.08	0.14	0.15
Total (A+B+C)		6.94	5.91	6.29	6.47	7.22	32.77	34.45

See page 53 for explanation of abbreviations.

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

& Estimated by DoS.

A.4.1 DEPARTMENT OF ARTS, HERITAGE AND ENVIRONMENT

Australian National Botanic Gardens

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 <u>in vitro</u> 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.

Bureau of Flora and Fauna

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

The aims of the ABRS can be summarized as attempting to answer two questions:

- what kinds of plants and animals are there in Australia?
- where are these plants and animals found?

In detail, the objectives 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.

Environmental Activities

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.

A.4.2 AUSTRALIAN FILM, TELEVISION AND RADIO SCHOOL

In March 1986 the School's Research and Information Unit was restructured to become the Research and Planning Branch, with increased funding, responsibilities and support.

One of its major briefs is the provision of research-based information and advice on training needs and priorities. The Branch is in the process of establishing networks with other government bodies with similar or common areas of interest in the conduct and dissemination of industry research. A Research Fellowship will be re-introduced. An online public access computer database on the media is being investigated as part of the School's research program.

The Branch brings together the Book and Film Libraries and the Research and Survey Unit. It collects data, undertakes research and disseminates information on all aspects of the radio, film and television industries. This assists in the formulation of the School's management and training policy and provides resources for students of media and for the industry.

The Branch produces the quarterly research journal Media Information Australia which receives support from the Australian Broadcasting Corporation, Australian Broadcasting Tribunal, Australian Film Commission, Special Broadcasting Service and Telecom Australia. The August 1986 issue of Media Information Australia is on radio.

The "On the Job Training Scheme for Women Evaluation' was published in June 1986 and a workshop is being planned to determine the second stage of the Scheme.

The Branch also assesses the School's training courses.

A.4.3 AUSTRALIAN NATIONAL PARKS AND WILDLIFE SERVICE

The Australian National Parks and Wildlife Service is responsible for providing policy advice to the Commonwealth Government. It's 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 (socio-economic impact of tourism in the Ayers Rock region)
- Christmas Island (vegetation)
- Norfolk Island (rat and weed control, surveys of Norfolk Island Boobook Owl and White-breasted White-eye)
- macropods (eg population dynamics, dietary requirements of yellow-footed rock wallaby)
- koalas (disease and stress)
- ornithology (eg studies of waders, Coxen's fig-parrot, migratory birds)
- flora (eg updating list of rare or threatened Australian plants, survey of Huon Pine in Tasmania)
- whale protection (surveys of Right Whales and Humpback Whales)

A.4.4 GREAT BARRIER REEF MARINE PARK AUTHORITY

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; and

- 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 proposed 4 year major research program into the Crown of Thorns Starfish which began in 1985-86, continues to be coordinated by the Authority. The NSE component 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 1985-86 on biological control; risk analysis; geological sedimentology, surveys, data analysis and modelling; and a trial control program. The main SSH component includes 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 1986-87.
- New developments include:
 - a study of inter-reefal transport and dispersion of coral spawning material with applications to waste water discharge and lagoon flushing; trawling impact; and a major 3-5 year project on population dynamics of green turtle populations.
- Major projects continuing from 1985-86 are: biological basis for management of dugong, spectrographic analysis of reef features, flow modelling collaborative project, and Red Spot King Prawn by-catch study.
- Significant components in the S&T field are: a review of physical oceanography, aerial survey data entry and analysis; survey of Whitsunday fringing reefs, monitoring of Replenishment Areas; seagrass surveys, and workshops related to Reef management.

A.4.5 NATIONAL LIBRARY OF AUSTRALIA

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.

The National Library Fellowship Scheme has been established with the following aims:

- to provide the Library as a centre of scholarly activity and research
- . to encourage scholarly use of the collections and the production of publications based on them
- . to publicise the Library's collections.

Three Fellowships were granted in 1985-86, and a further three in 1986-87.

A.4.6 OFFICE OF THE SUPERVISING SCIENTIST FOR THE ALLIGATOR RIVERS REGION

The Supervising Scientist for the Alligator Rivers Region is responsible 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 mining operations.

The Supervising Scientist manages the ARR Research Institute (ARRRI) which has the role of collecting and assessing information and undertaking and promoting research of environmental importance in the ARR so as to be able to provide advice on environmental protection, and to assist in the development of standards and measures to minimise the potentially harmful effects of uranium mining operations.

The Supervising Scientist conducts a multi-disciplinary research program, the major components of which include studies of environmental radioactivity, analytical chemistry, geomorphology, biological testing, ecological monitoring, and environmental modelling.

Most of the scientific study currently relates to either water management or tailings disposal, although several projects of limited scope are directed towards aerial dispersion of radionuclides at or near the Ranger site. Studies relating to public health and worker health and safety are also undertaken.

(\$ million)			R&D			S&T (including R&D)		
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget see	ctor net e	expenditure						
Australian Institute of Criminology	cap.S	_	0.02	0.08	_	_	0.05	0.04
8)	cur.S	0.43	0.52	0.64	0.74	0.87	2.05	2.31
Commonwealth Legal Aid								
Council	cur.S	0.16	0.04	0.05	-	-	-	-
	ext.S	0.09	0.07	0.12	-	-	-	-
Criminology Research Council	ext.S	0.05	0.04	0.08	0.10	0.12	0.10	0.12
Human Rights Commission	can S	0.12	0.02	0.05	0.06	_	0.06	_
Human Hights Commission	cur.S	0.51	0.84	1.15	1.28	-	1.38	-
	ext.S	0.09	0.03	0.11	0.11	-	0.20	-
Institute of Family								
Studies	cap.S	0.02	0.04	-	0.16	0.02	0.25	0.02
	cur.S	0.51	0.60	0.70	0.65	0.78	0.93	1.08
	ext.S	0.11	0.01	0.01	-	0.01	-	0.01
Law Peform Commission	can S		0.13	0.15	0.05	0.02	0.05	0.02
Law Reform Commission	cur S	1 37	1.73	2 40	2 44	2.62	2.03	2.62
	ext.S	-	0.01	-	-	-	-	-
Total (Budget sector)		3.46	4.08	5.52	5.58	4.43	7.50	6.22
B. Commonwealth Non-Budg	et sector							
Australian Institute of Criminology Criminology Research Council . Attributable to past	cur.S	-	-	-	-	-	0.06	0.02
Commonwealth contributions	ext.S	0.01	0.01	-	0.01	-	0.01	-
Law Reform Commission	cur.S	0.08	0.06	0.03	0.06	-	0.06	-
Studies	cur.S	-	-	-	-	-	-	0.05
Total (Non-Budget sector)		0.09	0.07	0.03	0.07	0.03	0.13	0.08
Total (Direct Commonwea funding)	llth	3.55	4.16	5.55	5.65	4.46	7.63	6.30

A.5 ATTORNEY-GENERAL'S

(\$ million)		R&D						S&T (including R&D)	
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
C. Expenditure from other sou	irces								
Criminology Research Council . Attributable to State contributions .Law Reform Commission	ext.S	0.07	0.05	0.08	0.10	0.12	0.10	0.12	
Attributable to State contribution	cur.S	-	0.04	0.07	0.03	0.04	0.03	0.04	
Total (Other sources)		0.07	0.09	0.14	0.12	0.16	0.12	0.16	
Total (A+B+C)		3.61	4.24	5.69	5.77	4.61	7.75	6.46	

See page 53 for explanation of abbreviations.

A.5.1 AUSTRALIAN INSTITUTE OF CRIMINOLOGY

The Institute's principal function is to conduct such criminological research and undertake conferences, seminars and workshops as are approved by the Board of Management 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.

Research activities in 1985-86 included work on the following subjects: Aboriginal criminal justice, corporate and white collar crime, crime and criminal justice statistics, drug law enforcement, Justice system planning model, domestic violence, national study of deaths in prison, public order Policing, sentencing, terrorism and youth and crime.

Seminars and Conferences during the same period included: pre-trial diversion; probation; domestic violence; youth, crime and justice; child abuse; sentencing; libraries in the criminal justice system; and drug market and law enforcement strategies.

A.5.2 CRIMINOLOGY RESEARCH COUNCIL

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 110 research projects extending over a wide range of subjects. During 1985-86 the projects funded by the Council included the following: Australian policing, the case for community policing, patterns of costs of arson, public perception of sentencing, reform of Australian firearms laws, effect of media publicity on incidence and characteristics of drug abuse, effectiveness of education in youth training centres and crime prevention strategies for services for unemployed youth. The Australian Institute of Criminology provides administrative and secretarial services to the Council.

A.5.3 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:

- two studies undertaken as part of an evaluation of the operation of maternity leave in Australia. The first involves a sample of women to assess usage of maternity leave and the second a sample of employers to assess views on the advantages and disadvantages from their perspective
- work on the Australian Families Income Transfer Project concentrated on family allowances and the dependent spouse rebate
- the first wave of interviews in a longitudinal study of 530 low income families with capital indexed loans from the Victorian Ministry of Housing was undertaken
- a study of the needs of unsupported students was undertaken.

A.5.4 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 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.

A.5.5 HUMAN RIGHTS COMMISSION

The Human Rights Commission was established in December 1981. Its mandate was to ensure that the laws of the Commonwealth and acts and practices under those laws conformed with the provisions of the International Covenant on Civil and Political Rights, the Declaration of the Rights of the Child, the Declaration on the Rights of Mentally Retarded Persons and the Declaration on the Rights of Disabled Persons. The Commission was also responsible for the administration of the Racial Discrimination Act 1975 and the Sex Discrimination Act 1984.

The Commission's Research program involved 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 promotion of human rights in Australia.

Major projects supported in 1985-86 included: performance differences between boys and girls under 12 years in swimming and athletics; women's return to paid work after maternity leave; the right of peaceful protest; and effects of the school system on students of non-English speaking background. The Commission will terminate in December 1986.

	(\$ million)		R&D						S&T (including R&D)	
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A.	Commonwealth Budget see	ctor net e	expenditure							
De	partment of Aviation									
•	Air transport forecasting, statistics and ADP									
		cur.S	-	-	-	-	-	0.57	0.73	
	Bureau of Air Safety									
	Investigation	cur.S	-	0.06	0.06	0.06	0.07	0.06	0.07	
•	Major Projects	cur.S	0.02	0.02	0.02	-	-	0.01	0.03	
·	Provision of Meteoro-								1 4 9 9	
	logical Services	ext.	-	-	-	-	-	16.22	16.80	
•	Maintenance of Airways									
	Facilities	cap.	0.35	0.40	0.40	0.88	0.97	11.88	12.97	
		cur.	0.30	0.30	0.30	0.32	0.34	0.82	0.84	
		ext.	0.24	0.26	0.24	0.26	0.28	0.26	0.28	
•	Regulation of Air Transpor	t								
	- Aviation medicine	ext.	-	-	-	-	-	0.10	0.09	
	- Airworthiness	ext.	0.05	0.15	0.15	0.12	0.08	0.12	0.08	
	Total (Direct Commonweal funding)	lth	1.01	1.20	1.18	1.65	1.73	30.05	31.88	

A.6 AVIATION

See page 53 for explanation of abbreviations.

A.6.1 DEPARTMENT OF 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.

Projects completed include an implementation study for the introduction of a confidential aviation incident reporting system and a study of aerial agricultural operations.

Current tasks include a study of aircraft landing accidents and fuel exhaustion/starvation aircraft accidents.

Major Projects (Airport/Air ways Development)

A number of master planning studies associated with the development of major airports around Australia are continuing, such as: studies, using advanced computer techniques, of taxiway usage and costs for project development purposes; studies of aircraft parking at the Sydney Kingsford-Smith Airport passenger terminals; and micro forecasting studies of proposed passenger air service networks, as part of the National Aerodrome Plan.

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 route 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 on becoming 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.
 - Airworthiness

Support was 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.
- 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.
- the Australian Atomic Energy Commission (A.20.2) 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

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

Science and technology activities are 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.

(\$ million)					S&T (including R&D)			
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget s	ector net e	expenditure						
Department of								
Communications	cap. cur.	-	-	-	-	-	0.22 0.17	0.13
Australian Broadcasting Corporation	cap. cur.	0.05 0.13	0.08 0.21	0.09 0.23	$\begin{array}{c} 0.08\\ 0.20\end{array}$	0.27 0.21	$\begin{array}{c} 0.16\\ 0.40\end{array}$	0.53 0.42
Tribunal	cur.S	0.18	0.14	0.07	-	-	0.05	0.06
Total (Direct Commonwe funding, excluding BE	ealth)	0.36	0.43	0.39	0.28	0.48	1.01	1.14
B. Commonwealth No.	on-Budget	sector						
Australia Post (BE)	can	0.07	0.08	0.08	0.13	0.14	0.33	0.36
	cur.	0.71	1.03	1.05	0.66	0.86	1.51	2.05
	ext.	0.09	0.09	0.08	0.09	0.11	0.42	0.50
Overseas Telecommunications Commission, Australia	5							
(OTC) (BE)	cap	-	-	0.06	0.23	0.75	0.23	0.75
	cur.	0.01	0.05	0.45	1.49	2.07	1.49	2.07
	ext.	0.59	0.44	0.65	2.04	3.10	2.10	3.12
Telecom Australia (BF)	can	4 77	4 17	3 39	6.00	11 70	13 40	27.00
Telecom Musuana (DL)	cur	36.93	36.33	39.69	45.00	44 30	100.60	102.20
	ext.	0.91	1.31	1.26	1.70	2.20	14.70	17.20
AUSSAT Pty Ltd	cap	-	0.65	0.18	0.30	0.45	0.30	0.45
	cur.	-	0.05	0.07	0.10	0.10	0.10	0.10
	ext.	-	-	-	0.12	0.09	0.12	0.09
Total (Non-Budget sector)	44.07	44.20	46.96	57.76	65.87	135.19	155.88
Total (Direct Commonwe funding, including BE)	alth)	44.43	44.63	47.34	58.04	66.34	136.20	157.02

A.7 COMMUNICATIONS

(\$ million)	(\$ million)			R&D					
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
C. Expenditure from others	sources								
Telecom Australia BE	cap. cur.	0.03 0.27	0.03 0.27	0.01 0.11	-	-	-	-	
Total (Other sources)		0.30	0.30	0.12					
Total (A+B+C)		44.73	44.93	47.64	58.04	66.34	136.20	157.02	

See page 53 for explanation of abbreviations.

A.7.1 DEPARTMENT OF COMMUNICATIONS

The Department of Communications' responsibilities include the policy and technical aspects involved in developing and maintaining broadcasting services and the management and use of the radio frequency spectrum.

During 1985-86 an extensive program of laboratory and field investigation was undertaken to determine system standards and performance specifications for small earth stations to be used in the reception of the Homestead and Community Broadcasting Satellite Service (HACBSS). Other investigations are being carried out on optical fibres, FM receivers, standards for domestic television receivers, and on the technical viability of transmitting sub-carriers with the main FM broad sound carrier (supplementary monophonic transmission) and preparation of an engineering standard.

A.7.2 AUSTRALIAN BROADCASTING CORPORATION (ABC)

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.

A.7.3 AUSTRALIAN BROADCASTING TRIBUNAL

The Australian Broadcasting Tribunal is responsible for matters relating to licensing and overseeing of public and commercial broadcasting and commercial television stations.

The Research Branch of the Tribunal provides background papers and statistical analyses. During 1985-86 no new major projects were undertaken. As part of a continuing study, the types of programs televised during sample periods in 1985-86 were analysed.

A.7.4 AUSTRALIAN POSTAL COMMISSION ('Australia Post')

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.7.5 AUSTRALIAN TELECOMMUNICATIONS COMMISSION ('Telecom Australia')

The provision of telecommunications services and the ongoing development and efficient operation of the national telecommunications network infrastructure are technology-dependent. Hence, 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 customer services, facilities and products,
- the provision of automatic telephone and data transmission services to customers in the remote parts of Australia,
- the introduction, through microelectronics, microwave radio, satellite and optical fibre technology, of digital switching and transmission techniques and computer control of switching systems into the national network infrastructure, to improve service standards and create 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 international standards for telecommunications.

Telecom's R&D activities provide an input to Telecom's wider S&T activities, which are concerned with technical innovations leading to the planning, development, implementation and operation of:

- new or improved services, facilities and products,
- expansion and development of the network infrastructure,
- improved network management, administration and integrity,
- improved operational and maintenance practices.

Telecom's R&D and S&T activities range over the whole spectrum of telecommunications science and engineering. Projects cover:-

- research related to techniques, technologies and standards 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 implementaton.
- solution of technical problems arising in the operation of systems, equipment, components and materials in the network,
- development of new or improved network management systems and operational and maintenance practices.

The projects being pursued by Telecom in 1986-87 encompass:-

- digital signal processing and modulation, detection and encryption techniques;
- single mode optical fibre transmission systems;
- digital microwave radio transmission systems;
- 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-services network environments;
- digital circuit and packet switching networks for voice and data;
- computer-aided telecommunications network dimensioning and dynamic management techniques;
- digital reticulation in the local subscriber transmission network;
- customer access and 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;
- radiocommunications antennas and propagation techniques;
- microelectronics technology;
- advanced semiconductor and optical devices;
- reliability studies of telecommunications plant and equipment;

- scientific techniques for the assessment of hazards (chemical, electrical, etc) arising in telecommunication operations, and for the protection of both personnel and plant from such hazards.

During 1985-86 Telecom:-

- continued to extend and upgrade the switched telephone network, applying up-to-date digital exchanges to introduce more sophisticated, easy to use features for customers, including call waiting, conferencing, call diversion, abbreviated dialling and last number re-dial facilities,
- continued its program to introduce digital switching and transmission techniques, together with computer-control and common channel signalling techniques, in the development of the national network infrastructure,
- installed single mode optical fibre transmission systems and digital microwave radio transmission systems to extend and increase the traffic capacities of key elements of the inter-capital trunk network,
- introduced the Interra Network Service, using the Aussat Satellite System, to provide automatic voice and data services to people and communities in the more remote parts of Australia, beyond the economic boundaries of the national terrestrial network,
- worked closely with several financial institutions to install networks for Electronic Funds Transfer at Point of Sale (EFTPOS) services, so that customers can make purchases with plastic credit cards which automatically debit their bank accounts with the costs of the purchases,
- enhanced its Telefinder Radio Paging Service by using digital signal techniques to convey short messages via alphanumeric displays incorporated in the portable paging unit,
- extended and enhanced its data communications and associated services (Datel, AUSTPAC, Digital Data Service) to cope with customer demand for higher speed services or network connection,
- extended its computer-based Viatel (videotex) service and introduced a new computer-based, store-and-forward messaging service, Telememo,
- joined with local industry to undertake or investigate the development of several significant new products/systems, including:
 - . a digital telephone exchange for rural applications
 - . a new standard telephone
 - . a card-operated pay telephone
 - . a new generation, multi-service, digital private automatic branch exchange (PABX).

A.7.6 OVERSEAS TELECOMMUNICATIONS COMMISSION (Australia) (OTC)

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 1986-87 will continue as in past years to be shared between internal studies 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 computing facilities have been acquired to perform simulation and other network related studies.

Externally, contracts have been let for major programs in submarine optical communications, roof-top satellite earth stations and tele-traffic engineering. 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 1990's. Further projects are in the areas of videoconferencing, software engineering and digital modulation techniques.

In the S&T category, OTC is supporting the development of a radio frequency interference prediction system to assist in siting satellite earth stations using the Intelsat satellites. An expansion of this system to cover a broader frequency range is proposed.

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.

Recent developments

In the area of submarine optical communications, OTC has placed a number of R&D contracts with the objective of upgrading the capability of local industry to participate in the supply of future submarine systems. Emphasis has been placed on innovative cable design and submarine repeater technology.

A.7.7 AUSSAT PTY LTD

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.

The Research and Development activities which are currently being carried out at AUSSAT include:

- implementation of the first generation AUSSAT system and exploitation of this new technology to provide a variety of new satellite communications services
- development of space segment facilities for the next generation of AUSSAT satellites, including conceptual design, technical tradeoff studies, performance evaluation and specification
- fostering development of an Australian Space industry and creating new opportunities for Australian Industry participation in earth station manufacture and the next generation of AUSSAT satellites; these activities are seen as an essential step in the development of an Australian space industry
- planning and development of new and advanced satellite communications systems and services, including corporate voice and data networks, half transponder television transmission, direct broadcasting systems for radio and television, and mobile satellite communications services and technologies
- fostering development of satellite communications related technologies including new earth stations designs for current and future use:
 - multi beam antennas
 - mobile terminals
 - . spread spectrum systems
 - . low cost earth stations for customer premises
- software and hardware modelling of satellite communications systems and networks
- research into effects of rain on satellite transmissions
- research into electromagnetic radiation from satellite earth stations
- development of new and advanced satellite communications system monitoring facilities and techniques
- development of new satellite-based distance education systems for remote parts of Australia
- development of new software techniques and system for control of satellites, and remote monitoring and control of unmanned earth stations
- export of technology and provision of high tech satellite communications training to overseas organisations.

(\$ million)				S&T (including R&D)					
		_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget s	ector net e	expenditure						
De	partment of Community Ser Office of Child Care	vices cur.S ext.S	0.01 0.04	0.02 0.08	0.02 0.08	0.02 0.14	0.03 0.15	0.20 0.53	0.22 0.55
•	Studies on Rehabilitation and Services for the Handicapped	ext.S	0.40	-	-	-	-	0.34	-
•	Welfare Research	cur.S ext.S	-	0.07	0.04	-	- -	0.04	0.06
•	Social Welfare Policy Secretariat	cur.S ext.S	0.60 0.02	0.66 -	0.64	0.68 -	0.65	0.68 -	0.65
•	Residential Programs	cur.S ext.S	-	- -	-	-	-	0.28 0.89	0.28 0.23
	Total (Direct Commonwealth funding)		1.08	0.82	0.77	0.84	0.82	2.96	1.98
B.	Expenditure from other so	urces							
	Welfare research	cur.S	-	-	-	-	-	0.05	0.08
	Residential Programs	cur.S ext.S	-	-	- -	-	- -	0.04 0.25	0.03 0.05
То	tal (other sources)		-	-	-	-	-	0.35	0.15
тс	OTAL (A+B)		1.08	0.82	0.77	0.84	0.82	3.31	2.13

A.8 COMMUNITY SERVICES

See page 53 for explanation of abbreviatons.

A.8.1 DEPARTMENT OF COMMUNITY SERVICES

The Department conducts research, evaluation and statistical activities in the context of its policy analyses relating to various aspects of the social welfare system, including income security, child care, rehabilitation and services for the aged and handicapped.

Office of Child Care

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

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

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 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.

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

The Social Welfare Policy Secretariat, established in 1978, became the Policy Co-ordination Unit in December 1985 when it became responsible to the Minister for Community Services. Although it is closely associated with the Department for administrative purposes, the Unit is separately staffed and financed and functions as an independent organisation.

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 health and welfare; and to promote the direction of appropriate research and statistical activities to these ends.

Residential Programs Division

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:

- a study of quality, staffing and standards in Commonwealth subsidised hostels undertaken by Peat, Marwick, Mitchell Services. The objective of the study was to establish standards of quality with respect to care of persons assessed as having particular types and levels of functional disabilities. The report was issued in July 1986.
- a study of quality, staffing and dependency in non-government nursing homes undertaken by the Centre for Applied Business Research. The objective of the study was to show what variations occur in care given (in quality as well as quantity) in nursing homes across Australia which have different staffing levels, different facilities and different levels of patient dependency, and the relationship between these factors. The report is expected to be released by October 1986.
- a study of the problem of dementia in Australia undertaken by the Social Psychiatry Unit at the Australian National University. The report was issued in January 1986.

S&T Projects include:

- the gathering of information in respect of the frail aged and disabled (and their carers) of relevance to the planning and administration of the Home and Community Care (HACC) Program.
- the conduct of a joint Commonwealth-State national evaluation of the Support Accommodation Assistance Program, as required by the SAA Act.
- the collection of pilot data covering all SAAP Service outlets in an attempt to provide basic information on SAAP clients (conducted in July-August 1986), with ongoing collection to start January 1987.
- the collection of service provider data, conducted in September-October 1986 to provide basic information on staffing, service provision etc, with ongoing collection to start early 1987.

	(\$ million)				R&D			So (includi	&T ng R&D)
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget	sector net	expenditure						
	Total department*	cap. cur. ext.	15.74 97.64 1.05	17.75 102.55 0.91	22.69 109.18 1.12	20.66	21.13	28.38	34.08
	DSTO	cur. ext.	na na	na na	na na	117.33 0.65	123.74 0.73	142.82 0.65	150.69 0.73
•	Office of Defence Production	cap. cur.	na na	na na	na na	-	-	2.19 14.60	1.66 13.68
•	Armed services	cur. ext.	na na	na na	na na	0.43	0.40	58.85 8.08	69.90 8.57
	Total (Budget Sector)		114.43	121.21	132.99	139.07	146.00	255.56	279.30
B.	Commonwealth Non-Buo	dget Sector	r						
	Office of Defence. Production	cap. cur.	-	- -	- -	-	- -	1.18 7.89	1.13 9.36
То	tal (Non-Budget Sector)		-	-	-	-	-	9.06	10.49
	Total (Direct Commonwo Funding)	ealth	114.43	121.21	132.99	139.07	146.00	264.62	289.79
С	Expenditure from other s	ources							
	Total department*	cur.	0.09	0.24	0.25	-	-	-	-
	DSTO	cur.	na	na	na	0.08	0.49	0.08	0.49
	Total (other sources)		0.09	0.24	0.25	0.08	0.49	0.08	0.49
	Total (A+B+C)		114.51	121.46	133.24	139.15	146.48	264.71	290.27

A.9 DEFENCE

See page 53 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.

A.9.1 DEPARTMENT OF DEFENCE

Defence Science and Technology Organisation (DSTO)

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 problems arising from the operation 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; and
- 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 JINDALEE over the horizon radar, the NULKA system for ship defence, and the KARIWARA buoyant fibre slimline acoustic towed array. Fifteen percent of DSTO's resources are deployed on indigenous development projects.

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 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 work to industry, wherever possible, particularly development work on projects likely to lead to volume production. DSTO tries to involve industry as early in the project as is practicable but needs to have sufficient competence initially to provide "R&D authority" supervision. Some large tasks have been placed in Australian industry, e.g. contracts worth \$25m for development of the BARRA sonobuoy and \$4.5m for the development, operation and maintenance of the JINDALEE Experimental Facility.

DSTO's program of research agreements with tertiary education institutions has continued to grow. Current research agreements cover such areas as aerodynamics, lasers, adhesive bonding, shock wave effects, aerosol studies, -artificial intelligence, high temperature corrosion and digital control systems. 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 has included:

Advances in optoelectronics studies 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 have been studied successfully using scanning electron microscopy.

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

The study of camouflage effectiveness 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.

Major Programs

<u>Project JINDALEE</u> Trials were carried out to evaluate the performance of the experimental JINDALEE over-the-horizon radar to confirm that it is suitable for conversion to an operational role. Research into over-the horizon radar performance in the Australian environment continues.

<u>Project KARIWARA</u> Research is being conducted to identify the technologies, risk and plans for subsequent engineering development of a low cost, slim line, reelable towed hydrophone array for surface ship application.

Office of Defence Production

The Office of Defence Production (ODP) 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 central task of the ODP is the management of Government owned and operated factories and dockyards. The ODP is required to maintain an industrial capacity needed for strategic purposes.

Scientific and technological work (other than R&D) is carried out in the Government munitions and aircraft factories in support of their functions. The former, of which there are ten, are engaged in producing munitions, explosives, other ordnance and engineering products and a range of equipment ranging from small generating sets to artillery and large fire-fighting vehicles.

The Government Aircraft Factories, at Fishermen's Bend and Avalon in Victoria, are Australia's main facilities for designing and producing manned and unmanned aircraft, and guided weapons.

Armed Services

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.

(\$ million)						S&T (including R&D)			
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget sec	tor net e	expenditure						
De	partment of Education Australian Council for Educational Research	ext.S	0.42	0.44	0.49	0.54	0.54	0.54	0.54
	CERI participation	ext.S	-	-	-	-	-	0.01	0.01
	Education Research and Development Committee	ext.S	0.14	-	-	-	-	-	-
	Education Review and	ext.S	0.13	0.12	0.16	0.17	0.17	0.17	0.17
	Evaluation Studies Educational use of Communications Technology	ext.S	0.05	0.11	0.06	-	-	-	-
	Participation and Equity Program	ext.S	0.22	0.27	0.29	0.24	0.19	0.24	0.19
	Postgraduate Awards	ext. ext.S	6.60 4.57	8.62 5.98	9.01 6.40	10.66 6.91	11.60 7.52	11.01 8.26	11.98 8.99
	Research Statistics and Special Projects Branch	cur.S	0.04	0.12	0.16	0.19	0.13	0.29	0.21
	TAFE National R&D Centre	cur.S ext.S	0.28	0.32	0.35	0.35 0.06	0.38 0.07	0.35 0.06	0.38 0.07
Co	ommonwealth Schools Commission	cur.S ext.S	0.20 0.41	0.30& 0.66&	0.37& 0.78&	0.47	0.84	- 1.06	- 1.90
Co	ommonwealth Tertiary Educati	ion Com	mission						
	Evaluations and Investigations	ext.S	0.10	-	-	-	-	0.66	0.97
Gr	ants to universities Commonwealth Special Research Centres	ext.	5.9	5.7	5.7	5.9	6.0	5.9	6.0
	Other*	ext.	94.0	104.0	114.0	126.0	128.0	126.0	128.0
	Total (Budget sector)		113.0	126.6	137.8	151.5	155.4	154.5	159.4

A.10 EDUCATION

(\$ million)			S&T (including R&D)					
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
B. Commonwealth Non-Budg Commonwealth Schools Commission	et sector cur.S ext.S	0.06	0.03 0.01	0.03 0.01	-	-	-	- -
TAFE National R&D Centres	cur.S	-	-	-	0.21	0.09	0.21	0.09
Total (Non-Budget sector)		0.06	0.04	0.05	0.22	0.09	0.22	0.09
Total (Direct Commonwea funding)	lth	113.1	126.7	137.8	151.7	155.5	154.8	159.5
C. Expenditure from other sources Department of Education . Educational use of Communications Technology ext.S		0.05	-	-	-	-	-	-
TAFE National R&D Centres	cur.S ext.S	- -	-	-	0.43 0.06	0.49 0.07	0.43 0.06	0.49 0.07
Total (Other Sources)		0.05	-	-	0.51	0.56	0.51	0.56
Total (A+B+C)		113.1	126.7	137.8	152.2	156.1	155.3	160.1

See page 53 for explanation of abbreviations.

- ** The amounts which universities spend on research from their general recurrent grants and equipment grants are not included. <u>Total</u> R&D expenditure funded by the Commonwealth in the Higher Education sector was \$423.2m in 1981 (ABS Publ no 8111.0, Oct 1983).
- # 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 87 for further details.

A.10.1 DEPARTMENT OF EDUCATION

Australian Council for Educational Research (ACER)

The annual research program and level of funding of ACER is agreed to by the Australian 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 promote research and development in education in Australia;
- to conduct research and undertake development in any matters affecting education through its own staff and in cooperation with other bodies in Australia and overseas; and
- to disseminate publications and results of research and development.

Broad research programs cover teaching and learning; the social context of education; and measurement and evaluation. These are supported by programs covering library and information services; survey and psychometric services; advisory services; and publishing. The research program contains many diverse projects. Examples of substantial projects current in 1985-86 include:

- Youth in Transition: this is a longitudinal study of Australian youth, which began in 1978. The program receives special Commonwealth funding to conduct mail surveys of national samples of persons on a yearly basis beginning in the years of their midteens and extending through to their early twenties.
- Career Planning and Guidance: the overall aim of this project is to ensure that there is a range of good instruments validated for use in Australia by career advisors, teachers and counsellors working both in schools and outside the school setting.
- The Australian Scholastic Aptitude Test is prepared annually for administration of the Year 12 populations in Queensland, the Australian Capital Territory and Western Australia. It is a one-hundred item multiple-choice test, covering a wide range of comprehension and interpretation skills assumed to be part of a student's aptitude for tertiary study.
- The Australian Education Index (AEI) has been produced regularly by ACER since 1957. It is published quarterly with an annual cumulation. Documents are selected from a wide range of sources in both published and unpublished forms and include journal articles, monographs, research and technical reports, evaluation studies, conference papers and proceedings, opinion papers, and bibliographies. All levels and areas of education are covered.

OECD Centre for Educational Research and Innovation (CERI)

Current Australian participation in the OECD Centre for Educational Research and Innovation is directed to investigatory exercises in areas such as: education and new information technology; transition of handicapped youth from school to work; school improvement and cultural pluralism and innovation exchange.

Educational Use of Communications Technology

A Commonwealth/State Advisory Committee was established in 1982 to recommend a balanced program of trials or other projects in the educational use of communications technology. The program ran for just over three years ending in October 1985.

Fifteen trial projects received funding over the three years of the program. Those projects of a research nature included: experimentation in the coordination of access to the ATS-1 satellite for educational trials; an interactive television teaching program; the use of distance learning materials by the primary school child as an isolated learner; the use of an FM radio sub-carrier for the provision of tutorial interaction in University distance education; facsimile reproduction to increase student-teacher feedback in a secondary correspondence school; audio-video-teleconferencing for the in-service education of teacher-librarians; use of UHF audio and video to link specialist services to rural schools; the development of interactive video and computer learning programs; electronic mail trials in distance education; teleconferencing trial for Aboriginal education in remote areas; and the potential of communications technology, especially satellites in increasing the access of young people to and delivery of education and trianing.

Research and Statistics Branch

The Branch is concerned broadly with education at the national level.

Included amongst the Research and Statistics Branch functions are:

- provision of research and analysis resources and statistical services for the portfolio;
- reporting on, reviewing and evaluating existing policies and programs; and
- conducting analytical projects in relation to major dimensions of, or issues in, Australian education with particular reference to coordinated projects involving other parts of the portfolio and other Departments.

The Branch conducts in-house studies for these purposes, and manages contracts under the Education Review and Evaluation Studies program and the Participation and Equity Program (see below).

Education Review and Evaluation Studies

Studies conducted under the Review and Evaluation Program are part of the Department of Education's continuing assessment of its student assistance and other financial programs, the monitoring of change, the exploration of emergency issues in education, and investigations supportive of policy development. In 1985-86 projects including an evaluation of the impact on students of different forms of student assistance, an analysis of the socio-economic circumstances of private overseas tertiary students, an evaluation of international scholarships and award schemes, and a review of art education provisions and policies in schools.

Participation and Equity Program

Funds for National Projects and Evaluation within the Participation and Equity Program were spent mainly in the areas of evaluation, research, dissemination and conference activities.

The projects are policy oriented and developmental in nature, with a view to extending the concept of and policies for transition education. Areas covered by projects current in 1985-86 include a longitudinal study of school leavers and a national evaluation study of the program.

Education Research and Development Committee (ERDC)

The Committee advised the Minister on educational research priorities and made education research grants and annual awards as well as arranged dissemination of reports. The ERDC has been abolished and its programs have been terminated following the Review of Commonwealth Functions. The last of its programs was completed by the end of March 1983.

Postgraduate Awards

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 allowance under the awards was increased for 1986 from \$7 616 to \$8 216.

TAFE National Research and Development Centre Ltd.

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), and
- to disseminate information on research and development in the TAFE Sector.

There were 47 research projects conducted in 1985-86, including:

- . occupational clusters of the engineering technical workforce in Australia;
- . development of selection procedures for trades;
- . the delivery of TAFE services to remote areas;
- . evaluation of women in trades programs in the Hunter region;
- . in-plant training centres;
- . education and labour force trends;
- . computer integrated manufacturing training programs;
- . information technology within traineeships.

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

A.10.2 COMMONWEALTH TERTIARY EDUCATION COMMISSION

The prime functions of the Commission under the Commonwealth Tertiary Education Commission Act 1977 arc 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; and
- the diversification of opportunities for tertiary education.

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 1985-86 include: the evaluation of critical factors for women's participation and achievement in science and technology tertiary education courses and employment; the reasons for student attrition in part-time courses; the effect of social grouping on educational performance; the nationwide assessment of professional law and professional engineering education; enquiry into efficiency and effectiveness in higher education institutions; and a range of measures to evaluate external study opportunities in tertiary education.

A.10.3 GRANTS TO UNIVERSITIES

Commonwealth Special Research Centres

In 1982, ten Special Research Centres were established under the Commonwealth Program for Promotion of Excellence in Research. One of the Centres, the Nerve-Muscle Research Centre at the University of New South Wales, closed in 1984. Funding for the nine existing Centres has been approved up to the end of 1987.

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 16.
- 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 \$280m was estimated for 1981 in the 1981-82 Project SCORE Survey. If the 1981 proportion of imputed to total expenditure from all sources is applied to total expenditure from all sources in subsequent years, the imputed value of R&D in this category performed by universities would be approximately \$310m in 1982, \$330m in 1983, \$406 million in 1984, \$430m in 1985 and \$460 million for 1986. Comparable figures for earlier years are \$220m in 1979 and \$250m in 1980.

For colleges of advanced education, the R&D reported to the ABS Survey of Research and Experimental Development for 1984 was \$23.2m 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:

Identifiable research expenditure	1979	1980	1981	1982	1983	1984	1985
	\$m	\$m	\$m	\$m	\$m	\$m	\$m
- general recurrent funds	52.2	57.9	65.3	72.2	78.8	83.8	86.5
- Special Research Grants	5.6	6.2	7.1	8.0	10.5	15.3	16.4
- equipment grants	7.7	8.3	8.7	9.5	9.5	10.4	11.3
TOTAL	65.5	72.4	81.1	89.7	98.8	109.5	114.2

Table 16. Identifiable research expenditure in universities

A.10.4. COMMONWEALTH SCHOOLS COMMISSION

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.

	(\$ million)		R&D						S&T (including R&D)	
		_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A.	Commonwealth Budget see	ctor net e	xpenditure							
Dej	partment of Employment and Australian Standard Classification o f Occupations	Industria	al Relations	-	_	-	-	0.27	0.22	
	Bureau of Labour Market Research	cur.S ext.S	0.69 0.05	0.79 0.39	1.34 0.55	1.39 2.06	1.60 2.51	1.39 2.06	1.60 2.51	
	Employee Relations Program	ext.S	0.01	-	0.09	-	-	0.61	0.77	
•	Grant to National Safety Council	ext.	-	-	0.17	1.27	0.65	1.44	0.65	
·	Australian Council for Employment and Training	ext.S	-	-	-	0.33	-	0.33	-	
	Total (Direct Commonwea funding)	lth	0.75	1.18	2.15	5.04	4.76	6.09	5.75	

A.11 EMPLOYMENT AND INDUSTRIAL RELATIONS

See page 53 for explanation of abbreviations.

A.11.1 DEPARTMENT OF EMPLOYMENT AND INDUSTRIAL RELATIONS

. Bureau of Labour Market Research

The Bureau of Labour Market Research (BLMR) is the research arm of the Department of Employment and Industrial Relations.

The Bureau undertakes research and analysis, sponsors research by other bodies and acts as a "clearing house" for labour market research to ensure that advances in understanding are widely known and used. Its main objectives are:

- to contribute to improved labour market policies and program delivery,
- to promote the understanding of labour market operations through research into the labour market,
- through the conduct of extensive evaluation work, ensure programs are effective, viable, and address the needs of larger groups.

BLMR will be abolished during 1986-87 and the resources absorbed by the Labour Economics Division of the Department of Employment and Industrial Relations and the Office of the Australian Council for Employment and Training.

Australian Standard Classification of Occupations (ASCO)

The Department of Employment and Industrial Relations and the Australian Bureau of Statistics are jointly developing a National Occupational Classification and Dictionary for use by the ABS, State and Commonwealth Government departments and authorities (including the Commonwealth Employment Service), universities, schools, and private industry to assist in functions such as:

- labour market analysis;
- development of training programs and labour force planning;
- improved manpower forecasting;
- accessibility to occupational information; and
- more efficient matching of job seekers and vacancies.

The ASCO First Edition Dictionary volume is to be published in late 1986. ABS will produce publications to assist statistical users.

The aim of the Working Environment Branch is to promote the spread of Industrial Democracy/Employee Participation (ID/EP). It advises the Government with regard to these issues and provides Secretarial support to the National Labour Consultative Council Committee on Employee Participation. Industrial Democracy Grants were made in relation to a variety of activities relating to the development of the Green Paper on Industrial Democracy, and the sub-programs including the ID/EP Cost Subsidisation Program, Research Grant Scheme, and ID/EP Resource Persons Development Program. The overall objective of the Industrial Democracy Grants Program is to contribute to the solution of some of the basic problems which hinder a sustained development of employee participation and industrial democracy.

Worksafe Australia (National Occupational Health and Safety Commission)

The National Safety Council of 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.

Australian Council for Employment and Training

The Australian Council for Employment and Training replaced the National Training Council on 30 June 1986. It provides for, and promotes, consultation and cooperation between governments, employers and trade unions on the development and implementation of employment and training policies, programs and services. The Council commissions, promotes and directs research on employment and training and related labour market issues, and on the evaluation of employment and training notices.

(\$ million)					S&T (including R&D)			
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget se	ector net e	expenditure						
Department of Foreign Affairs Bilateral Agreements	ext. ext.S	- -	-	0.02 0.02	0.01	0.03	0.09	0.09
Australian Centre for International Agricultural Research (ACIAR)	cur. ext. ext.S	- 0.96 -	- 4.75 -	- 8.62 -	- 7.72 0.88	- 8.59 1.19	1.64 7.72 0.88	1.17 8.59 1.19
Australian Development Assist	ance Bure	eau (ADAB))					
. Auministration	cur. cur.S	-	-	-	-	-	2.61 0.57	3.26 0.66
. ASEAN Australian Economic Cooperation Program (AAECP)	ext. ext.S	5.30 1.94	4.27 1.71	4.49 2.23	4.61 0.82	2.67 0.25	6.58 1.60	4.50 0.50
. Bilateral Aid - South East Asia and Pacific Region	ext. ext.S	6.41 0.09	6.76 0.49	7.70 0.64	8.01 0.58	7.15 0.20	56.50 6.90	61.96 7.61
. Bilateral Aid - n.e.i.	ext.	0.95	0.75	0.50	0.65	0.60	18.47	19.74
. Multilateral Programs	ext. ext.S	1.95 0.15	3.14 0.60	2.91 0.69	2.25 1.76	1.63 1.23	15.35 15.09	15.77 8.31
. Development Training	ext. ext.S	3.14 2.12	1.48 1.50	2.22 1.59	3.04 1.71	2.84 1.42	26.14 14.50	20.50 18.05
. International Science, Technology and Researc Programs	h ext.	6.48	6.27	7.83	7.69	5.13	7.95	5.36
. Co-financing with International Financial	ext. ext.S	-	-	- -	-	-	10.19 0.35	1.61 1.15
. Non Government Organisations	ext. ext.S	0.21 0.18	0.26 0.23	0.21 0.18	0.21 0.18	0.14 0.12	0.63 0.31	0.41 0.23
. Regional Programs and Organisations	ext.	0.02	0.02	0.01	0.01	0.01	8.95	7.91
Total (Budget Sector)		30.25	32.62	40.27	40.14	33.20	203.02	188.56

A.12 FOREIGN AFFAIRS

	(\$ million)	R&D					S&T (including R&D)	
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
B.	Commonwealth Non-Budget Sector							
	Australian Centre for International Agricultural ext. Research (ACIAR) ext.S	-	-	-	2.64 0.36	-	2.64 0.36	- -
	Total (Non-Budget Sector)	-	-	-	3.00	-	3.00	-
	Total (Direct Commonwealth Funding)	30.25	32.62	40.27	43.14	33.20	206.02	188.56

See page 53 for explanation of abbreviations.

A.12.1 DEPARTMENT OF FOREIGN AFFAIRS

Bilateral Agreements

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

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.

A.12.2 AUSTRALIAN DEVELOPMENT ASSISTANCE BUREAU (ADAB)

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)

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

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. More than one half of the aid aims at agricultural development. Other fields of significance are civil and resource engineering, natural resources and the environment, energy, administration and business, food technology, health and education.

Multilateral Programs

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

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

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

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

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

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.

A.12.3 AUSTRALIAN CENTRE FOR INTERNATIONAL AGRICULTURE RESEARCH (ACIAR)

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.

(\$ million)						S&T (including R&D)			
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget see	ctor net	expenditure						
De	partment of Health								
	Australian Radiation	cap.	0.51	0.22	0.21	0.25	0.25	0.42	0.42
	Laboratory	cur.	2.27	2.19	2.37	2.71	2.67	4.51	4.44
	Building grants to W. & E. Hall Institute	ext.	3.21	3.54	6.26	2.64	2.18	2.64	2.18
	School of Public Health	cap.	0.10	0.19	0.24	0.24	0.11	0.24	0.11
	and Tropical Medicine	cur.	2.27	2.43	2.78	2.25	2.21	3.36	3.29
•	Australian Institute of Healt Health Services R&D Research Grants Program	h ext.	0.29	0.31	1.38	1.43	1.61	1.64	1.83
	National Acoustics	can	1.23	2.01	0.93	1.09&	1.17&	4 49&	4.87&
•	Laboratories	cur.	0.65	0.85	0.85	1.14&	1.23&	4.14&	4.33&
	National Biological	c a n	0.24	0.42	0.57	0.658	0.708	1 188	1 60 8
•	Standards Laboratory	cur.	2.45	2.72	2.99	3.33&	3.60&	10.33&	11.20&
	,, ,	ext.	-	-	-	-&	-&	0.03&	0.03&
	National Health and								
•	Medical Research Council	ext.	29.56	37.98	44.18	51.24	58.95	51.24	58.95
_	Pathology Laboratories	cap.	-	-	-	-	-	0.94	1.00
-	8,	cur.	-	-	-	-	-	15.58	15.46
	Illtrasonics Institute	can	0.09	0.12	0.15	0.16	0.18	0.32	0.35
•	Oltrasolites institute	cur.	0.34	0.38	0.10	0.42	0.18	0.84	0.90
	Othors	0114						0.21	0.22
•	Other	ext	0.48	0.49	0.08	0.22	-	0.21	1.27
		ent.	0.10	0.19	0.00	0.22	1.17	0.51	1.27
Co	ommonwealth Serum	cap.	0.08	0.11	0.10	0.19	0.08	0.22	0.09
	Laboratories	cur.	2.22	1.93	2.50	3.16	3.40	3.35	3.64
		ext.	0.22	0.14	-	0.21	0.17	0.22	0.18
	Total (Budget sector)		46.21	56.03	65.97	71.33	80.12	106.68	116.35

A.13 HEALTH

(\$ mil	lion)			R&D			So (includi	&T ng R&D)
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
B. Commonwealth	Non-Budget Sector							
Department of Healt . Commonwealth Laboratories(I	h Serum 3E) cap. cur.	0.09 2.61	0.18 3.28	0.14& 3.49&	0.22 3.65	0.13 5.27	0.24 3.79	0.13 5.50
Total (Non-Bu	idget Sector)	2.70	3.46	3.63	4.09	5.58	4.25	5.81
Total (Direct) funding, inc	Commonwealth cluding BE)	48.91	59.49	69.60	75.41	85.70	110.93	122.16

See page 53 for explanation of abbreviations.

- # "Other" covers R&D expenditure by the Dental Health Unit, Institute of Child Health, Health Facilities Branch, Family Planning Program, National Diseases Control, Health Technology Advisory Committee, Paralaboratory Pathology Testing, etc.
- & Estimated by DoS.

A.13.1 DEPARTMENT OF HEALTH

Australian Radiation Laboratory (ARL)

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. During 1985-86 the Laboratory performed R&D on:

- . national standards of ionising radiation dose,
- . national standards of radioactivity and dose levels from radioactivity,
- . public health hazards, dose levels and national standards of radiation dose in relation to the mining of radioactive ores,
- . physical aspects of the use of radioactive materials in medical diagnosis or treatment,
- . public health hazards of microwave and electromagnetic radiation,
- . lasers and ultraviolet radiation in relation to public health hazards, and the establishment of standards,
- . public health hazards of ionising radiation,
- . technical support for the Royal Commission into atomic weapons testing at Maralinga and clean-up operations of the area.

The Laboratory prepares and reviews Codes of Practice, safety standards and guidelines relating to radiation health and continues to operate a National Personal Monitoring Service for occupationally exposed employees.

School of Public Health and Tropical Medicine

The School, located in the Sydney University campus, has taken over a large part of the functions of the Commonwealth Institute of Health. (The National Occupational Health and Safety Commission (A.11.1) has taken over the Occupational Health Section of the former CIH). The School conducts studies and research into the health status of the Australian population, the effective and efficient use of health services, and into tropical medicine. In addition to its own appropriation, the School receives research grants from various Government sources.

National Acoustics Laboratories (NAL)

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.

The construction of a new Laboratory building has resulted in a substantial increase in capital expenditure.

National Biological Standards Laboratory (NBSL)

The NBSL is the laboratory arm of a national system of therapeutic goods control and is jointly administered by Commonwealth and State authorities.

It has the responsibility to develop standards, tests and other measures to ensure that therapeutic goods for human and veterinary use are of good quality, safe and effective, by evaluating new therapeutic goods prior to marketing, testing therapeutic goods on the market for compliance with standards, investigating failures and complaints and by inspecting manufacturing practices.

National Health and Medical Research Council (NH&MRC)

The NH&MRC is an independent body which advises the Minister for 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

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

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.

Family Planning Program

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 so as to improve the health and quality of life of the community.

National Diseases Control Program

A component of the National Diseases Control Program provides funds for research into insect vectors and vector borne pathogens responsible for diseases such as dengue fever, malaria, Australian encephalitis, and Ross River Virus infections.

National Health Technology Advisory Panel

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 nuclear magnetic resonance imaging (NMRI), medical cyclotron facilities, in-vitro NMR spectroscopy, shock wave lithotripsy, lasers in medicine, vestibular function testing and digital subtraction angiography. The NMRI Technical Committee of the Panel is developing a program for the evaluation of NMRI in 5 Australian hospitals.

Pathology Laboratories

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

Paralaboratory Pathology Testing Committee

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

R&D activities of the Branch are: to provide research into drug abuse; to evaluate existing programs; development and evaluation of new programs and such other specific research projects as appear from time to time to be needed (eg National Campaign Against Drug Abuse Strategy Document p.8 - endorsed by all Commonwealth, State and Territory Governments).

Dental Health Unit

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 either naturally or added. This is important in the field of preventative dentistry.

A.13.2 THE COMMONWEALTH SERUM LABORATORIES (CSL)

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.

(\$ million)			R&D						S&T (including R&D)	
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A.	Commonwealth Budget sec	ctor net o	expenditure							
De	epartment of Housing and Con	structio	n							
•	Scientific Services Branch	cap. cur.	0.13 1.02	0.11 0.88	0.22& 0.94&	0.01 0.03	$\begin{array}{c} 0.01\\ 0.04 \end{array}$	0.42 1.99	0.38 2.13	
•	Contributions to - Australian Housing Research Council - Australian Uniform	ext.	0.08	0.05	0.10&	0.10	0.10	0.10	0.10	
	Building Regulations Coordinating Council	ext.	0.01	0.05	0.03	0.08	0.08	0.08	0.08	
•	National Building Technology Centre	cap. cur.	0.05 0.81	$0.05 \\ 0.97$	0.10 0.85	$\begin{array}{c} 0.48\\ 1.08\end{array}$	0.57 1.46	0.62 2.19	0.82 2.69	
Sr	nowy Mountains Engineering Corporation (SMEC) BE	cap. cur.	-	-	-	-	- -	0.07 3.87	0.03 3.80	
	Total (Budget Sector)		2.10	2.10	2.24	1.92	2.43	9.53	10.27	
B.	Commonwealth Non-Budge	et sector								
De	epartment of Housing and Con	structio	n							
	Attributed to past Commony	wealth C	ontributions	:						
	Research Council	ext.	0.06	0.02	0.04&	-	0.20	-	0.20	
	- Australian Onnorm Building Regulations Coordinating Council	ext.	0.01	-	-	-	0.20	-	0.20	
	National Building Technology Centre	cap. cur.	- -	-	0.02 0.21	0.11 0.25	0.15 0.38	0.12 0.28	0.16 0.44	
Sr	nowy Mountains Engineering Corporation (SMEC) BE	cap. cur.	-	-	-	-	- -	0.66 36.62	0.25 32.28	
	Total (Non-Budget sector)		0.06	0.02	0.27	0.36	1.00	37.67	33.59	

A.14 HOUSING AND CONSTRUCTION

	(\$ million)		R&D				S&T (including R&D)		
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
	Total (Direct Commonweal funding, including BE)	th	2.17	2.12	2.50	2.29	3.43	47.20	43.86
	Total (Direct Commonweal funding, excluding BE)	th	2.17	2.12	2.50	2.29	3.43	5.98	7.50
C.	Expenditure from other sour	rces							
De	partment of Housing and Con	structio	n						
•	National Building Technology Centre	cap. cur.	0.01 0.22	0.01 0.24	- -	-	- -	-	-
•	Attributed to State Contribu - Australian Housing Research Council	tion: ext.	0.13	0.07	0.10&	0.09	0.10	0.09	0.10
	- Australian Uniform Building Regulations Coordinating Council	ext.	0.02	0.02	0.03	0.05	0.08	0.05	0.08
	Total (Other sources)		0.38	0.34	0.13	0.13	0.18	0.13	0.18
	Total (A+B+C)		2.54	2.46	2.63	2.42	3.60	47.33	44.03

See page 53 for explanation of abbreviations.

BE: wholly Commonwealth-owned business enterprise.

A.14.1 DEPARTMENT OF HOUSING AND CONSTRUCTION

The Department has responsibility for the planning, execution and maintenance of Commonwealth Government works. In support of these operations, the Department carries out applied research and laboratory testing and provides a comprehensive range of technical services. In many cases these services also directly or indirectly benefit the needs of industry, and the Department contributes to the development of national standards, building regulations and other public interest activities requiring research and other technical services.

Australian Uniform Building Regulations Coordinating Council (AUBRCC)

AUBRCC is responsible for the further development of the Building Code of Australia as the technical basis for building control in Australian States and Territories.

Australian Housing Research Council (AHRC)

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.

- In 1985-86 the Council published the following reports:
- . "The Impact of Housing Expenditure on Employment"
- . "Multicultural Housing Preferences"
- . "Energy Requirements, Energy Use and User Satisfaction in Tasmanian Insulated Houses".

Current projects include studies into accommodation needs of single people and single parents on low incomes; ways of improving services provided by housing authorities; the participation of tenants in the management of public housing estates; the development and evaluation of transportable "granny flats"; financing of private rental investment, including future financing options for community rental housing; a detailed analysis of statistical information on the tenure, cost and occupancy of dwellings in Australia; and an analysis of the level and distribution of housing subsidies.

The 1986-87 Research Program will include studies on housing for the elderly; housing in the community for people who have previously been living in institutions; and an evaluation of programs for spot purchase of houses by housing authorities.

Scientific Services Branch

Formerly known as the Central Investigation and Research Laboratory, the Scientific Services Branch now 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.

National Building Technology Centre

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.

Current research projects include:

- . the control of smoke in large buildings such as supermarkets and hypermarkets and buildings with atria
- . masonry studies for the purposes of developing methods of design against various environmental influences including wind load and fire
- . analysis of fire statistics and participation in international fire research to standardise methods of quantifying hazard
- . studies of the morphology of blended cements and the durability of concrete and mortar made from them
- . risk analyses of the spread of fire and smoke in a building and their interaction with the evacuation of people
- . studies of sound-transmission through masonry walls with a view to correlating sound insulation with basic material properties and hence the achievement of good insulation at minimum cost
- . studies of the energy-saving potential of various lighting devices and the production of guidelines for solar control
- . research into the socio-economic effects of the disablement of a householder and the adaptation of housing to the disabled.

A.14.2 SNOWY MOUNTAINS ENGINEERING CORPORATION

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.

(\$ million)				R&D			So (includi	&T ng R&D)
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget se	ector net e	xpenditure						
Department of Immigration and	l Ethnic A	ffairs						
. Studies and Research	cur.S ext.S	0.20 0.23	$\begin{array}{c} 0.04 \\ 0.14 \end{array}$	0.10 0.23	0.12 0.23	0.11 0.23	0.48 0.29	0.35 0.30
Australian Institute of Multicultural Affairs	cap.S cur.S ext.S	- -	- - -	- - -	- -	- -	0.05 1.74 0.21	$0.01 \\ 1.18 \\ 0.08$
Total (Budget Sector)		0.43	0.18	0.32	0.35	0.34	2.76	1.92
B. Commonwealth Non-Budg	get sector							
Department of Immigration an Studies and Research - Attributable to past Commonwealth contributions	d Ethnic ext.S	Affairs 0.02	-	-	-	-	0.07	0.01
. Australian Institute of Multicultural Affairs	cur.S	-	-	-	-	-	0.02	0.01
Total (Non-Budget sector)		0.02	-	-	-	-	0.09	0.02
Total (Direct Commonwea funding)	ılth	0.45	0.18	0.32	0.35	0.34	2.86	1.93
C. Expenditure from other so	urces							
Department of Immigration and Studies and Research - Attributable to State contributions	l Ethnic A ext.S	offairs 0.03	-	-	-	-	0.04	0.01
Total (Other sources)		0.03	-	-	-	-	0.04	0.01
Total (A+B+C)		0.49	0.18	0.32	0.35	0.34	2.90	1.94

A.15 IMMIGRATION AND ETHNIC AFFAIRS

See page 53 for explanation of abbreviations.

A.15.1 DEPARTMENT OF IMMIGRATION AND ETHNIC AFFAIRS

The Department of Immigration and Ethnic Affairs (DIEA) develops, undertakes and overseer 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.

A.15.2 AUSTRALIAN INSTITUTE OF MULTICULTURAL AFFAIRS

The Institute was established in 1979 to promote, inter alia, the development among the members of the Australian community of an awareness of the diverse cultures within that community and an appreciation of the contribution of those cultures; understanding and harmonious relations among the different ethnic communities in Australia; and a cohesive, just and equitable Australian society.

The Institute's primary research role is to secure information to advise the Commonwealth Government and the community at large about how the aims of multiculturalism can most effectively be pursued.

The Institute is presently undertaking two major research projects.

- a study of the impact of multicultural television broadcasting in terms of its broadcasting objectives (eg facilitating the learning of English and community languages; assisting the settlement process of non-English-speaking immigrants).
- a case study of service provision and community relations in a local government area, aiming to provide an informed basis for community education programs, and better access of people of non-English-speaking background to community services.

Both projects are nearing completion, and final reports will be published in December 1986. The Commonwealth Government has announced that the Institute will be abolished at the end of 1986, and an Office of Multicultural and Ethnic Affairs, based in Canberra, will be established.

	(\$ million)			S&T (including R&D)					
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget see	ctor net e	expenditure						
De	partment of of Industry, Tech	nology a	and Comme	rce					
	Bureau of Industry Economics	cur.S ext.S	1.52 0.10	1.92	2.20	1.90	2.19	1.90	2.19
	Administrative and other costs of technology programs, not elsewhere included	cur.	-	-	-	-	-	3.66	3.97
	Commercial Development of Technology - InterScan support	ext.	2.19	2.53	-	-	-	-	-
	- Public Interest Projects	ext.	-	-	-	-	-	6.27	5.17
•	Grants-in-aid to - Industrial Design	ext.	-	-	-	-	-	0.20	0.21
	- National Association	ext.	-	-	-	-	-	0.92	0.85
	- Research Associations	ext.	1.34	1.68	1.90	1.92	2.00	1.92	2.00
	- Standards Association	ext.	-	-	-	-	-	2.95	3.18
	Industrial R&D Grants - Commencement Grants	ext.	13.08	14.56	16.26	14.30	17.40	14.30	17.40
	- Project Grants	ext.	34.80	43.24	38.13	37.65	23.46	37.65	23.46
	- Automotive Industry Desi Assistance Grants	gn ext.	-	-	-	4.00	4.00	21.00	25.00
	- GIRD Scheme*	ext.	-	-	-	-	10.31	-	10.31
	Biotechnology Grants**	ext.	-	0.72	2.14	4.30	2.19	4.30	2.19
•	Technology Development - Assistance to inventors**	cur. ext.	-	-	-	-	- -	0.14 0.80	- -
•	National Industry Extension Scheme Technology Transfer	cur. ext.	-	-	-	-	-	1.20 5.87	1.42 12.08
•	Council	ext.	-	-	-	-	-	1.05	1.05

A.16 INDUSTRY, TECHNOLOGY AND COMMERCE

(\$ million)			R&D						S&T (including R&D)	
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
	National Space Program	ext.	-	-	-	2.90	5.00	2.90	5.00	
•	Malaria Vaccine Joint Venture	ext.	-	-	-	0.32	0.60	0.32	0.60	
•	Materials handling	cap. cur.	-	-	-	-	-	1.19 1.47	0.23 1.38	
•	Australian Productivity Council (admin support)	ext.	-	-	-	-	-	1.60	1.40	
In	dustries Assistance Commissio	on								
•	IMPACT Project	cur.S ext.S	$\begin{array}{c} 0.11\\ 0.08\end{array}$	0.09 0.09	0.14 0.10	0.11 0.10	0.11 0.11	0.11 0.10	0.11 0.11	
	Total (Direct Commonweals funding)	th	53.22	64.83	60.86	67.50	67.37	110.82	119.31	

See page 53 for explanation of abbreviations.

- # From 1986-87, the Biotechnology Grants Scheme forms part of the GIRD scheme. However for comparative purposes it is still shown as a separate item.
- ## This program ceased in 1986-87.

A.16.1 DEPARTMENT OF INDUSTRY, TECHNOLOGY AND COMMERCE

Bureau of Industry Economics (BIE)

The BIE is a major centre for research into the manufacturing and commerce sectors of the Australian economy. It is assisted in devising its research program and in evaluating its performance by a Council of Advice, comprising business and union leaders and prominent academics. The Bureau's research program is design to take cognizance of a broad range of industry policy issues including:

- . individual industry studies as well as the investigation of general issues affecting a broad range of manufacturing and service industries;
- . studies on the likely future development of Australian industry, as well as detailed investigations of the factors responsible for the performance of industry in the recent past;
- . aspects of industrial technology and production as well as pricing and marketing issues.

In addition to its own research, the Bureau encourages research on industry in other organisations, such as tertiary institutions and industry research bodies.

Research findings are disseminated mainly through the publication of research papers and monographs and participation in and organisation of external seminars and conferences, particularly the BIE Conference.

Evaluation of the effectiveness of existing government policies and programs is an integral part of much of the Bureau's research. In addition the Bureau contributes to policy reviews, including IAC and other public inquiries, as well as assessing the economic aspects of papers put to it by industry and trade unions.

The broad research priorities in 1986-87 are:

- completing research projects commenced in 1985-86
 - impact of the depreciation of the \$A on manufacturing industry
 - non-ferrous metals pricing
 - factors which determine the success of heavy engineering firms in tendering for work on major projects
 - evaluation of industry regulations on specific industries
 - technical change and economies of scale in selected industries
 - productivity measurement in Australian manufacturing
- . new research studies
 - Australia's trade in services
 - foreign investment and industrial development
 - dynamics of adjustment in manufacturing
 - taxing capital income
 - research relevant to the small business sector
- . research in support of the Industry Council's/Australian Manufacturing Council's activities
- . provision of specialist economic advice in industry specific and broader policy issues to the Minister and the Department
- . evaluation of the effectiveness of existing government industry policies and programs.

Commercial Development of Technology

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-in-Aid

The Department is the channel for government support to the Industrial Design Council of Australia, the Standards Association of Australia, the National Association of Testing Authorities and various Research Associations. The Industrial Design Council of Australia (IDCA) provides resources and conducts seminars and workshops to assist improvement in the design of manufactured products and to foster design awareness in industry and the community. IDCA is becoming involved in new product development initiatives aimed at increasing the international competitiveness of Australian manufacturing industry. The monies provided by the Department assist in the running of the IDCA national office and for specific national programs. The grant to the Standards Association is a contribution towards its administrative costs in recognition of the Associations's role in preparing and publishing Australian Standards and in promoting the general adoption of standards relating to structures, commodities, materials, practices, and operations and other matters. The grant to the National Association of Testing Authorities is in recognition of the important support provided by NATA to the government, industry and the community at large, including the technology-based industries, through the provision of an independent national laboratory accreditation scheme.

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. The level of grant to each association is determined with regard to income raised from association membership. Associations receiving support are the Bread Research Institute of Australia, Australian Welding Research Association, Sugar Research Institute, Brick Development Research Institute, Radiata Pine Research Institute, Australian Particleboard Research Institute, Australian Timber Research Institute and the Medical Engineering Research Association. 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

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 amended 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 until 30 June 1989. For further details of these projects and grants, see pages 111-112 of the 1985-86 Science and Technology Statement.

Grants for Industry Research and Development (GIRD) Scheme

This Scheme, created under the Industry Research and Development Act 1986, aims at 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. Companies will have to spend a total of \$50,000 annually on in-house R&D to be eligible for the full 50 per cent grant, but a sliding scale of benefits will apply for annual R&D expenditures from \$20,000 to \$50,000. There is no lower limit for discretionary grants for R&D contracted to approved research institutions. These grants are designed to give a similar level of assistance as the tax concession.
- <u>Generic Technology Grants:</u> these will 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 will fund research in collaboration with industry to a stage where the private sector will take up further development.
- <u>National Interest Agreements:</u> for projects (such as the Bionic Ear) of significant national interest which would not otherwise have been undertaken by industry.

The Motor Vehicles and Components Development Grants Scheme

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 Governments policy objectives for the automotive industry.

National Industry Extension Service

The Technology and Business Efficiency Division of the Department of Industry, Technology and Commerce undertakes a range of programs in productivity development, technology transfer, technological development, invention and innovation that form essential elements of the Government's industrial development policy. The Division encourages development of:

- programs in consultation and in agreement with industry, employee organisations and government to examine specific industry sector problems, develop solutions and disseminate results;
- technology transfer programs facilitating industries' access to new technology by practical programs which assist:
 - . development and extension of practical technology transfer mechanisms;
 - . development and adoption of more effective information handling systems;
- co-operative technological development programs to develop, demonstrate and promote projects in industry based on industrial processes, techniques and applications, to facilitate increased competitiveness of Australian industry.

In 1986 these activities were bought within the National Industry Extension Service (NIES). NIES is a Commonwealth/State and Territories initiative to rationalise and more effectively co-ordinate the provision of extension (information and advisory) services, and to improve enterprises' awareness of and access to them. Over time the Commonwealth will be moving away from the delivery of extension services. State and Territory Governments have the primary responsibility for the delivery of NIES services. Under NIES, private firms engaged in the provision of extension services will have a major involvement in the delivery of extension services to enterprises.

The Australian Industry and Technology Council has agreed to a number of national extension service priorities identified by the National Advisory Committee on Extension Services (NACES) which are presently being implemented. These are:

- improving awareness of NIES and its services through national and state promotion

improving access to extension services by establishing a single access point (single location and telephone contact) in each State and Territory for NIES services

establishing a diagnostic counselling and referral service to help enterprises diagnose and solve their business problems. Funded consultancies will be available in areas such as business planning

the development and provision of a range of specialist extension services. Presently NACES is looking at five areas - best management practices, improved manufacturing and production processes, product innovation and development, quality and human resources management.

NIES is targetted at enterprises in the internationally traded goods and services sector. In addition it is responsive to users needs (market driven) through a consultative framework involving users and providers of extension services as well as governments.

NIES has been launched in Victoria and will be launched in the other States and Territories by the end of 1986.

In 1986-87 the Commonwealth is providing \$17.5M for NIES. Of this \$7M is provided to the States and Territories for the implementation of NIES. The remainder is for the development of national interest extension services.

National Materials Handling Bureau

Materials Handling includes the equipment, systems, standards, methods, management and control aspects involved in the supply, production, movement, packaging, storage and distribution of goods and materials.

The National Materials Handling Bureau was established by the Australian Government, in 1963, as a permanent co-ordinating authority for national materials handling practices, with a Charter which included the provision of 'research, advisory and education services to industry'. In 1967 the Bureau transferred all of its operations to a site at North Ryde. A pilot packaging laboratory was established in 1973 to determine the needs for, and requirements of, a complete laboratory facility. Subsequently the construction of a large, world standard laboratory having the capability to perform a comprehensive range of tests (where relevant, with NATA certification) on packaging materials, consumer packages, tranit packages, unit loads and Intermediate Bulk Containers was approved.

In 1983 the Government announced that the Bureau would be strengthened to maximise its effectiveness in developing materials management and distribution efficiency in Australia. The new laboratory building was formally opened in May 1985 by the Minister for Industry, Technology and Commerce, Senator Button, who stated in his opening address that he regarded the new facility as a very useful step in providing the infrastructure needed for the revitalisation of Australia's industrial base.

Priorities for 1986-87 are:

- . identification and investigation of emerging trends, problems and opportunities in the application of improved materials handling technology and systems through the conduct of research studies and contact with industry
- . fostering improvements in productivity by dissemination of information on improved materials handling technology and systems through seminars, exhibitions, lectures, the publication of reports and the provision of technical information services.
- . assisting industry, through the provision of technical services and testing facilities, to:
 - adopt methods which will reduce the level of product damage sustained during distribution, and
 - improve the performance of packaging materials and systems, unit loads, bulk containers, and handling equipment and systems.
- . active promotion and co-ordination of the effective application of appropriate materials handling technology, equipment and systems through

- the conduct of projects of national significance for industry and government bodies; and
- contribution to the formulation of national and international standards on technical aspects of Materials Handling.

Technology Transfer Council

The TTC is a non-profit company formed in 1980 by the MTIA and CAI, with support from the Department, to establish and conduct a technology transfer network, initially within the metal manufacturing industry. Centres are located in Melbourne, Sydney, Adelaide, Perth and Brisbane.

In addition to Government support TTC also derives earnings from its commercial operations, and has already assisted approximately 3 000 Australian companies. It brings a technology-based, management-oriented approach to manufacturing.

The TTC's primary mission is to develop new concepts and practices to assist Australian firms to become more competitive. Activities are generally carried out with groups of firms, to minimise access costs and maximise benefits through group interaction and dissemination of results. Increasingly TTC is focussing attention upon the need for companies to develop appropriate business plans and incorporate modern management policies before considering introduction of technology based solutions.

The TTC's new manufacturing program TEAM (Towards Excellent Australian Manufacturing) is based around a Value Adding Management which uses techniques such as Just In Time and Total Quality Control to eliminate waste in the manufacturing process.

National Space Program

The National Space Program was inaugurated in July 1985 to ensure continuity of R&D funding for existing space projects. The purpose of the program is to help position industry to participate in space technology by introducing the stimulus necessary to develop new technological, managerial and production skills essential to compete in the international high technology market.

Projects currently being funded under the program are:

- Project Endeavour, which aims to build and space qualify detectors for a space telescope
- Project Lyman in which Australia will contribute to feasibility studies for the Lyman high resolution ultraviolet space telescope
- ERS-1 in which design studies are currently being carried out for an Australian ground station to receive and process data directly from the European ERS-1 remote sensing radar satellite.

Some support has also been provided for feasibility studies of new projects.

Biotechnology Research Grants Scheme

The National Biotechnology Program Research Grants Scheme commenced in January 1984 with the aim of helping to establish an Australian biotechnology industry by encouraging interaction between researchers and industry, concentrating on large scale programs and by directing funds into commercially promising areas. Priority areas for research are: genetic engineering, cell manipulation and culture, enzyme applications and fermentation technology. From 1986-87 the Biotechnology Research Grants Scheme is to be incorporated within the GIRD scheme, where biotechnology is considered as a generic technology.

Malaria Vaccine Joint Venture

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 Hal! 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 J986-87, to cover costs of interest foregone and of management by the AIDC, is estimated at \$600 000.

Australian Productivity Council

The Australian Productivity Council (APC) is a national organisation representing the productivity improvement interests of industry, unions and government. Its programs examine the state and direction of technological advance in Australia and provide advice to both industry and unions on the impact of technology in the workplace. APC also promotes an understanding within the community of the meaning of and issues associated with productivity improvement and seeks to raise awareness of the social impact of technological change.

In 1986-87 the Department will provide \$1.4 million to support APC in these activities and to assist it to widen the range of services offered to industry.

A.16.2 INDUSTRIES ASSISTANCE COMMISSION (IAC)

The IAC is the coordinating agency for the IMPACT Project. IMPACT is a research project to improve policy analysis of inter-related economic and social issues, particularly in the areas of trade, industry development and manpower. The Project is a cooperative effort involving a number of Commonwealth Agencies (Industries Assistance Commission, Bureau of Agricultural Economics, Bureau of Industry Economics, Bureau of Labour Market Research, Department of Arts, Heritage and Environment and Department of Immigration 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 an analytical framework, consisting of compatible economic and demographic models and associated databases and computing systems, which enable the implication of both policy-induced and naturally occurring changes to be studied systematically in an economic-wide perspective. The purpose is to improve policy analysis of inter-related economic and social issues, particularly in the areas of trade, industry development and manpower.

(\$ million)	(\$ million)			R&D			S&T (including R&D)		
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A. Commonwealth Budget se	ctor net e	expenditure							
. Australian Survey Office	cap. cur. ext.	- -	- -	- - -	- -	- - -	0.72 15.87 1.08	1.01 16.07 1.10	
. Grants-in-aid to Australian Institute of Urban Studies and Centre for Regional Economic Ana	ext.S lysis	-	-	-	-	-	0.08	-	
Albury-Wodonga Development Corporation	cap. cur.	0.01 0.04	0.02	-	-	-	- -	-	
Total (Budget Sector)		0.05	0.02	-	-	-	17.74	18.18	
B. Commonwealth Non-Budg	et sector								
. Australian Survey Office	cap. cur.	-	-	-	-	-	0.04 0.81	0.06 0.99	
Albury-Wodonga Development Corporation	cur. ext.	$\begin{array}{c} 0.04 \\ 0.08 \end{array}$	0.02 0.03	0.09	0.10	0.11	0.16	0.17	
Total (Non-Budget sector)		0.12	0.05	0.09	0.12	0.13	1.02	1.25	
Total (Direct Commonwea funding)	lth	0.17	0.08	0.09	0.12	0.13	18.77	19.44	
C. Expenditure from other sou	irces								
Albury-Wodonga Development Corporation	cap. cur.	0.01 0.07	0.04	-	-	-	-	-	
Total (Other sources)		0.07	0.04	-	-	-	-	-	
Total (A+B+C)		0.24	0.11	0.09	0.12	0.13	18.77	19.44	

A.17 LOCAL GOVERNMENT AND ADMINISTRATIVE SERVICES

See page 53 for explanation of abbreviations.

A.17.1 DEPARTMENT OF LOCAL GOVERNMENT AND ADMINISTRATIVE SERVICES

Australian Survey Office

The Australian Survey Office is the Commonwealth's central surveying authority and is responsible for land, engineering and topographic surveys for Commonwealth purposes.

The Office acquires, processes and presents information using a wide range of technology (including an expanding use of satellite imagery and remote sensing) to satisfy client requests in the following areas:

- . national development and defence
- . science and environment
- . community services
- . administration and development of the ACT and other territories
- . policy advice and overseas projects.

Highlights of current activities are:

- . survey projects for defence purposes at Tindal, Derby and Jervis Bay; and for civil purposes at various capital city airports,
- . production of a digital terrain model of Australia,
- . shallow water mapping of Australia and Papua New Guinean territorial waters,
- . mapping and survey support for various scientific and environmental studies eg a marine geophysical program, Meckering Cadoux Crustal Study Project, BMR seismic surveys, Great Barrier Reef surveys and mapping, gravity and geoidal studies of the Australian continent, fisheries studies, wildlife studies,
- . surveys and mapping for proposed village development for aboriginal communities,
- . preparation of tactual maps of parts of Canberra for the visually handicapped,
- . maintenance of LANDSEARCH a directory of land-related data parcels held by Commonwealth agencies,
- . surveys and mapping to support the infrastructure for the development and management of land in the ACT,
- . development of the ACT Land Information System.

A.17.2 ALBURY-WODONGA DEVELOPMENT CORPORATION

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.

(\$ million)					S&T (including R&D)				
		_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.	Commonwealth Budget sec	tor net e	xpenditure						
De	partment of Primary Industry								
•	Administrative support for S&T, not elsewhere included								
	- Library Services - Ministerial Councils - Statutory Research	cur. cur.	-	-	-	-	-	0.63 0.15	0.46 0.16
	Funds and Special Research Grants Administration	cur.	-	-	-	-	-	0.03	-
•	Australian Agricultural Council Sponsored Projects	ext.	0.08	0.07	0.21	0.15	0.22	0.15	0.22
	Horticultural Quarantine Research Grants	ext.	-	-	-	-	0.20	-	0.20
•	Australian Wine Research Institute	cap. cur. ext.	- 0.26	- 0.27	0.03 0.25	0.06 0.25	- - -	0.08 0.46	- -
•	Bureau of Agricultural Economics	cap.S cur.S	- 1.31	1.43	0.16 1.54	0.01 1.49	0.04 1.57	0.08 8.65	0.23 9.03
•	Australian Agricultural Health and Quarantine Service**	cap. cur. ext.	0.24 0.06	$0.01 \\ 0.26 \\ 0.08$	0.01 0.45 2.74	0.01 0.37 2.89	0.01 0.41 3.12	0.20 7.49 21.15	0.24 8.29 22.82
	Commonwealth Special Research Grant	cur. ext.	0.26	0.26	0.50	- 0.69	- -	0.02 0.69	-
	Fisheries Service	cur. ext.	-	-	-	-	- -	2.22 1.38	2.29 1.58
•	Fishery Management (Torres Strait)	cap. cur. ext.	0.28	- 0.31	- 0.50	- 0.57	- 0.47	0.02 0.08 0.57	0.02 0.09 0.47
	Forestry Council	ext.	-	-	0.02	0.02	0.02	0.02	0.02
	National Soil Conservation Program	ext.	-	0.34	1.05	1.05	1.40	2.66	3.36

A.18 PRIMARY INDUSTRY

(\$ million)					S&T (including R&D)			
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget sector	r net ex	penditure (c	ontinued)					
. Plant Quarantine**	cap cur.	0.03 0.13	0.25 0.13	-	-	-	-	-
. Forestry Research Grants	ext.	0.04	0.04	0.05	0.05	0.06	0.05	0.06
. Plague Locust Commission**	cap. cur.	0.01 0.56	0.01 0.05	-	-	-	-	-
Subtotal (Departmental)		2.75	3.49	7.48	7.61	7.53	46.85	49.64
. Statutory Rural Industry Research Schemes	-							
- Barley	ext.	0.30	0.35	0.85	1.04	1.35	1.04	1.35
- Chicken Meat - Cotton - Dairying - Dried Fruit	ext. ext. ext. ext.	0.19 0.35 0.08	0.21 0.27 0.43 0.11	0.22 0.52 0.47 0.17	0.27 0.57 0.59 0.11	0.34 0.71 0.77 0.15	0.33 0.65 0.73 0.17	0.40 0.81 0.93 0.22
- Fishing Industry Development - Fishing Industry	ext.	-	-	-	-	-	0.15	0.30
- Grain Legumes	ext. ext.	0.66	1.68	3.86	4.03	4.95 0.35	4.86 0.01	5.98 0.37
- Honey - Meat	ext. ext.	0.05	0.05	0.05	0.06	- 0.24	0.07	0.08
- Offseeds - Pig Industry	ext.	0.31	0.28	0.31	0.28	0.54	0.34	0.42
- Poultry	ext.	0.13	0.13	0.14	0.16	0.20	0.21	0.26
- Tobacco	ext.	0.42	0.38	0.46	0.51	0.61	0.55	0.65
- Wheat	ext.	3.20	2.05	5.32	4.25	4.59	5.21	5.63
- Wine and Grape	ext.	0.89	0.89	0.94	-	0.30	-	0.30
- Wool	ext.	7.85	9.22	11.11	7.68	8.75	10.02	11.42
. Australian Meat & Livestock	4				11 10	11.20	11 10	11.20
R&D Corporation	ext.	-	-	-	11.10	11.29	11.10	11.29
Subtotal (Commonwealth- derived expenditure on rural research schemes)	-	18.02	20.68	27.98	31.03	34.77	36.03	42.69
Total (Budget Sector)		20.77	24.17	35.46	38.65	44.30	83.10	92.60

(\$ million)					R&D			S&T (including R&D)	
		-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
В	Commonwealth Non Budg	et Sector							
De	epartment of Primary Industry	r							
•	Wine Research Institute	cap. cur.	-	-	-	$0.02 \\ 0.08$	0.01	0.02 0.11	0.02 0.10
•	Australian Meat & Livestoc R&D Corporation	cur.	-	-	-	0.07	-	0.07	-
	Total (Non-Budget Sector)		-	-	-	0.17	0.01	0.20	0.12
	Total (Direct Commonweal Funding)	lth	20.77	24.17	35.46	38.82	44.30	83.30	92.72
C.	Expenditure from other sour	ces							
De	epartment of Primary Industry	,							
•	Statutory Research Funds and Special Research Gra Administration	ants cur.	-	-	-	-	-	0.69	0.63
•	Wine Research Institute	cap. cur.	-	-	0.02 0.17	0.05 0.21	0.05 0.61	0.07 0.45	0.12 1.11
•	Bureau of Agricultural Economics ##	cap.S cur.S	0.14	0.21	0.02 0.16	0.20	0.01 0.24	0.01 1.15	0.04 1.39
•	Australian Agricultural Health and Quarantine Service**	ext.	0.03	0.03	-	0.11	0.25	24.40	22.51
	Plague Locust Commission (State-contributed funds)	n** cap. cur.	0.01 0.06	0.01 0.05	-	-	-	-	- -
	Subtotal		0.24	0.30	0.36	0.56	1.16	26.77	25.79

(\$ million)		R&D						S&T (including R&D)	
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
. Statutory Rural Industry									
Research Schemes									
- Barley	ext.	0.34	0.43	0.97	1.31	1.70	1.31	1.70	
- Cotton	ext.	-	0.41	0.52	0.70	0.87	0.80	0.99	
- Chicken Meat	ext.	0.20	0.20	0.25	0.27	0.33	0.32	0.40	
- Dairying	ext.	0.47	0.44	0.72	0.60	0.77	0.74	0.93	
- Dried Fruit	ext.	0.09	0.10	0.22	0.13	0.16	0.18	0.24	
- Fishing Industry Development Fishisng Industry	ext.	-	-	-	-	-	-	0.13	
- Fishisig industry Desearch	ovt						0.01	0.02	
Grain Lagumas	ext.	-	-	-	-	0.40	0.01	0.02	
- Oralli Leguines	ext.	0.04	- 0.06	- 0.06	0.06	0.40	0.01	0.43	
- Honey Mont	ext.	5.13	5.26	7.01	0.00	0.07	0.08	0.09	
Oilsoads	CAL.	0.20	0.20	0.21	0.20	0.48	0.47		
- Oliseeus Dig Industry	ext.	0.30	0.30	0.51	0.39	0.48	0.47	0.59	
- I Ig Industry Doultry	CAL.	0.28	0.51	0.50	0.45	0.00	0.45	0.00	
- Foundy	ext.	0.10	0.19	0.15	0.18	0.22	0.23	0.29	
- Tobacco Wheat	ext.	0.40	0.55	0.90	0.39	0.70	0.05	6.75	
- wheat	ext.	2.92	4.30	3.05	5.20	0.20	0.57	0.87	
- while and Grape	ext.	-		- 20	-	0.50	-	0.50	
- W001	ext.	8.65	9.22	9.20	10.48	11.95	13.68	15.58	
. Australian Meat & Livestock R&D									
Corporation	ext.	-	-	-	1.01	0.73	1.01	0.73	
Subtotal (Industry-derived expenditure on rural	-								
research schemes)		19.04	22.02	26.50	20.34	24.16	24.29	28.78	
Total (Other sources) ##)		19.28	22.32	26.86	21.92	26.05	53.46	56.94	
Total (A+B+C) ##)		40.06	46.49	62.32	60.73	70.35	136.81	149.73	

See page 53 for explanation of abbreviations.

Amounts indicate payments for research made from the Trust Funds concerned, attributable to the common-rated appropriation (Table A-B) or industry contribution (Table C). The convention adopted for the reporting of expenditure to and from Research Trust Funds is outlined in Appendix C7. See the table in the body of the text for industry contributions to the Trust Funds.

- ** The Bureau of Animal Health, Plant Quarantine and the Plague Locust Commission have been combined into the Australian Agricultural Health and Quarantine Service.
- ## The intramural expenditure of the Bureau of Agricultural Economics shown in C is funded by grants from the Meat and Wool Industry Research Schemes. Therefore they have been excluded from totals in order to avoid double-counting for the Ministry as a whole.

A.18.1 DEPARTMENT OF PRIMARY INDUSTRY

A major role of the Department is to provide advice to the Minister for Primary Industry on rural industry policy issues and to implement and administer legislation and government programs for rural industries and their produce. These policy issues by necessity frequently involve a recognition and consideration of scientific and technical factors. The administration of research funds is a function of the Department.

Bureau of Agricultural Economics (BAE)

The Bureau of Agricultural Economics provides independent, objective and professional economic analyses and promotes public policy debate on issues affecting Australian agricultural, forestry and fishing industries.

The BAE'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 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, 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, fish and forest products and farm inputs. This involves the review and assessment of factors affecting demand, supply and prices and of the economic efficiency of marketing systems in domestic and export markets for these products.

Major BAE areas of study in 1985-86 included:

- . agricultural policies in the European Economic Community and effects of the Common Agricultural Policy (CAP)
- . some agricultural policies of US, Japan and China and their implications for Australia
- . submissions on the vegetation growing and processing industry, crop and rainfall insurance, and exports of merino genetic material
- . various sectoral studies in the sheep industry and fishing industry
- . modelling the effects of rural research
- . medium-term outlook for the rural sector.

New studies to be initiated in 1986-87 include:

- . water reliability policies in Australia
- . an economic analysis of land degradation
- . 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.

Australian Agricultural Health and Quarantine Service (AAHQS)

The AAHQS is responsible for:

- . provision of accurate technical advice on agricultural health and veterinary science;
- . prevention of dangerous and ineffective drugs and chemicals in agriculture;
- . control and eradication of endemic and exotic animal and plant diseases;
- . ensuring the health of imported and exported animal and plant species; and
- . the operation of the Plant Quarantine Service and the Australian Plague Locust Commission.

The Plant Quarantine Research Program investigates problems of an operational nature peculiar to plant quarantine, including the development and evaluation of techniques to eliminate pests and diseases in imported plants and plant products.

Types of research undertaken at the Plant Quarantine Research Station include the investigation of the penetration of fumigation gases into timber, logs and packing material, investigation of new techniques for the elimination of virus diseases from plant material, and work on aircraft disinfestation.

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 research related to this role.

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.

Australian Fisheries Service (AFS)

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; and
- . 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 (including the training of professional fishermen, for example in the use of sonar equipment); encouraging the development of the Australian fishing industry by the provision of grants from the Fishing Industry Research Trust Account 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 al program, the provision of assistance to developing countries in relation to fisheries matters.

Management of Torres Strait Fisheries

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 in 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, traditional fishing, effect 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.

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; and
- . 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.

Australian Agricultural Council-Sponsored Projects

The Department of Primary Industry 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 <u>Helio operto</u> (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.

Rural Research Trust Funds

The Rural Research Trust Funds differ somewhat in regard to their purposes. The general objective of the Funds, however, is to provide money for research and dissemination of information, relating to production improvement, in a broad sense, 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 (multiindustry research), development of new or emerging industries and research necessary in the national interest.

From 1 July 1986 wine and grape research will be assisted by the Wine and Grape Research Fund. This new RIRF will replace the ad hoc funding arrangements which previously applied to wine research carried out at the Australian Wine Research Institute. The new RIRF will also establish a statutory funding scheme for grape research.

(\$ million)	79-80	80-81	81-82	82-83	83-84	84-85	85-86	Projected 86-87
Barley		0.31	0.47	0.29	1.03	0.99	1.37	1.70
Chicken Meat	0.23	0.24	0.22	0.24	0.23	0.24	0.29	0.32
Cotton	-	-	0.20	0.25	0.67	1.00	0.89	1.00
Dairying	0.46	0.42	0.42	0.54	0.57	0.60	0.67	1.27
Dried Fruit	0.09	0.12	0.12	0.12	0.09	0.12	0.16	0.25
Grain Legumes	-	-	-	-	-	-	0.24	0.40
Honey	-	0.02	0.06	0.05	0.05	0.05	0.08	0.08
Meat	3.18	3.30	3.02	4.16	3.61	4.61	5.55	7.68
Oilseeds	0.41	0.28	0.30	0.23	0.30	0.31	0.55	0.61
Pig Industry	0.29	0.39	0.42	0.40	0.42	0.60	0.78	0.93
Poultry	0.10	0.14	0.15	0.15	0.15	0.16	0.22	0.28
Tobacco	0.39	0.38	0.41	0.47	0.55	0.67	0.66	0.70
Wheat	3.09	2.01	1.97	4.65	4.65	5.40	5.48	6.32
Wine	0.26	0.26	0.28	0.37	0.38	0.49	0.52	0.66
Wool	10.24	7.54	8.77	8.83	10.00	10.70	12.88	13.50
Total	18.72	15.39	17.67	18.01	22.27	24.82	30.34	35.70

TABLE 17 INDUSTRY CONTRIBUTION TO PRIMARY INDUSTRY TRUST ACCOUNTS (estimated proportion of levies attributable to R&D and S&T purposes)

Some of the R&D supported by the funds includes the following:

- . For WOOL five fields of research are supported production, wool harvesting, measurement, economic and textile research. Production research covers solid deficiencies through to research in the chemical structure of the messenger protein controlling wool production. Current programs aim to produce new plants with high resistance to insects, pests and plant diseases, particularly clover starch and root rots. The wool harvesting program is concerned with the development of improved shearing methods for use in traditional and automated shearing.
- . 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.

Commonwealth Forestry Post-Graduate Research Awards

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.

Horticultural Quarantine Research Grants

In 1986-87 the Department of Primary Industry will provide \$2 000 000 for horticultural quarantine research and ancillary purposes. This allocation is part of a five year program to set up research related to the development of disinfection treatments for horticultural products in order to overcome overseas quarantine barriers. Part of the 1986-87 funds will be used for supplementary research projects being pursued under the AAC - Fresh Fruits Disinfection Program.

Australian Meat and Livestock Research and Development Corporation

The object of the establishment of the Corporation is to improve the productivity and market performance of the meat and livestock industry.

The Corporation 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; and
- . 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 research projects include:

- . acquiring knowledge about markets
- . improving the efficiency of converting livestock to meat
- . improving the efficiency of livestock production
- . improving product range, quality and marketability.

Following consultation with various sectors of the meat and livestock industry, the Corporation has changed its emphasis from 'on' farm (ie production areas) to 'off farm (ie processing and marketing).

(\$ million)		R&D						S&T (including R&D)	
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A. Commonwealth Budget sect	or net exp	penditure							
Department of Prime Minister a	nd Cabine	et							
. Office of Youth Affairs	ext.S	0.01	0.01	0.03	0.08	0.20	0.08	0.20	
Australian Audit Office	cur.S	-	-	-	-	-	0.43	0.34	
Australian Science and Technology Council (ASTEC)	cur.	-	-	-	-	-	1.47	1.29	
Office of Public Service Board									
. Planning and Statistical Services Section	cur.S	-	-	-	-	-	0.69	0.95	
. Postgraduate Awards	ext.S	0.06	0.07	0.06	0.09	0.06	0.21	0.15	
Total (Direct Commonwealth funding)		0.08	0.15	0.10	0.17	0.26	2.88	2.93	

A.19 PRIME MINISTER AND CABINET

See page 53 for explanation of abbreviations.

A.19.1 AUSTRALIAN AUDIT OFFICE

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; and
- . assisting national audit institutions in Asian and Pacific countries to develop and implement new audit methodologies and techniques appropriate to their needs.

A.19.2 AUSTRALIAN SCIENCE AND TECHNOLOGY COUNCIL (ASTEC)

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; and
- . the means of improving efficiency in the use of resources related to science and technology.

The Council 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; and
- . 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, and draws on existing departments and agencies for the expertise, knowledge and assistance necessary to enable its functions to be discharged effectively.

A.19.3 OFFICE OF THE PUBLIC SERVICE BOARD

Planning and Statistical Service Section

Human resource planning is no longer a major part of the duties carried out by this Section, and the emphasis has shifted to development and undertaking of surveys and census of Australian Public Service staff where information is not available through other means. Recent projects include an outgoing quarterly census of APS staff suffering from RSI, a study of the reasons for the decline in the proportion of youth in the APS, and a study of the supply of, and demand for, senior staff in the APS. Results of surveys and other studies are normally set out in the FSB Annual Report, and ongoing statistical collections contribute to the Board's Statistical Yearbook.

A substantial proportion of S&T effort continues to go towards maintaining computerised records of all APS staff.

Postgraduate Awards

Each year the Board makes awards for postgraduate study, usually involving research towards a PhD or Masters degree.

A.19.4 THE OFFICE OF YOUTH AFFAIRS

The Office of Youth Affairs was set up by the Commonwealth Government in 1977 to improve co-ordination and consultation between Commonwealth Government departments and State and Local government and non-government organisations in relation to Commonwealth programs and policies which affect young people.

The objective of the office's research and policy development program is to:

- . encourage the development of a closer relationship between research into youth issues and new policy and program initiatives with particular emphasis on gaps in the existing research base
- . encourage and co-ordinate research into youth issues by government at all levels, nongovernment agencies and major research bodies with a view to improving the quality of policy input.

The research and policy development program comprises two components:

- . Activities initiated by OYA: these are activities identified by the Office as important areas for policy development which require specific research support.
- . Activities initiated in concert with States and Territories: during 1985-86 a concerted effort to improve co-ordination and development of youth services in the Government and non-government sectors was initiated. As part of this, the Youth Ministers' Council decided to establish a National Youth Affairs Research Scheme.

(\$ million)		R&D						S&T (including R&D)	
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A. Commonwealth Budget secto	r net ex	penditure							
Department of Resources and En	ergy								
. Energy Research and Development Division	cap. cur.	-	-	-	-	-	0.06 1.32	0.07 1.20	
. National Energy Research Development and Demonstration (NERD&D) Program: Energy Trust Account	cur. ext. ext.S	- - -	12.18 0.45	12.04 0.25	12.09 0.37	14.65 0.45	0.14 12.81 0.37	0.18 15.53 0.45	
. National Water Programs	cur. ext.	0.08 1.34	0.11 0.63	0.03 0.21	0.70	0.32	0.35 9.66	0.35 6.82	
. Bureau of Mineral Resources, Geology and Geophysics	cap. cur. ext.	2.01 14.56 0.01	1.06 15.23	4.71 19.27	3.67 23.09	4.45 24.81	5.25 33.74	4.78 36.33	
. Australian Safeguards Office	cur. ext.	0.03	0.03 0.01	0.04	0.04	0.04	0.04	0.04	
. Division of National Mapping	cap. cur. ext.	- - -	- - -	- - -	- - -	- - -	0.68 14.43 1.82	2.54 15.09 2.05	
. LANDSAT Station	cap. cur. ext.	- - -	- - -	- - -	- -	- - -	0.12 0.13 2.35	1.65 0.15 2.84	
. Australian Atomic Energy Commission	cap. cur. ext.	2.41 28.10 0.65	1.75 22.78 0.56	2.96 25.07 0.67	3.74 26.15 0.65	3.91 28.08 0.69	5.13 44.91 0.65	6.69 50.44 0.69	
Total (Budget sector)		49.18	54.79	64.25	70.50	80.40	134.65	147.90	

A.20 RESOURCES AND ENERGY

Department of Resources and NERD&D Program:	Energy							
- Energy Research	ext.	10.88	1.05	-	-	-	-	-
Trust Account	ext.S	0.82	0.04	-	-	-	-	-
. Australian Atomic Energy Commission	ext.	-	-	-	-	-	3.36	3.50
Total (Non-Budget sector)		11.69	1.08	-	-	-	3.36	3.50
Total (Direct Commonwealth funding)		60.87	55.87	64.25	70.50	80.40	138.01	151.40
C. Expenditure from other se	ources							
Department of Resources and	Energy							
. Australian Safeguards Office	cur. ext.	-	-	-	-	-	$\begin{array}{c} 0.10\\ 0.18\end{array}$	-
. Coal Research Trust Account	ext.	3.96	1.89	2.79	3.23	7.20	3.23	7.20
. Bureau of Mineral Resources, Geology and Geophysics	cap. cur.	0.03 0.21	$\begin{array}{c} 0.01 \\ 0.08 \end{array}$	0.03 0.13	0.02 0.17	0.02 0.17	0.02 0.17	0.02 0.17
Australian Atomic Energy Commission	cap. cur.	0.04	0.01	0.02 0.25	0.01 0.22	0.01 0.12	0.01 0.22	0.01 0.12
Total (Other sources)		4.24	1.98	3.47	3.65	7.52	3.93	7.52
. Total (A+B+C) . Less intra- Ministry		65.11	57.86	67.72	74.35	87.92	141.94	158.93
transfers* . Total		(0.65) 64.46	(0.42) 57.44	(0.35) 67.37	(0.36) 73.99	(0.33) 87.57	(0.36) 141.58	(0.33) 158.58

See page 53 for explanation of abbreviations.

B. Commonwealth Non-Budget sector

Some intramural expenditure of the BMR and the AAEC is funded by grants under the National Energy Research Development and Demonstration Program. The total is adjusted to avoid double counting for the Ministry as a whole. Figures for 1986-87 estimated by DOS.
A.20.1 DEPARTMENT OF RESOURCES AND ENERGY

National Energy Research, Development and Demonstration (NERD&D) Program

The National Energy Research, Development and Demonstration Council (NERDDC) was established in 1978 to advise the Minister for Resources 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 established priorities.

Applications for support grants are invited annually by NERDDC. The Council recommends the commissioning of projects where applications are not received in priority technology areas. Since 1978, grants totalling around \$163m have been approved on the advice of the Council.

The Energy Research and Development Division of the Department of Resources and Energy administers the Program and also provides advice to the Minister on energy R&D policy. The Division also provides secretariat and technical support for NERDDC and its seven technical standing committees.

National Water Programs

The Water and Development Division of the Department of Resources and Energy administers research grants and activities to support programs and policies concerned with the planning, development and management of Australia's water resources.

Current activities include:

- . Federal Water Resources Assistance (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 were disseminated by reports, workshops and other activities. Information on the results is also available through our on-line national water data base, STREAMLINE. A new Australian Water Research Advisory Council (AWRAC) was established in June 1985, to advise on a national program of water research. A total of \$3.35 million has been allocated for research activities recommended by AWRAC in 1986-87. Twenty-nine new research projects have so far been approved under the National Water Research Program.

Other initiatives include:

. research into the water resources management problems of the Murray-Darling Basin

. the establishment of a Fellowship scheme.

Bureau of Mineral Resources, Geology and Geophysics (BMR)

BMR's function's are:

- . to develop an integrated, comprehensive, scientific understanding of the geology of the Australian continent, the Australian offshore area and the Australian Antarctic Territory, as a basis for mineral exploration; this is to be done where appropriate in co-operation with State geological surveys and other relevant organisations and having regard to priorities for the search for minerals approved by the Minister for Resources and Energy;
- . to be the primary national source of geoscience data and to publish and provide information; and
- . to undertake mineral resource assessments in accordance with programs and priorities approved by the Minister for Resources and Energy with the advice of BMR.

BMR's research activities are grouped into the following programs:

Fossil fuels: to develop an understanding of the processes controlling the genesis and distribution of fossil fuels so as to provide a basis for their exploration and assessment.

Minerals: to develop the understanding of the origin, abundance, age and distribution of Australia's mineral resources in the context of the structure and geological history of the continent and its various geological provinces as a basis for exploration and assessment.

Groundwater: to establish the hydrodynamics and hydrochemistry of Australia's major groundwater resources as a basis for their assessment and development.

National Geophysical Observatories:

- . to monitor earthquakes in the Australian region and Antarctica, assess the earthquake risk of the Australian continent and provide data for national and international seismology.
- . to measure the geomagnetic field in the Australasian region and Antarctica and provide a model of the field over the entire region.
- . to monitor underground nuclear explosions in the hemisphere centred on Australia as a contribution to international monitoring of nuclear explosions for verification of a comprehensive test ban treaty.
- . to monitor volcanic activity and contribute to disaster management and assessment of geological hazards in the Australasian region.

National and International Geoscience Maps: to produce maps of the Australian continent, territories, and adjacent areas which depict the distribution and geological setting of petroleum and mineral resources.

Overseas Operations: to participate in international collaborative programs relevant to BMR program objectives, assist in the coordination of wide Australian participation, give effect to Government aid programs in the geological sciences, and participate in Antarctic research.

Petroleum and Mineral Resource Assessment: to assess Australia's petroleum and mineral resources, determine the likely availability of these resources, and provide scientific and technical advice in relation to petroleum and mineral exploration and development.

Geoscience and Mineral Resource Databases: to establish and maintain a national database so that scientific and technical data on Australia's petroleum and mineral resources are readily available to those engaged in exploration, resource assessment and research.

BMR Management and Administration

To provide geotechnical and administrative support to BMR's research, resource assessment and database programs. BMR's average staffing level (ASL) in 1986-87 is 590, with over 250 research and other scientists, 200 technical and cartographic staff, and 100 clerical and other support staff.

Recent developments include:

BMR Advisory Council

The Government has established an Advisory Council to help ensure the work of BMR is relevant to the needs of industry and the national economy and is of the highest possible quality. The Council will give the Government a wider perspective from which to evaluate the objectives and priorities of BMR's research programs in support of petroleum and mineral exploration.

New Computer

BMR has significantly upgraded its computing facilities with the installation of a Data General $MV/20\ 000\ system$. The System will provide a wide range of scientific data processing and computational capabilities. The recently created Geoscience Computing and Database Branch is responsible for managing the operation of the computer.

Nuclear Monitoring

Until now Australia has had no independent facility for the detection of underground nuclear explosions and has relied on foreign powers for information on nuclear testing. The ability to detect and identify nuclear explosions is an important element in achieving the Government's objective of seeking a Comprehensive Test Ban Treaty (CTBT) which would ban all nuclear tests by all States in all environments. Government has provided funds to BMR over the 3-year period to 1986-87 to establish an independent Nuclear Monitoring Centre (NMC). This facility has now been integrated with other seismological studies, including those related to earthquake risk, in BMR's Australian Seismological Centre.

Continental Margins Program

BMR is continuing research on the continental margins aimed at increased understanding of the offshore hydrocarbon resources. The program uses the charter vessel RIG SEISMIC, and the data are processed in house on the seismic processing facility. In 1986-87 research cruises will be undertaken in the Abrolhos Sub-Basin, WA; the Eyre Basin, SA; the Otway Basin, SA, Vic; the northern margin of the Gippsland Basin, Vic, NSW, and the Marion Plateau, Townsville Trough and Queensland Plateau, Qld.

Division of National Mapping

The objective of the Division of National Mapping (Natmap) is to provide government and the public with effective, easily accessible, comprehensive and timely geodetic surveying, mapping and remotely sensed information about Australia, its continental shelf and Territories essential to the orderly and balanced development of Australia.

Major activities include the establishment and maintenance of a national geodetic network; the acquisition, manipulation and maintenance of topographic, bathymetric and thematic information about Australia and its territories; the publication and distribution of topographic, bathymetric

and thematic information; the acquisition and distribution of aerial photographs; the provision of technical advice on maritime boundaries; the co-ordination, computation and dissemination of the precise national time scale; and the reception, processing and distribution of remotely sensed data from satellites.

Natmap engages in research and development to ensure that the use of technology can be maximised to assist in performing its activities. Areas in which Natmap is currently active in research and development include:

- Global Positioning System satellite navigation and its application to the national geodetic network;
- geographic information systems for use in thermatic and topographic mapping;
- developments in laser ranging to satellites and lunar targets to improve the accuracy of information acquisition;
- remotely sensed data from SPOT satellites to ascertain its usefulness for topographic map revision and for thematic mapping; and,
- investigating the use of video discs as a storage medium for printed maps.

Australian Safeguards Office

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.

A.20.2 AUSTRALIAN ATOMIC ENERGY COMMISSION

The Australian Atomic Energy Commission is the principal agency for nuclear R&D in Australia. The Commission 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;

- . providing to departments of nuclear medicine in Australian hospitals locally-produced 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, safeguards, fission and health and safety assessments of nuclear plant and operations.

The Commission 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 the AAEC, universities and other tertiary bodies.

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.

A.21 SCIENCE

(\$ million)		R&D					S&T (including R&D)		
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A. Commonwealth Budget sec	tor net ex	penditure							
Department of Science . Administrative and other costs not elsewhere included	cap. cur.	- -	- -	- -	-	- -	0.19 9.39	0.24 8.93	
 Antarctic Activities Antarctic Division 	cap. cur. ext.	6.98 10.47 0.02	6.50 12.11 0.01	6.15 15.14 0.03	6.11 16.94 -	7.09 18.61	10.62 31.37	12.48 33.51	
- Scott Polar Institute and Antarctic Research Grant	ext.	-	-	-	-	0.30	0.01	0.31	
. Australian Government Analytical Laboratories	cap. cur.	0.03 0.53	0.05 0.63	0.03 0.50	0.03 0.54	0.08 0.60	0.84 7.94	1.03 8.35	
. Bureau of Meteorology	cap. cur. ext.	0.03 1.70 0.12	0.10 1.65 0.15	0.41 1.76 0.15	0.46 2.37 0.16	0.26 2.68 0.16	9.79 52.10 0.16	14.06 56.05 0.16	
- International Activities	cur. ext.	-	- -	- -	-	- -	0.19 0.36	0.23 0.57	
Grants-in-Aid - Academies and ANZAAS	ext. ext.S	-	- -	-	-	-	0.48 0.16	0.58 0.24	
- 5th Generation Computer Studies	ext.	-	-	0.24	0.24	0.05	0.24	0.05	
 International Cooperation Academies' Scientific Exchanges 	ext.	-	-	-	-	-	0.14	0.14	
- Association for Science Cooperation in Asia	ext.	-	-	-	-	-	0.03	0.03	
- Bilateral Agreements	ext.	0.16	0.15	0.19	0.43	0.29	0.70	0.71	
- Regional Activities	cur. ext.	-	-	-	-	-	0.11 0.06	0.11 0.06	
- ASTCON		-	-	-	-	-	0.46	0.66	

(\$ million)		R&D					S&T (including R&D)	
	_	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
- Commonwealth Science	ext.	-	-	-	-	-	0.14	0.13
. Ionospheric Prediction Service	cap. cur.	$\begin{array}{c} 0.01 \\ 0.11 \end{array}$	0.01 0.09	0.10	0.03 0.11	0.07 0.12	$\begin{array}{c} 0.06\\ 1.66\end{array}$	$\begin{array}{c} 0.10\\ 1.80 \end{array}$
Patent ActivitiesPatent Office#	cap. cur. ext	- -	- - -	- - -	- - -	- -	0.67 19.18 0.14	$0.71 \\ 21.25 \\ 0.30$
- Contribution to International Patent Bodies#	ext	-	-	-	-	-	0.48	0.58
 Research Grants and Fellows ARGS Grants 	ships cur. ext. cur.S ext.S	- 14.54 - 4.19	- 16.77 - 4.47	- - 5.04	20.25	23.85	0.22 20.25 0.07 5.46	0.17 23.85 0.06 6.15
 National Research Fellowship – Queen Elizabeth II Awards and Marine Science Grants 	cur. ext. ext.S	3.04	3.22 0.06	- 5.84 0.39	- 7.64 1.20	7.98 1.33	0.13 7.64 1.20	0.15 7.98 1.33
. Space Projects	cap. cur.	-	-	-	-	-	0.09 0.06	-0.14
. Commission for the Future	cur.S ext.S	-	-	- -	0.01 0.01	$\begin{array}{c} 0.01 \\ 0.11 \end{array}$	0.13 0.11	0.22 0.25
Anglo-Australian Telescope Board (AATB)	cap. cur. ext.	0.57 1.23 0.09	0.41 1.30 0.06	0.14 1.40 0.32	0.09 1.47 0.28	0.17 1.57 0.23	0.09 1.47 0.39	0.17 1.57 0.23
Australian Institute of Marine Science (AIMS)	cap. cur.	0.58 5.80	0.67 6.23	0.93 6.42	0.53 7.07	0.62 7.58	0.53 7.07	0.62 7.58
Commonwealth Scientific and Industrial Research Organization (CSIRO)##	cap. cur. ext.	81.41 233.25 1.19	56.33 253.89 1.49	39.83 259.62 1.90	45.00 283.85 1.52	55.89 301.73 1.60	46.49 295.69 3.98	57.51 314.34 4.40
National Standards Commission	curap.	-	-	-	-	-	1.12	1.22
Total		366.09	366.33	364.64	401.87	439.11	539.77	591.26

(\$ million)		R&D						S&T (including R&D)	
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
Less recoveries from patent related charges# Total (Budget Sector		-	-	-	-	-	(24.49)	(26.59)	
net expenditure)		366.09	366.33	364.64	401.87	439.11	515.28	564.67	
B Commonwealth Non- budge	et Sector								
Anglo -Australian Telescope B (funds brought forward and	oard								
other revenues)	cur.	0.02	0.02	0.02	0.08	0.06	0.08	0.06	
Australian Institute of Marine Science (AIMS)	cap. cur.	0.02 0.15	$\begin{array}{c} 0.01\\ 0.11\end{array}$	0.02 0.13	0.01 0.16	0.03 0.40	0.01 0.16	0.03 0.40	
Commonwealth Scientific and Industrial Research Organization (CSIRO)##.	cap. cur.	1.11 10.79	1.82 9.07	2.92 16.48	2.67 18.26	3.39 21.83	2.74 18.77	3.50 22.45	
National Standards Commission	cap. cur.	-	-	-	-	-	0.01 0.27	0.01 0.30	
Total (Non-Budget sector)		12.08	11.03	19.58	21.17	25.71	22.10	26.78	
Total (Direct Commonwealth funding)		378.17	377.37	384.22	423.04	464.82	537.38	591.45	
C Expenditure from other sou	rces								
Department of Science . Space Projects (US contribution)	cap. cur. ext.	- -	- - -	- - -	- -	- - -	4.21 2.70 8.49	2.74 9.12	
. Bureau of Meteorology	cap. cur.	- -	-	-	-	-	2.14 18.54	2.89 18.91	
Anglo-Australian Telescope Board (UK contribution and other revenue)	cap. cur. ext.	0.57 1.23 0.09	0.41 1.30 0.06	0.14 1.40 0.32	0.09 1.47 0.39	0.17 1.57 0.23	0.09 1.47 0.39	0.17 1.57 0.23	
Australian Institute of Marine Science (AIMS)	cap. cur.	$\begin{array}{c} 0.01 \\ 0.14 \end{array}$	0.02 0.14	0.10 0.69	0.13 1.66	0.18 2.21	0.13 1.66	0.18 2.21	

(\$ million)	R&D					S&T (including R&D)		
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
Commonwealth Scientific and Industrial Research Organization (CSIRO)##	cap. cur.	2.66 29.16	5.68 27.27	5.19 35.38	5.83 43.69	6.36 47.45	5.96 44.71	6.51 48.58
Total (Other sources)		33.89	34.89	43.24	53.32	58.23	90.55	93.17
Total (A+B+C)		412.06	412.26	427.46	476.35	523.04	627.93	684.62

See page 53 for explanation of abbreviations.

- # The activities of the Patent Office result in revenues to the Commonwealth. This amounted to \$8.22m in 1979-80, \$11.03m in 1980-81, \$12.71m in 1981-82, \$14.5m in 1982-83, \$16.70m in 1983-84, \$20.50m in 1984-85, and \$23.19m in 1985-86.
- ## Most of the scientific and technological service activities undertaken by CSIRO are integral with the organization'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. From 1985, some of the CSIRO activities included in B above, are financed by SIROTECH (see A.21.4 below) and should be classified as BE in Tables 1 and 2 of the Statement: however, at this stage, reliable data are not available.

A.21.1 DEPARTMENT OF SCIENCE

The Department has a broad policy role in relation to science and has administrative and operational responsibilities across a wide span of research, scientific, and service activities. These are described in detail under the following headings.

Antarctic Activities

The Australian Antarctic Territory was declared in 1936 as a result of the pioneering work of Australians in the area of Antarctica to Australia's south and south-west. In 1959, Australia signed the Antarctic Treaty which, together with the Commission for the Conservation of Antarctic Marine Living Resources, provides for the management of the Antarctic continent and surrounding seas. Thirty-two nations have acceded to the Treaty.

The Treaty stipulates that Antarctica should be used only for peaceful purposes, promotes exchange of scientific information and freedom of movement in Antarctica, and removes potential for sovereignty disputes by 'freezing' the status of territorial claims.

Through an Antarctic research program, the operation of Antarctic stations and by playing an active part in the Antarctic Treaty system and in all other Antarctic forums, Australia seeks to:

- . preserve our sovereignty over the AAT and adjacent offshore events;
- . maintain Antarctica free from strategic and political confrontation;
- . protect the Antarctic environment, having regard to its special qualities and its effects upon Australia's region;
- . take advantage of the special opportunities Antarctica offers for scientific research;
- . be informed about and able to influence developments in the Antarctic region; and
- . derive any reasonable economic benefit from the living and non-living resources of the Antarctic.

The Antarctic Division manages Australia's Antarctic program. The Division provides helicopter and ship transport for annual Australian National Antarctic Research Expeditions, co-ordinates and conducts Antarctic research, and maintains Australia's Antarctic research stations.

Four continuously operating research stations are managed by the Antarctic Division: Casey, Davis and Mawson on the coast of the Australian Antarctic Territory (AAT) and Macquarie Island in the sub-Antarctic. In addition, the Antarctic Division operates a summer research station, Edgeworth David, also on the coast of the AAT. This was set up in the summer of 1985-6.

Logistic support for the resupply of stations and field marine research is provided by the charter of ice-strengthened ships: Icebird and Nella Dan. The charter agreement for the 25 year-old combined research and resupply vessel, Nella Dan, expires at the end of the 1987-88 Antarctic resupply season.

During 1986-87 the Division will seek proposals for the time charter for at least ten seasons commencing 1988-89, of a suitable replacement vessel. A project team has been established to co-ordinate the charter of a replacement Antarctic vessel, and a consultant has been engaged to assist in refining specifications and in assessing charter proposals.

Casey, Davis and Mawson stations are being rebuilt by the Department of Housing and Construction to provide facilities that will last well into the 21st century. In order to reduce costs and the time taken for completion of rebuilding, the program has been reduced to the minimum viable level. Research in Antarctica covers a range of discliplines, including glaciology, marine science, terrestrial biology, upper atmosphere physics, cosmic ray physics, geography, geology, geophysics and medical science.

In 1986 the Antarctic Science Grants Scheme was introduced to stimulate Antarctic research by external agencies. The Scheme is administered by the Antarctic Division and advice for allocation of grants is provided by the Antarctic Research Evaluation Group, which is made up of authorities in Antarctic research disciplines drawn from outside the Antarctic Division.

The Antarctic Science Advisory Committee, appointed by the Minister for Science in September 1985, advises the Minister on priority areas for scientific and technological research and on measures to ensure effective Australian participation in international Antarctic programs.

Australian Government Analytical Laboratories (AGAL)

AGAL provides essential services in analytical chemistry and microbiology to enable client government departments and other agencies to meet their responsibilities to protect public health, collect revenue on imported goods, enforce laws against importation of illicit drugs of abuse and protect the good name of export foodstuffs. AGAL's operational laboratories are supported by a research and development group which is responsible for the development of new methods, quality assurance programs, management of reference chemicals and the provision of specialist technical services.

Bureau of Meteorology

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) was established on 1 January 1985 to provide 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.

In order to focus on major aspects of its research priorities, the BMRC is structured with six research groups: Mesoscale Modelling; Medium-range Predictions; Long-range Forecasting; Aviation Meteorology; Data Analysis; and Tropical Meteorology.

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.

Since January 1984 the Baseline Air Pollution Station (Cape Grim, Tasmania) has been operated by the Bureau of Meteorology. The station is part of a worldwide baseline monitoring network sponsored by the United Nations and guided and coordinated by the World Meteorological

Organization. The object is to monitor changes in atmospheric constituents to determine whether man-made pollution is changing the atmosphere on a global scale and whether this in turn is changing the world's weather and climate.

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.

Grants in Aid

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, 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. There is no Congress scheduled in 1986. The 56th Congress of ANZAAS will be held in New Zealand in January 1987.

5th Generation Computer Studies

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.

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 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 for regional programs in the SE-Asia and Pacific areas. The main beneficiaries are the IOC Marine Science Program Group (WESTPAC) the ASEAN-Australia Economic Cooperation Program (AAECP), and the Scientific Industries Steering Committee (SISC), which was established to promote cooperation in S&T between Australia and these regions, and to increase the visibility of, and demand for, Australia's S&T capabilities.

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 activities 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.

New counsellors were appointed to London, Washington and Bonn in 1985-86. In 1986-87 increased emphasis will be given for private sector clients.

Ionospheric Prediction Service (IPS)

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.

Patent, Trade Marks and Designs Office

The Office:

- . oversees and administers Australian industrial property systems for the protection of inventions, trade marks and industrial designs;
- . investigates all applications for letters patent of invention and for the registration of designs and trademarks;

- . issues deeds of letters patent and certificates of registration and publishes details of successful applications;
- . acts as a Receiving Office, International Searching Authority and an International Preliminary Examining Authority under the Patent Co-operation Treaty;
- . provides and further develops patent information services to facilitate diffusion of technology by enabling access by research, manufacturing and industrial concerns to information contained in patent specifications; and
- . contributes advice and expertise to other areas of the Department concerned with encouraging invention and technological innovation.

The Office also contributes advice and expertise to other government departments and agencies concerned with invention and technological innovation. In addition it provides 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. It is responsible for administering Australian participation in bilateral and multilateral international agreements and contributes 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.

Fees charged for activities under the Patents, Trade Marks and Designs Act and other revenues largely exceed the cost of operating the Office (in the Ministry of Science Table above such revenues have been offset against the Department's Budget Appropriation).

Research Grants and Fellowships

- Australian Research Grants Scheme

The Australian Research Grants Scheme (ARGS) supports high level research by individuals and research 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 \$22.42m and \$23.87m were allocated to individual research scientists and research teams for the calendar years 1984 and 1985 respectively under the ARGS. The number of individual grants decreased from 1313 in 1984 to 1226 in 1985, showing a trend towards larger grants in support of basic and applied research projects of exceptionally high quality. Grants are awarded in eight disciplines - biological sciences, engineering and applied sciences, physical sciences, social sciences and humanities, and economics.

- National Research Fellowships

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.

- National Research Fellowships - Queen Elizabeth II Awards.

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

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.

Following consideration of the advice of AMSTAC the Minister for Science has directed that the Marine Research Allocations Advisory Committee give priority in its recommendations to high quality proposals in the following categories:

- . physical, chemical, and biological oceanography, marine ecology and taxonomy of value in the effective management of the marine environment, particularly activities of commercial importance such as fisheries, marine parks, oil and mineral exploration, navigation and coastal engineering;
- . the identification and management of human influences upon the marine environment, such as public use, industrial exploitation, recreational activities and pollution;
- . advancement of knowledge of the geological constitution and resource potential of areas off-shore to Australia;
- . advancement in the description and understanding of the large-scale variability of the regional oceans;
- . the advancement of all forms of marine-related technology including marine instrumentation, mariculture, remote and automated sensing and coastal structures; and
- . the advancement of understanding of fundamental marine processes and systems and the strengthening of Australia's capability in marine taxonomy, within the context of the above priorities.

Total amounts of \$3.827m and \$3.037m were allocated to individuals and research teams in private, tertiary and government research institutions for the calendar years 1986 and 1987 respectively under the Scheme.

Space Projects

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 operations in Australia under an international agreement.

Commission for the Future

The main aim of the Commission for the Future is to raise community awareness and understanding of the social and economic impact of technological changes. Its terms of reference are to secure information relating to futures forecasting of scientific and technological developments, and their likely social and economic impacts ie:

- . technology and the future of work
- . education, training and retraining for a technological future
- . information technology and policy
- . demographic change and its social implications
- . health and medical technology.

Current research projects include

- . technological change and its impact on households and small social systems
- . futures forecasting methodologies
- . demographic change and its social implications
- . the future of unions
- . trialing of community education programs and curriculum material on the social impact of technological change on the future of Australia
- . seminars, publications, videos, information dossiers targetted at specific community groups
- . public communication through speeches, articles, interviews for print and electronic media on current and future issues relating to scientific and technological change.

Specific projects include

- . curriculum monographs on computers in schools and on the information society
- . targetted workshops on information policy
- . development of a community science and technology network
- . Clearing House on Futures Issues
- . development of a Media Resource Service to assist journalists gain access to scientists and technologists with special expertise on current issues.

All S&T activities and research projects aim to disseminate information about the implications of scientific and technological developments and their implications for personal choices in education, career, leisure and related matters.

A.21.2. ANGLO-AUSTRALIAN TELESCOPE BOARD (AATB)

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 to leading astronomers, principally from Australia and the United Kingdom, to carry out research relating to all fields of astrophysics. The Telescope is available 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. During 1985-86 the following improvements have been added to the equipment available to the scientists using the Telescope.

- . the Observatory's charge coupled devices (CCDs) have been upgraded by the acquisition, testing and installation of better quality devices. CCDs are now becoming important detectors for many astronomical applications.
- . improvements have also been made to the optical fibres which enable the simultaneous observation of many objects. The new fibres transmit blue light much more efficiently. The Anglo-Australian Telescope remains the only facility in the world offering multi-object spectroscopy to its users on a routine basis.
- . a new survey instrument was commissioned for use on the Telescope which, for some specific types of observation, provides a more sensitive alternative to optical fibres for multi-object spectroscopy.

Because the scientists employed at the Observatory mostly have short term appointments, the fields of research covered in-house change continuously. During 1985-86 research interests included:

- . detailed matching of observations and computer models for the conditions in some hot stars which are unstable and shed their outer layers at a prodigious rate.
- . studies of pairs of stars in which one star sheds gas onto a compact, magnetic companion.
- . attempts to clarify the confusion of activity at the centre of our Galaxy, and to determine whether a black hole resides there.
- . examination of distant quasars as a probe of the intervening population of galaxies which are too distant and faint to see directly but which moderate the light of those quasars.

A.21.3. AUSTRALIAN INSTITUTE OF MARINE SCIENCE (AIMS)

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.

The charter of the Institute is very broad and does not limit its research to any specific topics or regions. Because of its location near Townsville, the Institute, for the foreseeable future, is directing its research efforts towards the coastal and continental shelf regions of tropical Australia including the Great Barrier Reef, its adjacent waters and mangrove dominated coastlines.

In 1986 the Institute reorganised its research programs 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 basic 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 a provisional patent (March 1986) 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, in addition to proven correlations with atmospheric pressure. 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 in order to enhance the interpretation of such imagery.
- . As part of a Coral Spawning Experiment (CORSPEX) in collaboration with James Cook University, AIMS will be using field data of material diffusion 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.21.4. COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION (CSIRO)

CSIRO was established as an independent statutory corporation by the Science and Industry Research Act 1949. It succeeded the former Council for Scientific and Industrial Research established in 1926. The Act was substantially amended in 1978.

More recently, Government decisions announced in June 1986 as a result of a review by the Australian Science and Technology Council (ASTEC) confirmed that CSIRO 's primary role will continue to be applications oriented research in support of major industry sectors and selected areas of community interest, with a commitment to the effective transfer of its results to users. Amendments to the Science and Industry Research Act, expected during 1986-87 and reflecting government decisions, will include changes to the top management structure of the Organization, and to advisory mechanisms.

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 research results.

Other functions, in summary form are:

- to undertake liaison with other countries in matters of scientific research;
- .- to train research workers;
- to make grants and award fellowships and studentships relevant to the Organization'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 Organization is funded primarily by direct appropriations from the Commonwealth Parliament. Decisions on research priorities are made in the light of advice received through

the organization's formal advisory mechanisms, government departments, industry and other interested bodies.

The research work of the Organization is carried out in five Institutes, each headed by a Director. Institutes are groupings of Divisions and Units with related research interests. The latter are headed by Chiefs and Officers-in-Charge respectively. Divisions and Units are each responsible for coherent sets of research programs, with Units generally being responsible for narrower fields of research and having fewer staff than Divisions.

Support services include:

-	Information and Public Communication	Library and information services, public and internal communication policy and practice.
-	Corporate Secretariat	Corporate policies and 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 1986, CSIRO had a total staff of 7 343 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.

Currently, the broad objectives, fields of research and composition of the five CSIRO research institutes are as follows:

Institute of Animal and Food Sciences

The Institute comprises the following Divisions and Units:

Division of Animal Health Division of Animal Production Division of Fisheries Research Division of Food Research Division of Human Nutrition Division of Tropical Animal Science Division of Molecular Biology Division of Fisheries Research Australian Animal Health Laboratory Wheat Research Unit

The Institute conducts scientific and technological research aimed at improving the efficiency of livestock production, the management and productivity of Australia's fisheries resources, the conservation of its marine ecosystems, and the quality and safety of human foods; and at obtaining a better understanding of the relationships between human diet and health.

The Institute's activities include research on:

- . control of indigenous and exotic animal diseases;
- . nutrition, reproduction, genetics and management of livestock;

- . marine ecosystems and the ecology and population dynamics of the ocean's harvestable resources;
- . methods of processing, handling and storing meat, fish, dairy foods, fruit, vegetables and grain;
- . identification of nutritive imbalances and deficiencies in the diets of Australians and investigation of their effects on human health; and
- . molecular and cellular biology and its application in the livestock and pharmaceutical industries.

Institute of Biological Resources

The Institute comprises the following Divisions and Unit:

Division of Entomology Division of Forest Research Division of Horticultural Research Division of Plant Industry Division of Soils Division of Tropical Crops and Pastures Division of Water and Land Resources Division of Wildlife and Rangelands Research Centre for Irrigation Research.

The Institute conducts scientific and technological research aimed at improving the management and productivity of Australia's land, soil, water, agricultural, pastoral and forestry resources, and the management and conservation of Australian ecosystems.

The Institute's activities include research on:

- application of the plant sciences to the management and utilisation of crops, pastures, forests and native ecosystems;
- introduction, selection and breeding of plant material as a basis for developing new and improved varieties of crop and pasture plants and forest trees;
- control of insect pests of plants and animals, and of weeds and plant diseases, with particular emphasis on research aimed at reducing dependence on chemical control;
- biology of native and introduced animals in the context of conservation and pest control; and
- assessment and management of land, soil and water resources in agricultural, pastoral, forested and near-urban areas.

Institute of Energy and Earth Resources

The Institute comprises the following Divisions:

Division of Energy Chemistry Division of Energy Technology Division of Fossil Fuels Division of Geomechanics Division of Groundwater Research Division of Mineral Chemistry Division of Mineral Engineering Division of Mineral Physics and Mineralogy Division of Minerals and Geochemistry

The Institute conducts and fosters scientific and technological research aimed at contributing to the better definition, use and management of Australia's mineral, energy and groundwater resources with due recognition of the environmental consequences of these activities.

The Institute's activities include research on:

- locating, evaluating, defining and characterising Australia's energy and earth resources; and
- planning their recovery, development and effective use, consistent with the minimization of environmental stresses.

Institute of Industrial Technology

The Institute comprises the following Divisions:

Division of Applied Organic Chemistry Division of Building Research Division of Chemical and Wood Technology Division of Manufacturing Technology Division of Protein Chemistry Division of Textile Industry Division of Textile Physics.

The Institute's objectives are to carry out research and transfer appropriate technology to the rural, manufacturing and tertiary sectors of the economy. The Institute has special research interests related to:

- The manufacturing sector: research into the improvement of existing products and processes and the development of new products and processes suitable for manufacturing industry in Australia, with particular reference to:
 - . processing of rural products, especially wool, wood, hides and skins.
 - . development of new projects and processes suitable for local and overseas markets.
 - . improving the competitiveness of Australian manufacturing industry.
- The rural sector: research into the application of industrial technologies to assist the rural industry in areas of plant production and animal health and with the marketing and processing of rural products, with particular reference to:
 - . objective measurement for the marketing of raw wool.
 - . grain protection.
 - . chemicals and vaccines for plant protection and animal health.
- The service sector: development of technologies for various service industries with special interests, with particular reference to:
 - . water and waste water purification,
 - . building and construction.

urban development.

Institute of Physical Sciences

The Institute comprises the following Divisions:

Division of Applied Physics Division of Atmospheric Research Division of Chemical Physics Division of Environmental Mechanics Division of Information Technology Division of Materials Science Division of Mathematics and Statistics Division of Oceanography Division of Radiophysics

The Institute conducts scientific and technological research in the physical, chemical and mathematical sciences aimed at meeting the needs of Australian industry and the community generally. The research includes work directed to increasing understanding of the physical environment, and undertaken both in the national interest and in accord with the Organization's obligation to contribute to the discharge of Australia's international scientific responsibilities in areas such as astronomy, oceanography and the atmospheric sciences.

The Institute's activities include research on:

- application of the physical sciences to industrial problems;
- maintenance of the national standards of measurement;
- development of scientific and industrial instrument techniques;
- properties of industrial materials and development of improved materials and chemical and physical processes;
- climate, weather and atmospheric transport of pollutants and other entities;
- physics of interactions between soil, water, plants and atmosphere;
- microwave technology; image and signal processing technologies and support and development of radio astronomy;
- the physical and chemical oceanography of the Australian marine environment, including air-sea interaction;
- application of mathematics and statistics to problems in industry and science; and
- development and application of advanced techniques in information technology.

Commercial Activities

The main aim of CSIRO's commercial activities is to achieve the greatest possible social and economic benefit to Australia by contributing to commercially viable innovation. This requires research that can be exploited by Australian industry, or that will otherwise bring benefits to Australia, and the selection of commercial partners with the capability to develop, apply and market the innovation. Normally economic and social benefits will be maximised through establishing manufacturing or other activities in Australia based on the CSIRO innovation. The main benefit to the community comes from the resultant generation of wealth, employment and export income. At the same time, the CSIRO technology with the

greatest potential to increase Australian industry's competitiveness will normally be that which industry is willing to pay most for - judged against the cost and profit structure of the sector of industry concerned. A secondary, but important, aim of CSIRO's commercial policy is to maximise CSIRO's revenue from its commercial transactions.

SIROTECH Limited

SIROTECH, the research commercialisation company established by CSIRO in early 1985, has now developed into a company with some 30 staff skilled in the vital areas of technology marketing, intellectual property management and technology communication. In its initial period the company has successfully concentrated on the transfer of research results with sound commercial potential to companies capable of making the best use of those results to enhance the competitiveness of Australian industry.

The technology marketing thrust of the company has been accompanied by the management of CSIRO's large patent portfolio and the communication of technical support information.

During 1985/86 assistance ranging from advice to negotiation of agreements on more than 200 projects was provided. Some examples follow:

. Flu Research

A new Australian research company, Biota Holdings Limited, has been established to support research involving CSIRO, the Australian National University and the Victorian College of Pharmacy. SIROTECH negotiated CSIRO's position in this collaborative research venture.

. QEM*SEM

SIROTECH is now marketing an automatic mineral image analysis system called QEM*SEM (Quantitative Evaluation of Materials by Scanning Electronic Microscopy) as a mineral scanning bureau service. The system was developed by the CSIRO Division of Mineral Engineering and is generally accepted as an exceptional breakthrough in the world of mineral processing.

Herbicides and Insecticides

A joint venture between Du Pont (Australia) Ltd and SIROTECH has now been established to develop, manufacture and market internationally a series of compounds for herbicides and insecticides. These compounds were developed by the CSIRO Division of Applied Organic Chemistry and their manufacture in Australia has been assured. SIROTECH holds 51% of the new company called Dunlena on CSIRO's behalf.

. Zirconia

A new company, Z-TECH Pty Ltd, has now been formed as a joint enterprise between the ICI (Australia) Group of companies and SIROTECH. Z-TECH has been established to supply zirconia powders and zirconium chemicals to manufacturers around the world. The research and development on the new technologies required to manufacture the chemicals took place in the CSIRO Division of Mineral Chemistry with ICI and CSIRO contribuing \$1 million. ICI is now building a \$0.5 million pilot plant for part of the process at the Division's premises in Port Melbourne. SIROTECH holds 51% of the new company on CSIRO's behalf.

. Footrot

A collaborative research program and a licensing agreement for a footrot vaccine have been established between CSIRO and Sydney University, with Biotechnology Australia and Arthur Webster Pty Ltd. The industrial partners aim to produce a competitive vaccine through the use of the latest molecular biology techniques. The agreement has involved negotiation between, and the co-ordination of, three CSIRO Divisions, Sydney University and the two industrial partners.

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 Corporate Secretary, CSIRO, PO Box 225, Dickson, ACT, 2602.

Table 17. CSIRO EXPENDITURE BY RESEARCH SECTOR 1985-86 AND PROJECTED 1986-87

A. EXPENDITURE BY DETAILED RESEARCH SECTOR

(\$ million)		
	1985-86	Projected 1986-87
MANUFACTURING INDUSTRIES		
Technology Based Manufacturing Industries		
Scientific and Electronic Equipment and Instrumentation Chemicals, Polymers, Pharmaceutical and Veterinary Products	7.550 15.607	8.054 16.625
Fabricated Metal Products and Processes Machinery and Equipment Not Specifically Allocated	2.032 0.541 4.345	2.164 0.579 4.635
Sub-total - Technology Based Manufacturing Industries	30.075	32.057
Resource Based Manufacturing Industries		
Food and Beverages Textiles and Leather Wood, Paper and Forest Products Industrial Mineral Processing and Basic Metal Products Not specifically allocated	12.265 8.011 4.897 7.248 0.094	13.096 8.544 5.227 8.127 0.100
Sub-total - Resource Based Manufacturing Industries	32.515	35.094
Manufacturing - General	·	
Generic Manufacturing Technologies Advanced Materials Standards for Manufacturing Industries Not Specifically Allocated	5.955 12.542 3.384 2.522	6.895 13.381 3.612 2.690
Sub-total - Manufacturing General	24.403	26.578
Manufacturing Industries Not Specifically Allocated	0.981	1.047
TOTAL - MANUFACTURING INDUSTRIES	87.974	94.776

(\$ million)		
	1985-86	Projectec 1986-87
RURAL INDUSTRIES		-
Agriculture		
Cereal Crops Oilseed and Legume Crops Horticultural Crops Fibre and Industrial Crops Pastures Sheep Beef Cattle Dairy Cattle Intensive Livestock Agricultural Systems Multi-commodity Research Not specifically allocated	$\begin{array}{c} 8.007\\ 4.185\\ 6.980\\ 10.836\\ 8.912\\ 5.184\\ 7.220\\ 0.732\\ 0.603\\ 4.908\\ 12.084\\ 13.859\end{array}$	$\begin{array}{c} 8.535\\ 4.456\\ 7.446\\ 11.539\\ 9.484\\ 5.527\\ 7.683\\ 0.780\\ 0.642\\ 5.227\\ 12.859\\ 14.770\end{array}$
Sub-total - Agriculture	83.510	88.948
Forestry	·	
Plantation Forests Natural Forests Bushfires Not Specifically Allocated	$\begin{array}{c} 6.274 \\ 4.081 \\ 0.948 \\ 0.828 \end{array}$	6.698 4.354 1.013 0.887
Sub-total - Forestry	12.131	12.952
Fishing		
Fisheries Marine Biology	8.025 2.828	8.560 3.022
Sub-total - Fishing	10.853	11.582
Rural Industries - Not Specifically Allocated	2.314	2.450
TOTAL - RURAL INDUSTRIES	108.808	115.932

(\$ million)	1985-86	Projectec 1986-87
MINERAL, ENERGY AND WATER RESOURCES		
Mineral Resources		
Exploration Mining Minerals Beneficiation Not Specifically Allocated	8.919 3.182 6.954 0.619	9.532 3.394 7.430 0.662
Sub-total - Mineral Resources	19.674	21.018
Energy Resources		
Coal Production Coal Utilisation Petroleum, Natural Gas and Oil Shale Renewable Energy, Energy Storage, Conservation and Use	4.814 5.260 9.867 6.790	5.135 5.611 10.524 7.249
Sub-total - Energy Resources	26.731	28.519
Water Resources		
Water Resource Management Water Technology Not Specifically Allocated	10.119 1.886 0.599	10.811 2.012 0.638
Sub-total - Water Resources	12.604	13.461
Mineral, Energy and Water Resources - Not Specifically Allocated	0.500	0.526
TOTAL - MINERAL, ENERGY AND WATER RESOURCES	59.509	63.524

(\$ million)		Destantes
	1985-86	Projectec 1986-87
CONSERVATION AND THE NATURAL ENVIRONMENT		
Soils and Land Use		
Soils Resources Land Use Soil Conservation and Management Not Specifically Allocated	1.501 2.092 3.702 3.155	1.602 2.233 3.949 3.367
Sub-total - Soils and Land Use	10.450	11.151
Ecology and Environment		
Aquatic Environment Terrestrial Environment	3.573 6.420	3.806 6.845
Sub-total - Ecology and Environment	9.993	10.651
Flora and Fauna		
Flora Fauna	4.336 5.946	4.625 6.338
Sub-total - Flora and Fauna	10.282	10.963
Oceans and Atmosphere		
Oceans Atmosphere Not Specifically Allocated	7.782 6.579 0.194	8.265 7.020 0.202
Sub-total - Oceans and Atmosphere	14.555	15.487

(\$ million)		
	1985-86	Projectec 1986-87
Environmental Protection		
Land	0.919	0.978
Water	1.294	1.379
Air Human Environment	2.564	2.736
Not Specifically Allocated	0.439	0.469
Sub-total - Environmental Protection	5.787	6.172
Conservation and the Natural Environment - Not Specifically Allocated	2.365	2.535
TOTAL - CONSERVATION AND THE NATURAL		
ENVIRONMENT	53.432	56.959
SERVICE INDUSTRIES		
Urban and Civil Engineering		
Transport Systems	0.295	0.312
Geo-Engineering	2.010	2.146
Construction Urban Planning	4.993	5.332
Not Specifically Allocated	0.376	0.408
Sub-total - Urban and Civil Engineering	8.298	8.865
Human Health		
Nutrition and Food Safety	6.557	7.332
Medical Technology	2.392	2.661
Not Specifically Allocated	0.063	0.071
Sub-total - Human Health	9.032	10.064
Standards for Service Industries		
Standards and Calibration Services	4.962	5.294
Sub-total - Standards for Service Industries	4.962	5.294
TOTAL - SERVICE INDUSTRIES	22.292	24.223

(\$ million)		Droinatad
	1985-86	1986-87
MULTI-SECTORAL TECHNOLOGIES		
Biotechnology	39.120	42.517
Information Technology Space Technology and Astronomy	15.762	17.549
- space technology	8.678	11.386
- astronomy	14.776	22.065
TOTAL - MULTI-SECTORAL TECHNOLOGIES	78.336	93.517
INTERNATIONAL AID	7.986	8.341
TOTAL ESTIMATED RESEARCH	418.337	457.272

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B. SUMMARY DATA

(\$ million)	79-80	80-81	81-82	82-83	83-84	84-85	85-86	Projected 86-87
Manufacturing								
Industries	49.818	55.893	77.976	87.819	90.757	93.786	109.331	120.245
Rural								
Industries	90.494	107.462	132.160	150.313	144.178	136.527	155.946	171.128
Mineral, Energy and Water								
Resources	28.582	36.913	51.165	62.608	62.991	62.039	62.676	67.298
Conservation and the Natural								
Environment	32.716	37.640	44.880	52.653	49.774	60.890	63.232	68.599
Service								
Industries	19.198	20.291	20.651	21.018	28.738	27.200	27.152	30.002
TOTAL	220.808	258.199	326.832	374.411	376.438	380.442	418.337	457.272

Growth Areas

The Executive periodically designates areas of research where growth will be specifically encouraged. Resources for this growth come mainly through redeployment of existing resources either specifically by limiting resources in one area to support growth in another, or less specifically through the redirection of vacancies arising out of the normal processes of staff turn-over.

For 1986-87, the nominated growth areas are:

- generic manufacturing technologies;
- space science and technology,
- information technologies;
- water resources research;
- raw material processing;
- human nutrition.
 - Generic Manufacturing Technologies

Worldwide there are moves in the industrialised countries to automate, integrate and control manufacturing processes in the continuing search for greater efficiency, accuracy and speed in manufacture. Underlying these moves are a number of advanced technologies which are applicable to many industries and which are collectively called generic manufacturing technologies. They include such technologies as robotics, local area networks, computer-aided design and sensing systems. An integrated manufacturing system encompasses the range of activities through design and planning to the actual manufacturing processes, and such a system might embrace one or more of the generic technologies.

. Space Science and Technology

Space-related technologies are rapidly assuming major significance around the world. They are seen by many countries to be necessary tools for the maintenance of strategic and commercial interests and as primary sources of modern technological innovation that invigorates existing industries. Spacecraft are becoming an integral part of national and international systems for communications, meteorology, resources management, surveillance, remote sensing, navigation, search and rescue and national security. CSIRO's space research program is a designated growth area and is intended to maximise industrial involvement and interaction with government instrumentalities and user agencies. Industry groups will receive considerable benefit from the funds diverted to space research by CSIRO in 1986-87.

Within CSIRO space activities are coordinated by the CSIRO office of Space Applications (COSSA), which liaises with at least 15 of CSIRO's Divisions and interacts with other Australian government instrumentalities involved in space activities. Projects are selected on the basis of the following criteria:

- applications that will be utilised in Australia", providing manufacturing opportunities in which a substantial local and export space products market can be generated,
- applications for which Australia must have substantial elements of control, international negotiations strength and technical competence in order to preserve its national interests,

- activities that would permit Australia to maintain the personnel and technologies it requires for the future, and
- opportunities for building on existing competence in Australian government laboratories, universities and industry.

COSSA's initial emphasis was on ground sector activities and projects that stimulated industry to provide space-qualified hardware for operational, technology development, and scientific satellites. It has since increased its involvement in sponsoring of industry seminars and other information activities, and facilitation of significant Australian involvement in instrumentation of future international spacecraft.

Information Technology

Information Technology is well on the way to becoming not only the basis of entirely new major industries, but also an essential component of those existing industries likely to survive past the end of the decade. CSIRO has a scientific and technological base in information technology-related areas in many of its Divisions. In discussions with Australian industry, it is evident that, in the utilisation of information technology in a specific industry, those Divisions of CSIRO that have traditionally served that industry are expected to provide first level advice. The appreciation that CSIRO as a whole is investing in the internal use of advanced information technology, and in certain other Divisions, is providing the assurance needed by industry that support in depth will be provided by CSIRO. The feedback to core areas of information technology in CSIRO from other discipline - and application - specific Divisions provide the Organization with a much richer environment than any other in Australia and, with a few exceptions, elsewhere in the world.

CSIRO has established an information technology program and plans to redeploy additional resources to this area for at least the next few years. The information technology program has three components: the newly established Division of Information Technology, collaborative projects between CSIRO Divisions and partners in Australian industry, universities and other tertiary educational institutions, and the support of information technology-related projects throughout CSIRO. This information technology program will result in co-ordinated effort in the areas of software technology and related hardware, man-machine interface, device and systems hardware technologies, information management and computer networking.

. Water Resources Research

Water is a commodity essential to almost all activities of society, and its supply and treatment is a multi-billion dollar business conducted mainly in the public domain. The enormous direct and indirect social and economic benefits of adequate supplies transcend State boundaries and is a concern of the Commonwealth as it provides the major part of the total expenditure on water resources research.

CSIRO has a major and increasing role in Australian water resources research. CSIRO seeks to maintain the quality and quantity of Australia's water resources and to develop techniques for quality improvement. The Organisation's water resources research is thus directed primarily at the needs of Australia's water industry and the major users of water. The role of water in the biological cycle is included in other sectors of CSIRO's research.

Raw Materials Processing

Australia has a rich endowment of natural resources which have a fundamental role in the economy, especially in the export sector, relatively inexpensive and abundant energy resources, a highly skilled workforce and a strong research capability. Raw materials processing is an important part of Australia's industrial activity, and a focus for structural adjustment of the

Australian economy to products of higher added-value. Research within CSIRO is aimed at marketable products, or processes leading to them, particularly:

- minerals, metals and fossil fuels, including high intensity smelting, processes for non-metallic high value materials, high performance refractories, carbon products from coal, and marketable liquid fuels from oil-shale and natural gas;
- advanced materials such as high purity zirconia and rare earths;
- wood use, including reconsolidated wood, and natural fibre reinforced matrices;
- agricultural products, including wool processing to 'tops', and increased local processing to tanned or finished leather or sheepskins.
- . Human Nutrition

Cardiovascular disease and cancer, both nutritionally-related disorders, account for 75% of mortality in Australia and a high proportion of health care costs. Other diet-related diseases such as obesity and diabetes account for much less mortality but have a high incidence in the community. In addition, the microbiological safety of food is a continuing public health problem. It is estimated that 2 million cases of food poisoning a year occur in Australia and a wide range of bacterial species have been implicated in recent outbreaks of food poisoning.

Further research in these areas is needed so that:

- national dietary guidelines can be refined and the best advice given to consumers;
- appropriate government policies and regulations can be developed on food standards, supplements, additives, labelling and hygiene; and
- agricultural, fishing and food industry policies can be directed towards food composition and adjustment of production to consumer trends.

A.21.5. NATIONAL STANDARDS COMMISSION (NSC)

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.

A.22 SOCIAL SECURITY

(\$ million)	R&D					S&T (including R&D)		
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget sect Department of Social Security . Welfare Research	or net ex	penditure 0.59	0.68	0.68	0.64	0.75	0.64	0.75
Total (Direct Commonwealth funding)		0.59	0.68	0.68	0.64	0.75	0.64	0.75

See page 53 for explanation of abbreviations.

A.22.1. 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.23 SPECIAL MINISTER OF STATE

(\$ million)		R&D						S&T (including R&D)	
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87	
A.Commonwealth Budget sector	or net exp	enditure							
Department of the Special Mini . Support for International Congresses	ister of S	tate							
and Other Grants-in-Aid	ext. ext.S	-	-	-	-	-	0.10 0.29	0.10 0.29	
National Police Research Unit	cap. cur. ext.	0.03 0.04	0.02 0.13 0.01	$0.01 \\ 0.18 \\ 0.02$	-	-	-	-	
Australian Federal Police . Forensic Research	cap. cur. ext.	0.33 0.01 0.11	0.05 0.07 0.12	0.07 0.02 0.14	0.07 0.05 0.15	0.03 0.05 0.06	0.07 0.10 0.15	0.03 0.10 0.06	
Total (Direct Commonwealth Funding)		0.51	0.41	0.43	0.26	0.13	0.70	0.58	
B. Expenditure from other sour	ces								
National Police Research Unit (State funding)	cap. cur. ext.	0.06 0.08 -	0.05 0.27 0.01	0.01 0.36 0.03	- - -	- - -	- - -	- - -	
Total (Other sources)		0.14	0.32	0.40	-	-	-	-	
Total (A+B)		0.65	0.73	0.83	0.26	0.13	0.70	0.58	

See page 53 for explanation of abbreviations.

A.23.1. DEPARTMENT OF THE SPECIAL MINISTER OF STATE

Through appropriations to the Department of the Special Minister of State, the Commonwealth provides grants to national organisations and international conferences held in Australia, some of which are of a scientific or technical nature.
A.23.2. 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.

A.23.3. 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 1985-86 the main 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. A number of research projects were finalised during the 1985-86 period - post blast analysis, forensic odontology and digital signal processing. In-house research into the use of computer techniques for the enhancement of police operational photographs is continuing.

A.24 TERRITORIES

(\$ million)				R&D			S&T (including R&D)	
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A.Commonwealth Budget sector	or net exp	enditure						
Department of Territories Department	cap. cur.S	0.10	0.12	0.17	- -	-	0.13 0.98	0.10 1.04
National Capital Development Commission	cur. ext.	0.02	0.02	- 0.02&	-	- -	0.83 0.38	1.09 0.36
ACT Health Authority	cur.S	-	0.18	0.02	0.13	0.16	0.13	0.16
ACT Schools Authority	cur.S	0.18	0.13	0.13	0.28	0.30	0.28	0.30
Total (Budget sector)		0.30	0.45	0.35	0.42	0.47	2.73	3.05
B.Commonwealth Non-Budget	Sector							
Department of Territories Forestry Trust Account	cur. ext.	0.01	0.04	0.02	0.06	0.08	0.26	0.33 0.03
Total (Non-budget sector)		0.01	0.04	0.02	0.06	0.08	0.26	0.36
Total (Direct Commonwealth funding)	L	0.31	0.48	0.37	0.48	0.55	2.99	3.41
C.Expenditure from other sourc	es							
Department of Territories ACT Health Authority	cur.	0.10	0.17	0.18	0.17	0.19	0.17	0.19
Total (Other sources)		0.10	0.17	0.18	0.17	0.19	0.18	0.20
Total (A+B+C)		0.41	0.66	0.54	0.65	0.73	3.17	3.61

See page 53 for explanation of abbreviations. & Estimated by DoS.

A.24.1. DEPARTMENT OF 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 <u>Aprasia parapulchella</u> and <u>Dasyornis</u> 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 <u>Eucalyptus</u> 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

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.

A.24.2. NATIONAL CAPITAL DEVELOPMENT COMMISSION (NCDC)

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 and evaluation of the effectiveness of water quality control ponds
- . measurement and prediction of traffic noise levels
- . archaeological studies of cultural sites threatened by new land uses
- . 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 native grasses for potential application in landscaping work
- . 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.

A.24.3 ACT SCHOOLS AUTHORITY

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

- . discipline policies and practices in ACT Government schools (completed)
- . measuring quality in public schooling
- . promotional opportunities for CTS personnel in the ACT
- . SCOPE: a study of student job and course aspirations.

A.24.4 ACT HEALTH AUTHORITY

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.
- . assessment of the role of receptors to glycosaminoglycans on synovial membrane cells in the production of cell to cell mediators involved in articular cartilage degradation in the normal joint, and to assess the role of these receptors in a model of acute and chronic inflammatory arthritis.
- . research into work-related stress indicators in a specific population,
- . research into drug education programs in Australia and overseas.
- . research into the history of government policy on aspects of heroin supply and use in Australia.

A.25 TRANSPORT

(\$ million)				S&T (including R&D)				
	-	82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget set	ctor net ex	penditure						
Department of Transport . Marine Navigational Aids	cap. cur.	0.01	-	-	-	-	0.09	0.01 0.01
. Office of Road Safety: - Emissions research	cap. cur.	0.01 0.01	0.01 0.02	- -	-	-	-	-
- Road Safety	cur.S ext.S	0.15 0.21	0.30 0.23	0.31 0.11	0.17 0.06	0.08	0.33 0.82	0.21 0.82
. Grants for Transport Planning and Financial Assistance	ext. ext.S	1.40 0.26	1.40	0.86 0.20	1.23 0.24	1.23	1.34 0.60	1.34
Bureau of Transport Economics	cap.S cur.S ext.S	0.05 2.15	0.01 2.17	0.01 2.32	0.07 2.37 0.08	0.12 2.57 0.09	0.10 3.30 0.10	0.16 3.57 0.10
Total (Direct Commonwealth funding)		4.46	4.32	4.37	4.74	4.61	7.33	6.87

See page 53 for explanation of abbreviations.

A.25.1. DEPARTMENT OF TRANSPORT

Grants to Transport Research Bodies

- Australian Rail Research and Development Organisation (ARRDO)

ARRDO is a national railway research organisation established in 1977 under the auspices of the Australian Transport Advisory Council, and is jointly supported by the Commonwealth and State Government-owned rail systems of Australia. ARRDO's work program concentrates on the financial, operational and managerial problems of Australian railways. The aim is to provide a basis on which a "national corporate plan" for railways can be developed.

- 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. Payments to ARRB under the Australian Land Transport Program in 1985-86 went to projects in the following areas:

- . 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.

Marine Navigational Aids

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 is due for commission in 1986-87.

Road Safety Division

The goals of the 1985-86 research program of the Federal Office of Road Safety as approved by the Minister are

- 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

- development of a national road crash fatality and casualty data system
- analysis of rural road crashes
- driver training, licensing and testing
- surveys on community attitudes to road safety
- enforcement of traffic law and its relationship to road safety

- heavy vehicle speed limit rationalisation and heavy vehicle braking.

A.25.2. BUREAU OF TRANSPORT ECONOMICS (BTE)

The Federal Bureau of Transport Economics (BTE) is a professional research body which reports directly to the Minister for Transport on its program of research work. For administrative purposes the Bureau is attached to the Department of Transport. The Bureau is responsible for independent applied economic research into Australian transport systems. The BTE analyses the nature, capacity, performance and financing of transport systems. It also investigates the economic and resource allocation implications of such systems. Furthermore, the BTE undertakes:

- analysis of the effects of specific pricing and regulatory policies, (including methods of rate and fare setting);
- evaluation of transport investment proposals and programs;
- collection, analysis and dissemination of information relating to transport activities;
- development of economic evaluation methods, transport planning procedures and operations research techniques; and
- application of inter-disciplinary approaches to analysis of transport problems.

The BTE researches all modes of transport 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. Although the research program can be analysed in a number of ways, the major practical division relates to the sources of particular projects. In this context, the work of the BTE tends to fall into four general categories:

- major projects referred to the BTE by the Minister for Transport;
 - projects developed by the BTE in consultation with the Department of Transport and the Department of Aviation, other Commonwealth departments and other agencies (such as Commonwealth-State councils and industry advisory bodies);
 - ongoing commitments to information collection and dissemination. BTE-sponsored conference, workshops and similar activities; and
 - mainstream internally-generated background studies aimed at providing the technical basis for the above activities.

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 is scheduled to be completed in mid-1987.
- development of a model for estimating operating costs of cargo vessels.
- a study on transport-trade interactions which will identify the regulatory and institutional problems which increase transport costs.
- preparation of a report on the trends and prospects for Australian international air transport. The study is examining trends in Australian markets in relation to global trends in traffic.

A.26 TREASURY

(\$ million)					S&T (including R&D)			
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget sector	or net exp	penditure						
Department of Treasury . Econometric Modelling	cur.S	0.07	0.06	0.05	0.11	0.12	0.11	0.12
Australian Bureau of Statistics	cap.S cur.S	0.40 5.68	0.08 4.25	0.58 6.10	0.18 7.66	0.20 8.08	2.60 120.20	4.17 161.49
Total (Budget Sector)		6.16	4.39	6.73	7.94	8.40	122.90	165.78
Less recoveries from ABS cha	arges	-	-	-	-	-	(1.17)	(0.96)
Funding, excluding FE)		6.16	4.39	6.73	7.94	8.40	121.73	164.82
B. Financial Enterprises Sector								
Commonwealth Bank (FE) Reserve Bank of Australia (FE) Grant Schemes	ext.	0.02	0.01	0.01	0.01	0.01	0.01	0.01
- Rural Credits	ext.	1.72	2.51	2.68	2.61	3.10	2.61	3.10
Financial Research	ext.S	0.18	0.21	0.34	0.08	0.01	0.08	0.01
. Special Projects	cur.S	0.18	0.19	0.15	0.33	0.39	0.69	0.83
. CNRD Banknote Project	cap. cur. ext.	- - -	4.23 -	1.45 1.16 0.10	0.25 1.30 0.16	6.20 1.58 0.43	0.25 1.30 0.16	6.20 1.58 0.43
Total (Financial Enterprises sector)		2.09	7.14	5.89	4.73	11.71	6.26	13.11
Total (Direct Commonwealth funding including FE)		8.25	11.53	12.62	12.67	20.11	129.16	178.89

See page 53 for explanation of abbreviations.

FE Commonwealth financial enterprise.

A.26.1. DEPARTMENT OF THE TREASURY

Modelling Section

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.

A.26.2. THE AUSTRALIAN BUREAU OF STATISTICS (ABS)

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.

A.26.3. COMMONWEALTH BANKING CORPORATION

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.

The Corporation's current project relates to the second area and involves funding of research towards controlling flystrike in sheep.

A.26.4. RESERVE BANK OF AUSTRALIA

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;
- . grants are awarded from the Rural Credits Development Fund for research, development or extension projects directed towards the promotion of primary production. The main recipients of grants are universities, State departments of agriculture and the CSIRO. Seventy seven grants and four fellowships totalling approximately \$3.0 million were allocated in 1985-86 from the Rural Credits Development Fund for projects to be undertaken over the next three years. Projects supported include: managing pesticide residues; fungal diseases in Australian native plants; improved yields from irrigated fruit trees and the effect of nutrient status on the photosynthesis of eucalypts.
- . The CNRD project is aimed at the development of a more secure and cost-effective banknote.

A.27 VETERANS' AFFAIRS

(\$ million)				S&T (including R&D)				
		82-83	83-84	84-85	85-86	Projected 86-87	85-86	Projected 86-87
A. Commonwealth Budget sec	tor net ex	penditure						
Department of Veterans' Affairs	8							
Unit Central Medical Research	cur.	-	-	-	-	-	0.32&	-
Advisory Committee	cap.	0.04	0.05	0.04&	0.10&	0.10	0.10&	0.10
·	cur.	0.36	0.32	0.38&	0.53	0.50	0.53&	0.50
. Repatriation Hospitals Pathology Services	cap.	-	-	-	-	-	11.50	12.25&
Total (Direct Commonwealt funding)	h	0.40	0.37	0.42&	0.63&	0.60	12.45&	12.85

See page 53 for explanation of abbreviations.

A.27.1. DEPARTMENT OF VETERANS' AFFAIRS

Central Development Unit (CDU)

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

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

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.

REVIEW OF BILATERAL SCIENCE AND TECHNOLOGY COOPERATION AGREEMENTS

A major objective for the Department of Science is to promote 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

	80-81 \$	81-82 \$	82-83 \$	83-84 \$	84-85 \$	85-86 \$	Projected 86-87 \$
<u>US/Australia Agreement for</u> <u>Scientific and Technical</u> <u>Cooperation</u> Physical and Chemical							
Sciences Engineering & Applied Science Biological and Agricultural	16 194 11 269	22 793 5 200	19 377 7 255	28 685 20 189	20 239 25 602	55 195 33 033	14 370 20 080
Sciences Earth Sciences Social Sciences	43 200 4 331	28 400 9 474 11 050	21 568 28 401 2 875	27 716 12 500 26 612	93 896 35 264 5 602	103 524 33 301	81 427 3 591
Sub-total	74 994	76 917	79 476	105 702	180 603	225 053	119 468
India/Australia Science and Technology Agreement							
Physical and Chemical Sciences Engineering & Applied Science Biological and Agricultural	2 105	10 856 1 200	1 672	2 328 1 600	-	3 600	2 992
Sciences Earth Sciences Social Sciences	12 775 18 082	2 790 23 160	800 10 422	2 800 7 560	-	3 000 7 302	-
Other	-	-	-	-	-	7 889	46 000
Sub-total	32 962	38 006	12 894	14 288	-	21 791	48 992

	80-81 \$	81-82 \$	82-83 \$	83-84 \$	84-85 \$	85-86 \$	Projected 86-87 \$
FRG/Australia Science and Technology Agreement							
Physical and Chemical Sciences Engineering & Applied Science Biological and Agricultural Sciences Earth Sciences Social Sciences	3 930 1 300 7 975 15 900	2 994 21 999 9 000	3 875 - 16 195 8 070	4 500 18 365 - - -	6 000 30 000 5 200 17 264	5 828 6 000 33 000 7 020	22 000 11 350 - -
Sub-total	24 999	20 975	36 993	16 195	44 704	51 878	33 350
Japan/Australia Science and Technology Agreement							
Physical and Chemical Sciences Engineering & Applied Science Biological and Agricultural	28 140	7 483	13 400 50 009	33 500	2 000 40 543	12 281 23 452	24 555 59 310
Sciences Earth Sciences AAS/ISPS Exchange Program	27 400	21 700	67 002 2 300	38 757 23 800	46 479 36 582	$ 18 900 \\ 10 000 \\ 40 000 $	26 870
Other	-	6 035	1 207	28 736	35 000	2 085	-
Sub-total	55 540	35 318	133 918	124 793	160 604	106 718	150 735
Mexico/Australia Science and Technology Agreement							
Physical and Chemical Sciences Engineering & Applied Science	-	2 854	3 000 3 000		- 1 660	- 16 598	- 11 767
Sciences Earth Sciences	-	-	25 436	7 269	13 800 11 180	6 872	3 615
Other (Senior Scientific Delegations)	-	22 030	711	12 617	-	-	16 183
Sub-total	-	24 884	32 147	19 886	26 640	23 470	31 565

	80-81 \$	81-82 \$	82-83 \$	83-84 \$	84-85 \$	85-86 \$	Projected 86-87 \$
China/Australia Science and Technology Agreement							
Physical and Chemical Sciences Engineering & Applied Science Biological and Agricultural	-	-	-	-	3 414	6 000 45 986	2 380
Sciences Earth Sciences Social Sciences	- -	- -	2 820	960 - -	- - -	7 744 9 420 5 028	7 950 4 560
Other (Senior Scientific Delegations)	-	19 000	752	34 165	46 275	1 191	20 000
Sub-total	-	19 000	3 572	35 185	49 689	75 369	34 890
USSR/Australia Science and Technology Agreement							
Astrophysics Earth Sciences Other Sciences	- -	- -	- -	- -	21 762	22 644 41 542 8 353	25 000 44 000 26 000
Sub-total	-	-	-	-	21 762	72 539	95 000
Bilateral exchanges with Non-agreement Countries							
France Israel Republic of Korea Other Country Cooperation	- - -	- - -	- - -	- - -	- - -	39 309 21 000	57 000 48 000 25 000 13 000
Other Exchanges							
Academy/UK Royal Society Exchange	-	-	-	-	50 000	50 000	40 000
Miscellaneous (including Committee Servicing, IOC Grant, UK ISIS Project)	-	-	-	-	-	13 603	13 000
Sub-total	-	-	-	-	50 000	123 912	196 000
GRAND TOTAL	188 225	215 000	299 000	318 804	559 000	700 730	710 000

TECHNICAL NOTES

C.I <u>Background</u>

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. Appendix 6 of the Science and Technology Statement 1981-82 outlines the development of the Statement prior to 1982-83. The remainder of the present Appendix describes the current concepts and methodology. Tables for the statement are prepared by the Indicators and Resource Analysis Section (IRAS) of the Department of Science. Further information is available from IRAS.

C.2 Definitions and concepts

Research and development (R&D)

The definition adopted by the Organization for Economic Co-operation and Development (OECD) (1) was used in the information collection:

<u>Research and experimental development</u> (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 stock of 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#.

- 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, 1981-82, Australian Bureau of Statistics Cat No 8112.0, February 1984, Appendix A, ppl-2.
- # 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:

C.3 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.

C.4 <u>The nature of S&T data included in Science and Technology Statements from</u> <u>1982-83 onwards</u>

In Statements prior to 1982-83, S&T (other than R&D) was collected for all or most agencies on a different basis from R&D (3). In collecting data for the 1982-83 Statement this difference was removed. S&T data shown in this Statement should therefore in principle embody estimates of the S&T components of programs, rather than simply include or exclude total programs on the basis of whether there is or is not a preponderance of S&T activity.

While this change should make comparisons between Ministries more meaningful, caution must still be exercised 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.

C.5 Broad field of science

Some users of the first two Statements, including ASTEC, highlighted a need to distinguish between activities in the natural sciences and engineering (NSE) and those in the social sciences and humanities (SSH). This is common practice in R&D statistics, where the data are collected from R&D performers, but is more difficult when data are collected from R&D funding agencies. Nevertheless, it proved possible to make reasonable estimates of the expenditures on NSE and SSH for nearly all agencies and programs. The guidelines used were as follows:

(3) Research and Experimental Development, All Sector Summary, Australia, 1981-82, Australian Bureau of Statistics Cat No 8112.0, February 1984, Appendix A, p5.

(a) for R&D

R&D reported should be classified as either natural sciences and engineering (NSE) or social sciences and humanities (SSH) according to the field of science in which the R&D is performed, as follows:

Natural Sciences and Engineering (NSE) includes:

 Agricultural sciences and forestry, biological sciences, chemical sciences, earth sciences, engineering and applied sciences, mathematical sciences, medical sciences, and physical sciences.

Social Sciences and Humanities (SSH) includes:

- Accounting; demography; economics; geography (human, economic and social); information science; management; organisation and methods; miscellaneous business sciences and interdisciplinary, methodological and historical activities relating to subjects in this group. (Note that physical geography is classified with the earth sciences).
- Anthropology (social and culture) and ethnology; education and training; law; linguistics; political sciences; psychology; sociology; miscellaneous social sciences and interdisciplinary methodological and historical activities relating to subjects of this group. (Note that technical education, physical anthropology and psycho-physiology should normally be classified with the natural sciences and engineering.)
- Arts (history of the arts and art criticism, but excluding artistic activity itself); languages (ancient and modern languages and literature); philosophy (including the history of science and technology); prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeology, etc.; music; religion; other fields and subjects pertaining to the humanities and interdisciplinary, methodological, historical and other activities relating to the subjects in this group.

(b) for S&T (other than R&D)

Each of these S&T activities (other than R&D) may also be further classified, according to the purpose of the activity, as NSE-supporting and SSH-supporting. For activities concerned with the promotion of innovation or knowledge, such classification is determined by the field of the innovation or knowledge. For service activities it depends on the field of the major professional group relying on the service.

In many cases the NSE and SSH activities falling within a given S&T category are reasonably clear by analogy. To help clarify cases which are less clear the following examples were given:

- "Trialing" of a new educational curriculum is an example of SSH in the category "demonstration of both technical and commercial viability";
- A study using operations research and/or econometric techniques specifically related to the siting of a chemical plant is an example of NSE in the category "policy related studies using advanced techniques";
- Services for anthropological and archaeological collections are normally to be classified as SSH.

The division of S&T activities (other than R&D) into NSE-supporting and SSHsupporting categories is, as far as the Department is aware, an innovation in international practice. It is considered to be a useful distinction for policy purposes and in practice there was little difficulty for respondents in this aspect of the survey.

C.6 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 and Local Government and 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. (See p.5.)
- 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 and Local Government and Administrative Services on behalf of each agency.
- <u>Extramural expenditure</u> 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":

<u>Contracts and commissions</u> refer to funds disbursed specifically under contract or commission arrangements to other organisations to perform specified tasks. Totals for "contracts and commissions" to other Commonwealth agencies, private enterprise, and tertiary education institutions were separately reported.

<u>Grants and donations</u> 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). Totals for "grants and donations" to private enterprise and tertiary education institutions were separately reported.

For both intramural and extramural expenditure, respondents were 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 <u>Budget sector</u> (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 <u>Non-Budget sector</u> (consisting of all transactions of authorities which do not pass through the Public Account).

<u>Other sources</u> 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.

C.I Sources of expenditure from Research Trust Funds

There are a number of possible ways of presenting information on support for S&T resulting from the operation of research trust funds. There are four figures for expenditure which should be considered:

R, the total R&D (or S&T) expenditure from the trust fund account in the particular year;

C, the Commonwealth contributions to the trust fund account in that year in respect of the Commonwealth's support for research;

A, any Commonwealth appropriation to the trust fund account in respect of industry (or other) contributions to the Consolidated Revenue Fund for the purposes of the particular trust fund; and

I, the industry (or other) contribution in that year (usually a levy or tax).

In presenting information on trust fund support for S&T in the Science and Technology Statement, it has been our aim to seek a reporting method which, at least over a period of years, will tend to represent accurately the total of those components of expenditure from the fund which are attributable to Commonwealth contributions. A corollary of this is that we seek a similarly accurate representation with respect to industry (or other non-Commonwealth) contributions. The major classes of trust funds dealt with in the Statement were treated as follows.

⁽⁴⁾ See for example 1986-87 Budget Paper No 1, Statement 6, p345 & ff, and Budget paper No 6 (Portfolio Program Estimates).

- 1. Funds where Commonwealth support is matched to the level of expenditure from the trust account.
 - Commonwealth Budget sector net expenditure.
 C only is shown. (N.B. A is omitted since Commonwealth <u>net expenditure</u> only is sought).
 - (ii) Commonwealth Non-budget sector. There is no expenditure shown in this sector.
 - Other. R-C is shown since this expenditure can be attributed to industry (or other) contributions.
- 2. Funds where Commonwealth contributions are <u>not</u> matched to the level of expenditure from the trust account.
 - (i) Commonwealth Budget sector net expenditure.
 C only is shown, <u>unless</u> the Commonwealth component of R is less than C in this case only that component is shown (e.g., where the Commonwealth contribution to the fund matches other contributions \$:\$, R/2 is shown).
 - (ii) Commonwealth Non-budget sector. Expenditure is shown (if any) which is attributable to Commonwealth contributions in previous years (e.g., where the Commonwealth contribution to the fund matches other contributions \$:\$, 1/2 (R-C-I) is shown).
 - (iii) Other. The amount shown here is the remainder after subtracting any amounts shown under (i) and (ii) from R.

Where the details of trust fund expenditure have been published in the annual Report of the Auditor-General upon Financial Statements prepared by the Minister for Finance, we have drawn on the Report to derive the figures for R, C, and I. C.8 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 Animal (incl. Pastures) Agriculture: _ Agriculture: Plant Agriculture: Soils (Conservation Science, etc) _ Agriculture: Other OTHER PRIMARY INDUSTRIES OTHER PRIMARY INDUSTRIES Commercial Forestry: Forestry: Other Fisheries MINING MINING OF NON-ENERGY MINERALS (incl. Safety and Environmental Protection) _ Prospecting and Resource Assessment Techniques: Metallic Minerals (other than Uranium) Prospecting and Resource Assessment Techniques: Other Extraction Techniques: Metallic Minerals (other than Uranium) Extraction Techniques: Other MANUFACTURING INDUSTRY (including R&D likely to MANUFACTURING benefit Manufacturing Industry eg R&D into manufacturing processes) Food Beverages and Tobacco Textiles and Textile Products Clothing and Footwear Wood, Wood Products and Furniture Paper and Paper Products, Printing & Publishing Chemical, Petroleum & Coal Products: Chemical Fertilisers Chemical, Petroleum & Coal Products: Veterinary Products Chemical, Petroleum & Coal Products: Pharmaceuticals Chemical, Petroleum & Coal Products: Other Non-metallic Mineral Products **Basic Metal Products**

- Fabricated Metal Products
- Transport Equipment
- Medical & Surgical Equipment

- Scientific Equipment
- Photographic Équipment
- ADP Equipment
- Telecommunications & Broadcasting Equipment
- Electronic Equipment n.e.c.
- Electrical Machinery & Equipment n.e.c.
- Agricultural Machinery
- Construction Machinery
- Industrial Machinery & Equipment n.e.c.
- Miscellaneous Manufacturing (Leather, Rubber
- Plastic, etc.

PRODUCTION AND UTILISATION OF ENERGY From Oil and Gas (excl. Oil Shale and Tar Sands)

- Refining, Transport and Storage
- Other (eg Safety, Envionmental Protection)

From Oil Shale and Tar Sands

- Refining, Transport and Storage
- Other (eg Safety, Environmental Protection)

From Coal

- Preparation and Transport (eg Coking, Blending)
- Combustion
- Other (eg Safety, Environmental Protection)

Solar Energy

- Heating and Cooling
- Photo Electric
- Thermal Electric

Nuclear Non-Breeder

- Light Water Reactor (incl. Safety, etc.)
- Other Converter Reactor (incl. Safety, etc.)
- Fuel Cycle (excl. Mine Site Aspects), including Conversion, Enrichment, Recycling, Transport, Treatment and Disposal
- Supporting Technologies (excl. Mine Site Aspects) including Safety, Environmental Protection, etc. relating to the Fuel Cycle

Nuclear Breeder

Nuclear Fusion

Other Primary Sources

- Wind
- Ocean
- Geothermal Energy
- Other Sources and New Vectors (eg Bagasse)

ENERGY

PRODUCTION AND UTILISATION OF SYNTHETIC FUELS

From Coal Conversion (eg Gasification) From Biomass

CONSERVATION OF ENERGY

In Industry Residential and Commercial Transportation (eg Fuel Savings, Public Transport) Other (eg Heat Pump, Waste Recycling)

OTHER ENERGY R&D

Electric Power Conversion (eg Generation, Pollution Aspects) Electicity Transmission and Distribution Energy Storage n.e.c. Energy Systems Analysis (eg Sociological, Economical and Environmental Aspects n.e.c.) Other (eg Dissemination)

MINING OF ENERGY MINERALS

Extraction Techniques

- Uranium
- Coal
- Oil and Gas (excl. Oil Shale and Tar Sands)
- Oil Shale and Tar Sands

Prospecting and Resource Assessment Techniques

- Uranium
- Coal
- Oil and Gas (excl. Oil Shale and Tar Sands)
- Oil Shale and Tar Sands

Other (eg Safety, Environmental Protection)

- Uranium
- Coal
- Oil and Gas (excl. Oil Shale and Tar Sands)
- Oil Shale and Tar Sands

TRANSPORT

- Road accidents & safety
- Other road
- Railway
- Water transport
- Air transport
- Multimodal transport
- Intermodal materials handling
- Other transport

COMMUNICATIONS

TRANSPORT

COMMUNICATIONS

- Broadcasting
- Telecommunications
- Postal Communications

Other Communications ECONOMIC SERVICES N.E.I. COMMERCIAL ACTIVITIES Wholesale and Retail Trade Banking, Finance and Insurance _ Other Commercial Activities MISCELLANEOUS PUBLIC SERVICES Water Supply (excl. Water Pollution) Waste Disposal and Recycling Fire Protection _ ECONOMY (incl. National, State and Regional Economies) Overseas Trade Productivity n.e.c. _ Industrial Relations R&D relating to Economic Data Collection and Modelling _ Economic Activities n.e.c. ENVIRONMENT (incl. Protection ENVIRONMENT and Rehabilitation) Air Pollution _ Water Pollution Other Pollution _ Other Environment: Natural _ Other Envirohment: Human

URBAN AND REGIONAL PLANNINGURBAN AND REGIONAL PLANNING

- Housing (except Construction Aspects)
- Urban and Regional Planning

HEALTH

HEALTH: PRE-AND PARA-CLINICAL

HEALTH: CLINICAL (Organs, Diseases and Conditions)

- Acquired Immune Deficiency Syndrome (AIDS)
- Arthritic and Rheumatic
- Other Diseases and Conditions mainly affecting the Aged
- Cancer
- Cardio-vascular and Haemopoietic: Heart
- Cardio-vascular and Haemopoietic: Blood
- Cardio-vascular and Haemopoietic: Other
- Diabetes
- Other Endocrinal
- Malaria
- Infective and Parasitic n.e.c.
- Mental Health
- Multiple Sclerosis
- Neural n.e.c.
- Pain
- Spina Bifida
- Other Birth Defects and Congenital Diseases

- Sudden Infant Death Syndrome
- Exocrinal n.e.c.
- Gastrointestinal, Metabolic and Hepatic n.e.c.
- Muscular and Skeletal n.e.c.
- Oro-dental (incl. Speech)
- Renal and Urological
- Reproductive
- Respiratory
- Skin and Connective Tissue n.e.c.
- Vision, Hearing and Other Sense Organs
- Other Organs, Diseases and Conditions
- Clinical Health not specific to particular Organs, Diseases and Conditions

HEALTH: PUBLIC

- Addiction: Alcohol and Tobacco
 - Addiction: Other Drugs
- Health Services and Education
- Environmental Health
- Occupational Health
- Other Public Health

EDUCATION

WELFARE

EDUCATION

- Special

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- General

SOCIAL DEVELOPMENT AND WELFARE SERVICES

- Unemployment/Unemployed
- Working Conditions (excl. Industrial Relations,
- Occupational Health)
- Aboriginal Welfare and Development
- Migrant Welfare and Development
- Aged Persons Welfare and Development
- Youth/Child Welfare and Development
- Family Welfare and Development
- Invalid, Handicapped Persons Welfare and Development
- Social Development and Welfare Services n.e.c.

COMMUNITY SERVICES N.E.I.

MISCELLANEOUS COMMUNITY SERVICES AND OBJECTIVES

- International Relationships or Objectives (eg Peace)
- R&D Primarily for the Benefit of Other Countries
- Consumer Affairs
- Public Administration: Information Manipulation/Dissemination
- Public Administration: Other
- Public Administration: Othe
- Law Reform
- Law Enforcement
- Corrective Services
- Sport
- Culture
- National and Other Parks
- Other Recreation and Tourism

EARTH, OCEAN, ATMOSPHERE AND SPACE

ADVANCEMENT OF KNOWLEDGE OF THE PHYSICAL ENVIRONMENT (excl. aspects covered under ENVIRONMENT)

- Earth (except Mining Aspects)
- Ocean (except Fisheries Aspects)
- Atmosphere (incl. Meteorology)
- Remote Sensing
- Space

GENERAL ADVANCEMENT OF KNOWLEDGE

GENERAL ADVANCEMENT OF KNOWLEDGE

- Natural Sciences and Engineering
- Social Sciences and Humanities

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".

C.9 <u>Allocation of expenditures by discipline-related field</u>

Users of the S&T Statement have sometimes sought an allocation of R&D/S&T Commonwealth expenditures by field of research or discipline. At present, a classification of such a type can only be found (for R&D activities) in the ABS R&D survey data.

For the first time, on an experimental basis, the present Statement includes a disciplinerelated classification (Table 6, p.15-16), as a response to user requests. These data should be regarded as indicative only. The collection unit for the Science and Technology Statement survey is based on socio-economic objective. About 350 forms are received from respondents on this basis. The following ad hoc discipline-related fields have been derived for this Statement. Each form has been allocated to one of these fields on the basis of estimates by the Department of Science. Clearly since many forms will overlap more than one field there are many approximations in this process.

1.	Engineering and Technology - Defence Application	Includes practically all R&D/S&T whose sole or main beneficiary is National Defence and Security.
2.	Engineering and Technology - Resources Application	Mining and Chemical engineering, Metallurgy, Food technology, Textile technology, Material science, etc.
3.	Engineering and Technology - Technology-intensive Industries	Aeronautical and Space engineering, Electrical and Electronic engineering, Mechanical engineering, System analysis, Sunrise technology, etc.
4.	Engineering and Technology - Service Application	Civil, Traffic and Communication engineering, Architecture, Construction science, etc.
5.	Physics and Mathematics	Includes, eg, Astronomy and most of the non-applied Exact sciences.
6.	Atmospheric and Space Science	Meteorology and associated sciences, knowledge of the Spacecraft-accessible space.
7.	Energy Disciplines	Fuel and Power, Nuclear engineering, Petroleum technology, Power generation including hydroelectrical, etc.
8.	Chemistry	Physical, Organic, Inorganic, Analytical, Theoretical, Biochemistry, etc.
9.	Earth Resources	Geography, Geology, Geochemistry, Geophysics, Geodesy Cartography, Surveying, Mineralogy, Exploration, etc.
10.	Water Resources and Physical Environment	Fresh water Hydrology, Water engineering (not included in 4 above), Remote Sensing, Geomorphology, non strictly biological Environmental protection, etc.
11.	Marine Sciences	Oceanography, Marine Biology, Fisheries research, etc.
12.	Health and Medical Sciences	Medicine, Surgery, Dentistry, Optometry, Orthopaedy, Medical Psychology, Human Biology, Physics and Chemistry applied to health, etc.
13.	General Biology	All biological and life science not elsewhere included; including physical Anthropology, Biogeography, etc.

14. Rural Sciences	Biology applied to agriculture, Agronomy, Animal Husbandry, Veterinary science, Soil science, Agricultural engineering, Agricultural economics, etc.
15. Business and Information Science	Accounting, Economics, Human and Economic Geography, Information and Communication Science, including journalism and Modern Languages, Management, commercial application of Computer science, Applied Statistics, etc.
16. Humanities and Social Science	Arts, Education, Law, Linguistics, History, Philosophy, Political Science, Sociology, and other SSH not elsewhere classified.

C.10 Distinction between "advancement of knowledge" and basic research

Some readers of the Science Statement 1979-80 assumed a correspondence between the socio-economic objective category "advancement of knowledge" and the type of activity "basic research". A broad summary of General Government sector (i.e. Commonwealth plus State) intramural R&D expenditure data from the 1981-82 SCORE survey illustrates the difference.

 Table 19
 R&D in the General Government Sector 1981-82 - Objective category by type of activity

(\$ million)	Type of activity						
Objective category	Basic research	Applied research	Experiment: l development	Total			
National security Economic development Community welfare Advancement of knowledge	10.6 132.6 28.3 48.0	70.6 255.8 35.8 12.3	31.9 67.5 5.4 8.4	113.2 455.9 70.5 68.7			
Total	219.6	375.5	113.3	708.3			

The basic research performed in objective categories other than "advancement of knowledge" is classified as basic because it has no "particular application or use in view" but satisfies the SCORE definition of strategic basic research, namely "research directed into specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge necessary for the solution of recognised practical problems."

Valid entries in the type of activity classes "applied research" and "experimental development" in the objectives category "advancement of knowledge" would be associated with developments which" could ultimately contribute to several specific objectives in ways that do not allow one such objective to be selected as predominant".

On theoretical grounds, the figure for "basic research" in the objectives category "advancement of knowledge" should be an estimate of expenditure on "pure basic research", defined in Project SCORE as "research which is carried out without looking for long term

economic or social benefits other than advancement of knowledge". In fact, two thirds of the \$48.0m in this category was reported as "pure basic research", and \$5.2m of "pure basic research" was reported outside the category.

The Statement does not attempt to distinguish between basic research, applied research, and experimental development.

C. 11 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 of price change is greatly limited by a number of factors (6). 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.

⁽¹⁾ Australian National Accounts, National Income and Expenditure 1984-85, Australian Bureau of Statistics, Catalogue No 5204.0, pp 79-81.

Price Index		Index values for year (1979-80 = 100)*										
or I	Deflator	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	Projected 86-87	
A.	GDP implicit price deflator(IPD)	83.5	90.1	100.0	110.5	121.7	134.6	144.7	153.7	164.1	175.6	
B.	Gross non-farm IPD	85.3	91.1	100.0	110.6	123.4	136.8	147.3	156.9	168.0	179.7	
C.	Government final consumption expenditure IPD	85.9	91.5	100.0	112.3	127.2	139.9	148.3	157.3	167.5	179.2	
D.	Consumer price index 1	83.9	90.8	100.0	109.4	120.8	134.7	144.0	150.1	162.7	175.7	
E.	Commonwealth research salary payment index 2	88.4	92.9	100.0	114.0	133.4#	145.2	152.3	159.9	168.8	177.1	
F.	Private non-dwelling construction IPD 3	84.0	90.3	100.0	112.2	126.9	143.9	151.1	161.3	180.1	192.8	
G.	Private enterprise intramural R&D expenditure IPD 4	82.4	91.1	100.0	115.0	132.3	141.2	153.0	166.1	177.7	190.1	
H.	Universities aggregate price deflator 5	87.1	92.2	100.0	114.2	126.9	139.3	147.5	157.8	167.4	179.2	
I.	ABS R&D other capital expend. deflator 6	81.0	86.0	100.0	103.5	117.6	129.3	139.1	145.4	164.4	175.9	
J.	ABS R&D non-salary current expenditure deflator 6	84.9	91.5	100.0	110.2	122.8	135.1	143.2	151.9	161.7	173.0	
K.	Commonwealth extramural R&D payments deflator 7	87.2	92.2	100.0	112.4	130.2	141.8	149.5	157.2	167.2	176.7	
L.	Private Equipment IPD 8	81.9	90.8	100.0	109.6	117.6	129.3	139.1	145.4	164.4	175.9	

TABLE 20: Deflator series relevant to Commonwealth-funded R&D

Sources : Budget papers, ABS bulletins and unpublished data, Commonwealth Tertiary Education Commission data, Department of Science unpublished data based on Public Service Board salaries information.

- * DOS estimates based on assumptions in the Budget Papers for 1986-87 (ie, GDP non-farm deflator to increase 7%, CPI to increase by 8%).
- # Takes account of an additional pay period falling during 1981-82 in that application of this value also adjusts deflated expenditure to a 26-pay period basis. (Australian Public Service salaries are paid on a fortnightly basis and at eleven or twelve year intervals there are 27 payments rather than 26.) For applications where the adjustment is not desired use 128.4.
- 1 Figures derived by DOS from original series having a 1980-81 base (ABS Catalogu 6401.0, March Quarter, 1986).
- 2 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.
- 3 A public non-dwelling construction deflator is available to 1981-82 in unpublished working estimates of the ABS. The private construction deflator is used here as there are published figures after 1981-82 and the quarterly publication of the series facilitates estimation for the current year.
- 4 Estimated by DOS using the current constant 1979-80 price figures for the years 1976-77, 1978-79, 1981-82 and 1984-85 published by ABS (Catalogue No 8105.0, May 1986. Partial data were obtained for 1976-77 and 1983-84 (Catalogue No. 8114.0, June 1985) with interpolation of the deflator for missing years 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 sees the constant price estimates in Cat. No. 8114.0 as less reliable than most published ABS constant price data.
- 5 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.
- 6 These series are unpublished working estimates made available by ABS.
- 7 Used to deflate extramural payments made by agencies to other Commonwealth bodies. Based on weighting factors derived from an analysis of 'Other Source' (ie, excluding Budget and Non-budget) expenditure for the Science Ministry and applied to other indices.
- 8 Derived from ABS Catalogue No 5206.0, June Quarter 1986.

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.

ACRONYMS, ABBREVIATIONS AND SYMBOLS

AAEC	Australian Atomic Energy Commission
AAECP	Asean Australian Economic Co-operation Program
AAHL	Australian Animal Health Laboratory
AAHQS	Australian Agricultural Health and Quarantine Service
AAT	Australian Antarctic Territory
AATB	Anglo-Australian Telescope Board
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
ACIAR	Australian Centre for International Agricultural Research
ACRE	Australian Computer Research Board (now in ATERB)
ACT	Australian Capital Territory
ACTU	Australian Council of Trade Unions
ADAB	Australian Development Assistance Bureau
ADACS	Australian Development Assistance Courses
ADP	Automatic Data Processing
AEC	Australian Education Council
AEI	Australian Educational Index
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
AIDC	Australian Industry Development Corporation
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
AMSTAC	Australian Marine Sciences and Technologies Advisory Committee
ANARE	Australian National Antarctic Research Expeditions
ANPWS	Australian National Parks and Wildlife Service
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
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

ASCA	Association for Science Cooperation in Asia
ASCO	Australian Standard Classification of Occupations
ASEAN	Association of South-East Asian Nations
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)
AWRAC	Australian Water Research Advisory Council
AWRC	Australian Water Research Council
BAE	Bureau of Agricultural Economics
BE	In this Statement Refers to Wholly Owned Commonwealth 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
BTE	Bureau of Transport 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
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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)
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
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSIRONET	National Computer Network Operating within Australia
CSL	Commonwealth Serum Laboratories
СТВТ	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)
DIEA	Department of Immigration 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
EFTPOS	Electronic Funds Transfer at Point of Sale
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
FM	Frequency Modulation
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

Gross Domestic Product
Gross Domestic Expenditure on Research and Development
Grants for Industrial Research and Development
Homestead and Community Broadcast Satellite Service
Home and Community Care
High Frequency
Heavy Ion Analytical Facility
High Flux Australian Reactor
Industries Assistance Commission
International Atomic Energy Agency
International Civil Aviation Organisation
Imperial Chemical Industries
Industrial Democracy
International Data Centre
Industrial Design Council of Australia
International Development Program
International Association for the Evaluation of Educational Achievement
A project of analysis of economic and social issues (see A.16.2)
International Maritime Satellite Organisation
International Telecommunications Satellite
International Oceanographic Commission
Implicit Price Deflator
Ionospheric Prediction Service
Industrial Relations
Indicators and Resource Analysis Section. (Department of Science)
Industrial Research and Development
International Standard Classification of Education
Just in Time
Jet Propulsion Laboratory (USA)

KW	Kilowatt
Landsat	NASA Remote Sensing Satellite
Ltd	Limited
MATPAK	Materials Handling Program
MCB	Metric Conversion Board
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
Ν	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
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
NH&MRC	National Health and Medical Research Council
NHTAP	National Health Technology Advisory Panel
NIES	National Industry Extension Scheme

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
ODP	Office of Defence Production
OECD	Organization for Economic Co-operation and Development
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
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
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
TCC	Technological Change Committee
TEAM	Towards Excellent Australian Manufacturing
Telecom	Australian Telecommunications Commission
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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