

PROGRAM TEN: SCIENCE AND TECHNOLOGY

OBJECTIVE

To give advice that is professional, impartial and informed, on the application of science and technology that is best suited to Australia's defence and security needs.

DESCRIPTION

The Science and Technology Program, through the Defence Science and Technology Organisation (DSTO), provides the core of Australia's skills in defence research and its applications. There are four principal supporting objectives:

- to position Australia to exploit future developments in technology which show promise for defence application;
- to ensure that Australia is an informed acquirer of new capabilities and equipment;
- to develop new capabilities where Australia's circumstances require this; and
- to support existing capabilities by increasing operational performance and reducing the costs of ownership.

The skills required to meet these objectives enable DSTO also to support Australia's regional and global security interests and to interact with industry.

The Program Manager is the Chief Defence Scientist. The program comprises three Sub-Programs:

- 10.1 Aeronautical and Maritime Research: undertakes research and development in, and seeks solutions to, problems relating to military aircraft, naval ships and submarines, weapons systems and defence force personnel.
- 10.2 Electronics and Surveillance Research: undertakes research and development in, and seeks solutions to, problems relating to surveillance and reconnaissance, command and control, communications, intelligence, military information systems, electronic warfare and land operations.
- 10.3 Executive and Support: provides corporate planning and support, science policy advice, policy oversight and management of DSTO's interaction with industry, policy oversight and management of DSTO's international and regional cooperation, and engineering and administrative support.

STRATEGIES FOR 1998-99

DSTO will pursue Defence and Program objectives by:

- a. seeding and shaping the perceptions and priorities of the Defence organisation for the use of science and technology;
- b. responding to tasking and other demands, both planned and unplanned, from the Defence organisation;
- c. conducting enabling research in areas of science and technology likely to be relevant to Australia's future circumstances;
- d. working with industry and other scientific and R&D organisations in support of Defence objectives;
- e. supporting wider national security interests; and
- f. providing effective and efficient management and other support for DSTO's specialist needs.

PERFORMANCE MEASURES FOR 1998-99

The extent to which:

- a. clients' needs and priorities are met, and in particular:
 - advice provided to the Defence organisation to make informed decisions on new defence capabilities is timely and useful;
 - enhancements to existing defence capabilities provide increased operational effectiveness, including more cost-effective use of personnel and materiel; and
 - the life-of-type of defence platforms is extended, with consequent cost and operational benefits;
- b. those emerging technologies relevant to Australia's future needs are identified and exploited;
- c. DSTO's interactions with industry lead to an increased ability on industry's part to support Australia's national defence effort and to contribute to national wealth creation;
- d. DSTO's interactions with regional countries contribute to Australia's regional security;
- e. DSTO's international interactions contribute to alliance relationships and allow access by the Defence organisation to current and future defence science and technology relevant to Australia's priorities; and
- f. the overall management of, and support to, DSTO continues to improve.

DSTO monitors each activity to assess its progress and achievement. Client feedback is sought throughout the conduct of an activity, including the degree to which the activity achieved a successful outcome. Activities are reviewed regularly as to technical and scientific merit, while the Task Management Accounting System tracks resource usage.

PERFORMANCE FORECAST FOR 1998-99

DSTO's activities planned for 1998-99, and the expected outcomes, are grouped below in the broad areas corresponding to DSTO's client groups.

Policy and Command

Research in support of policy and command focuses on command and control, communications, intelligence, information technology, wide-area surveillance, joint operations, and defence against nuclear, biological and chemical weapons. Priorities include:

Operational Command:

- providing scientific advice to assist Defence in the acquisition of a military payload on board the Optus C1/D spacecraft;
- establishing an experimental distributed command, control, communication and information (C³I) environment. This will be used to demonstrate candidate solutions to interoperability of distributed C³I systems including the US Global Command and Control System. Network management infrastructures will also be provided. This activity also contributes to Strategic Intelligence;
- establishing a group in HQAST to assist in researching, defining, developing and evaluating command and control support systems for theatre-level operations. This activity also contributes to Strategic Intelligence;
- completing a command and control study which will identify capability shortfalls and policy trade-offs to aid high-level decision making on future command and control capability development; and
- demonstrating the application of the Australian Membrane and Biotechnical Research Institute ion channel sensor technology for Defence purposes by the fabrication of a biosensor for the detection of ricin.

Maritime Force Capabilities

Research priorities in support of the ADF's maritime force include:

Capability for Major Surface Combatant Operations:

- improving the survivability of surface combatants against radar homing anti-ship missiles through further development of the Nulka system;
- enhancing the survivability of naval platforms through the development of a suite of software tools for damage assessment, damage control, operational planning and training for surface vessels and submarines. A key deliverable in the reporting period will be a damage control command decision aid for use on board FFG-7 frigates. This activity also contributes to the Capability for Submarine Operations;

Capability for Submarine Operations:

- investigating the acoustic signature of Collins class submarines to develop means to manage the acoustic signature and so increase the operational capability of the submarines;

- providing the Navy, DSTO and industry with a laboratory environment for the rapid prototyping and evaluation of combat system concepts for the Collins class submarine, surface combatants and possibly airborne platforms. This will provide a significant contribution to the evolution of the naval combat systems. This activity also contributes to the Capability for Major Surface Combatant Operations;

Capability for Major Surface Combatant Operations and Capability for Submarine Operations:

- providing advice and technical assistance on the integration of weapon systems into the Anzac class ships and Collins class submarines, including collaboration with Australian industry to maintain a capability to support weapons systems/maritime platform combinations unique to Australia; and

Capability for Mine Countermeasures and Defensive Mining:

- providing advice and technical assistance to ensure that appropriate quantitative data is obtained from the shock testing of the Minehunter Coastal, including development of ultrasonic inspection methods for the composites hull. This will assist in assessing the vulnerability of the vessel to underwater blasts.

Land Force Capabilities

Research priorities in support of the ADF's land force include:

Capability for Land Task Forces Operations:

- developing the initial capability and technology demonstrator to demonstrate the utility of a broad-area aerial surveillance capability in support of land operations in the *Restructuring the Army* trials. This activity also contributes to Military Geographic Information;
- conducting analysis of the *Restructuring the Army* Task Force structures and operations to assess the effectiveness of the Task Force in conducting operations in the Top End. This activity also contributes to the Capability for Special Forces Operations;
- developing a 'synthetic environment' for linking simulations for the assessment of capability options. To demonstrate this concept, the 'environment' will be used to evaluate some specific cases of high priority to the Land Force. This activity also contributes to Operational Command;
- producing and evaluating demonstrations of improved aggregation and presentation of information on the battle situation on the computer screens of Land Force commanders (Situation Awareness) to enable better decision making. This activity also contributes to the Capability for Special Forces Operations; and
- providing advice to the Army on the performance of night-vision goggles. This will lead to greater safety and awareness of the limitations imposed by the goggles in aviation operations. This activity also contributes to the Capability for Special Forces Operations.

Air Force Capabilities

Research priorities in support of the ADF's air force include:

Capability for Air Strike/Reconnaissance:

- conducting simulated fatigue loading of a full-scale F-111 wing and carry-through box, followed by a teardown inspection to identify potential failure locations and crack growth rates

at these locations. This will help ensure safe operation of the F-111 fleet to its planned withdrawal date of 2020;

- improving self-protection for the F-111 in reconnaissance and strategic roles through support to the RAAF for full-scale engineering development of the ALR 2002 radar warning receiver and its integration into the F-111's new electronic warfare self-protection suite;

Capability for Air Strike/Reconnaissance and Capability for Tactical Fighter Operations:

- improving aircraft electronic warfare self-protection capabilities through a joint research, development and engineering program with the US by exchange of data, joint demonstration of aircraft electronic warfare using cockpit simulators, and commencement of a number of joint R&D technology programs. This activity also contributes to the Capability for Airlift and other aircraft-related Defence outputs;

Capability for Tactical Fighter Operations:

- developing models of pilots' tactical reasoning using artificial intelligence technology to contribute to more reliable evaluations of Australia's air defence system. This activity also contributes to the Capability for Strategic Surveillance;

Capability for Strategic Surveillance:

- contributing to the evaluation of responses to the Airborne Early Warning and Control aircraft tender by providing advice on scientific issues;

All Defence Outputs Involving Aircraft

- developing a sensor that has the capability to detect and measure rates of corrosion, thereby reducing the costly (in terms of dollars and aircraft availability) unscheduled maintenance that results from corrosion; and
- completing the fatigue testing on PC-9/A and providing Support Command Australia with advice for extending the structural airworthiness clearance of PC-9/A from 6,000 hours to 10,000 hours, and information on airframe modifications, fleet usage management and life extension options.

Defence S&T Research

This research comprises those elements of forward-looking (or enabling) research which are initiated by the Science and Technology Program itself, rather than by one of the client groups. Enabling research involves the development and maintenance of skills and expertise to position DSTO to exploit new and developing science and technologies which show promise for application to Australia's defence needs. Priorities include:

- developing new methods, based on thermal excitation and emission, for identifying defects and stress fields in structural components to reduce cost of ownership of ADF aircraft;
- investigating the sonar reflectivity of the inhomogeneous sea bed and refractive properties of the sea, so that the maritime environment may be better used to the advantage of the ADF; and
- research to improve the capability to develop guidance software for air defence, point defence and other missile systems.

Industry and External Relations

The main aims of DSTO's industry and external relations activities are:

- helping Australian industry and other R&D organisations to become better able to support defence;
- contributing through industry to national wealth creation; and
- improving the understanding by the Defence community, Australian industry, the scientific community and the general public of the role of advanced technology in the defence of Australia, and DSTO's part in this.

Activities which will be pursued during 1998-99 include placing R&D contracts and licence arrangements with industry, universities and other research organisations; developing existing and new industry alliances and other collaborative arrangements in a variety of areas; and developing beneficial affiliations with other research institutions.

International Cooperation and Regional Cooperation

Extensive interaction and cooperation with the United States, the United Kingdom, Canada and New Zealand will continue under the auspices of The Technical Cooperation Program and bilateral agreements. Longstanding defence research and development arrangements with Sweden and France will continue. DSTO will also continue to provide technical support to Australia's United Nations and global security activities. Initiatives in international activities for 1998-99 include:

- revising the MOU on Defence Science and Technology with Canada; and
- increasing collaboration with France and Sweden.

Cooperation in our region in defence science and technology will continue through a range of collaborative activities conducted under existing bilateral defence, and science and technology, cooperation arrangements with Indonesia, Malaysia, Singapore and Thailand.

DSTO Corporate Planning and Support

Priorities for 1998-99 are:

- implementing a new classification structure for DSTO staff working in R&D which will remove unnecessary barriers to career advancement and allow a more flexible approach to working arrangements that will enhance DSTO's ability to achieve its outcomes;
- finalising approval of the property rationalisation in Melbourne; progressing planning and approvals for the relocation of elements of Maritime Operations Division from Pymont, Sydney; and obtaining approval for facilities needed to accommodate additional staff and equipment resulting from the increase in DSTO's Five Year Defence Program allocation; and
- initiating an executive leadership development program to enhance the leadership and management skills of senior R&D staff.

RESOURCES

Table 10.1: Defence Function Outlays Summary

Sub-Program	1997-98	1997-98	1997-98	1998-99	Variation	
	Budget	Revised	Estimated	Budget	98-99 Budget less	
	Estimate	Estimate	Outcome	Estimate	97-98 Outcome	%
	\$'000	\$'000	\$'000	\$'000	\$'000	%
10.1 Aeronautical & Maritime Research	87,883	91,280	85,770	93,224	7,454	8.7
10.2 Electronics & Surveillance Research	65,537	72,107	67,402	75,653	8,251	12.2
10.3 Executive & Support	76,880	56,336	53,376	38,626	-14,750	-27.6
Program Total	230,300	219,723	206,548	207,503	955	0.5

Table 10.2: Staffing Summary

Sub-Program	1997-98	1997-98	1997-98	1998-99	Variation	
	Budget	Revised	Estimated	Budget	98-99 Budget less	
	Estimate	Estimate	Outcome	Estimate	97-98 Outcome	%
	Personnel Numbers					%
10.1 Aeronautical & Maritime Research	998	994	970	1,045	75	7.7
10.2 Electronics & Surveillance Research	710	732	701	779	78	11.1
10.3 Executive & Support	698	424	380	382	2	0.5
Program Total	2,406	2,150	2,051	2,206	155	7.6

Table 10.3: Staffing Profile

Personnel		Sub-Program			Total
		10.1	10.2	10.3	
Permanent Force	97-98 Revised	8		15	23
	97-98 Estimated	8		15	23
	98-99 Budget	8		15	23
Civilian	97-98 Revised	986	732	409	2,127
	97-98 Estimated	962	701	365	2,028
	98-99 Budget	1,037	779	367	2,183
Total Personnel	97-98 Revised	994	732	424	2,150
	97-98 Estimated	970	701	380	2,051
	97-98 Budget	1,045	779	382	2,206

Table 10.4: Defence Portfolio Outlays Summary

Division/Appropriation Item	1997-98	1997-98	1997-98	1998-99	Variation	
	Budget	Revised	Estimated	Budget	98-99 Budget less	
	Estimate	Estimate	Outcome	Estimate	97-98 Outcome	
	\$'000	\$'000	\$'000	\$'000	\$'000	%
180-01 RUNNING COSTS						
Service Personnel	1,669	1,583	1,629	1,645	16	1.0
Civilian Personnel	140,588	138,154	136,088	133,698	-2,390	-1.8
Administrative Expenses	50,149	40,842	40,647	41,029	382	0.9
Facilities Operations	9,040	9,040	1,221		-1,221	-100.0
180-02 OTHER SERVICES	855	615	540	632	92	17.0
181 EQUIPMENT & STORES	31,145	32,635	29,251	32,756	3,505	12.0
Total Defence Function Appropriations (A)	233,446	222,869	209,376	209,760	384	0.2
Total Defence Function Receipts (Offset Within Outlays) (B)	-3,146	-3,146	-2,828	-2,257	571	-20.2
Total Defence Function Outlays (A+B)	230,300	219,723	206,548	207,503	955	0.5

Defence Reform Program

DSTO plans to achieve its 1998-99 Defence Reform Program savings through general administrative efficiencies.

Table 10.5: Estimated DRP Savings

Category (\$m)	1998-99	1999-00	2000-01	2001-02	Mature
Science and Technology					1.8
Administrative Support	0.4	0.6	0.7	1.7	1.7
Total	0.4	0.6	0.7	1.7	3.5

Table 10.6: Estimated Cumulative DRP Personnel Savings

Category	1998-99		1999-00		2000-01		2001-02		MATURE	
	ADF	APS	ADF	APS	ADF	APS	ADF	APS	ADF	APS
Science and Technology	99		99		99		99		99	
Total	99		99		99		99		99	

DSTO's funding baseline will be increased by \$15m in 1998-99, with an additional increase of \$7m planned for 2000-01. Consistent with the priorities of *Australia's Strategic Policy*, this additional expenditure will be in such areas as the Knowledge Edge (surveillance, information operations, support to HQAST), Defeating Threats in our Maritime Approaches (weapons systems effectiveness,

support to the Collins class submarines, tactical surveillance), and Defeating Hostile Land Forces (the further development of DSTO's Land Operations Division).

Table 10.7: Estimated Reallocation of DRP Savings

Category	1998-99	1999-00	2000-01	2001-02
Science and Technology	15.0	15.0	22.0	22.0
Total	15.0	15.0	22.0	22.0

Table 10.8: Explanation of Major Variations

Explanation for Variations Between 1997-98 Estimated Outcome and 1998-99 Budget Estimate Contained in Table 10.4	(\$'000)	%
Defence Function Outlay (1997-98 Estimated Outcome)	206,548	
180-01 RUNNING COSTS		
<i>Service Personnel</i>		
Real Variations		
Increased provision associated with ADF Workplace Bargaining Agreement	44	
Variations in Accrual Based Superannuation payments resulting from the impact of pay increases, revised Employer Contribution Rates and movements in average staffing levels	5	
Variation in 3% Productivity Benefits Payments resulting from movements in average staffing levels and changes in per capita rates, including the impact of pay increases	2	
Reduced provision for allowances	-10	
Variations in rank profile	-12	
Transfers		
Transfer of Living Out Allowance to Program 8 arising from the Housing and Accommodation Policy Review	-13	
Total Service Personnel	16	1.0
<i>Civilian Personnel</i>		
Real Variations		
Variation in 3% Productivity Benefits Payments resulting from movements in average staffing levels and changes in per capita rates	87	
Variations in Accrual Based Superannuation payments resulting from revised Employer Contribution Rates and movements in average staffing levels	40	
Reduced provision for Payments-in-Lieu associated with redundancies, resignations and retirements	-190	
Reduced requirement for CSP redundancy payments	-900	
Full-year effect of salary savings from the \$125m Redirected Administrative Savings Initiatives	-2,500	
Reduced requirement for voluntary redundancy payments due to organisational restructure approaching completion	-7,691	

Explanation for Variations Between 1997-98 Estimated Outcome and 1998-99 Budget Estimate Contained in Table 10.4	(\$'000)	%
Miscellaneous minor variations	-346	
DRP Reinvestment		
Defence Science - capability projects	9,110	
Total Civilian Personnel	-2,390	-1.8
<i>Administrative Expenses</i>		
Real Variations		
Reduced provision for contract staff	-1,217	
Reduced provision for capability initiatives associated with electronic and surveillance research	-1,859	
Miscellaneous minor variations	-412	
DRP Savings		
Related to Administrative Support	-351	
DRP Reinvestment		
Defence Science - capability projects	3,714	
Price/Exchange Variations		
Movement from 1997-98 Budget to 1998-99 price and exchange rate parameters	507	
Total Administrative Expenses	382	0.9
<i>Facilities Operations</i>		
Real Variations		
Reduced requirement for building works associated with site consolidation at DSTO Salisbury and DSTO Maribyrnong	-1,221	
Total Facilities Operations	-1,221	-100.0
180-02 OTHER SERVICES		
Real Variations		
Increased provision for Research Agreements with Tertiary Institutions due to reduced use of contract staff	85	
Price/Exchange Variations		
Movement from 1997-98 Budget to 1998-99 price and exchange rate parameters	7	
Total Other Services	92	17.0
181-00 EQUIPMENT AND STORES		
Real Variations		
Increased provision for Threat Radar Emulator	625	
Increased provision for research into Theatre Operations	534	
Increased provision for Image Management Facility	500	
Net effect of retrospective price and exchange movement	-390	
Miscellaneous minor variations	-181	

Explanation for Variations Between 1997-98 Estimated Outcome and 1998-99 Budget Estimate Contained in Table 10.4	(\$'000)	%
DRP Reinvestment		
Defence Science - capability projects	2,176	
Price/Exchange Variations		
Movement from 1997-98 Budget to 1998-99 price and exchange rate parameters	241	
Total Equipment and Stores	3,505	12.0
Total Defence Function Appropriations Variation (A)	384	0.2
DEFENCE RECEIPTS		
Real Variations		
Reduced receipts from Evolved Seasparrow Missile	480	
Miscellaneous minor variations	147	
Price/Exchange Variations		
Movement from 1997-98 Budget to 1998-99 price and exchange rate parameters	-56	
Total Defence Receipts Variation (B)	571	-20.2
Total Defence Function Outlay Variation (A+B)	955	0.5
TOTAL DEFENCE PORTFOLIO OUTLAY (1998-99 BUDGET ESTIMATE)	207,503	