Australian Government
Department of Defence
Defence Science and
Technology Organisation

SENATE STANDING COMMITTEE ON FOREIGN AFFAIRS, DEFENCE AND TRADE

INQUIRY INTO DEFENCE PROCUREMENT

DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION SUBMISSION

29 July 2011

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1. OVERVIEW

This submission has been prepared in response to a letter from the Secretary, Foreign Affairs, Defence and Trade References Committee, dated 4 July 2011, that invited the Defence Science and Technology Organisation (DSTO) to make a written submission in view of its 'important role in the procurement of major capital assets'.

DSTO provides independent and objective Science and Technology (S&T) advice and innovative solutions to Defence, extending across the whole capability life-cycle. DSTO support to Capability Development and Acquisition (CD&A) represents some 33% of the DSTO program, and is increasing as projects are defined in response to the Defence White Paper 2009. This direct support is underpinned by analysis, studies and technology development which provide the depth and breadth of knowledge required to advise Defence and Government on CD&A.

The paper provides an overview of DSTO contributions to the major capital acquisition process through the capability life-cycle, with a brief description of the types of activities involved at each stage. This overview is supported by **Annex A**, which provides some specific case studies of the advice provided to particular Defence Capability Plan (DCP) projects.

The case studies provide examples of how the S&T activities have improved outcomes for Defence. Some of these examples are well aligned with roles DSTO has traditionally played (such as S&T advice and technology development), while some reflect newer roles, particularly changes introduced to implement the findings of the Defence Procurement Review (also known as the Kinnaird Report, 2004) and the Defence Procurement and Sustainment Review (Mortimer Report, 2008).

DSTO support to CD&A is conducted within the broader scope of the DSTO program. To place the support provided to CD&A within the broader organisational context, **Annex B** provides an overview of this program, and of DSTO.

The paper also summarises how DSTO has been continuously improving its processes and practices in order to increase the quality, effectiveness and efficiency of its support.

2. DSTO SUPPORT TO DEFENCE PROCUREMENT

DSTO is extensively involved in force development, and capability development and acquisition, through all phases of the capability development life-cycle. This encompasses identification of capability needs, development of requirements, acquisition, and introduction into service. DSTO is currently supporting 94 projects pre-First Pass, 48 projects pre-Second Pass and 99 projects post-Second Pass. DSTO is a member of all capability development-related Committees, with the Chief Defence Scientist providing representation on the Defence Capability and Investment Committee.

2.1 Support to Force Structure

DSTO played a significant role in the Force Structure Review (FSR) in 2008, supporting the conduct of seminar wargames (or military experimentation) as well as providing advice on technical and performance of current and future systems.

The 2009 Defence White Paper committed the department to a new strategy-led capability development process. In particular, no force structure option or capability requirement will be considered unless it has been generated as a consequence of this process. This new process will be implemented as a five-year planning cycle, including a comprehensive Force Structure Review in 2013 (FSR13) leading to the next Defence White Paper. The first five-year planning cycle commenced with the creation of the Force Structure Development Directorate within the Strategy Group, which includes a DSTO position. The preparation for and conduct of the FSR13 will form the Needs Phase of the capability development and acquisition process.

For FSR13 DSTO will provide initial analysis of selected capability issues relevant to the changing strategic environment, including undersea warfare, strike, space and ballistic missile defence. DSTO will also provide analysis of the whole-of-force structure and of the review process itself. DSTO has also been supporting force structure analysis and gap assessment through experimentation conducted by the individual Services, including joint issues such as amphibious operations and joint battlespace awareness.

One of the key inputs into the Force Structure Review is an understanding of which Defence systems will need to be replaced during the period envisaged in the FSR, either because of obsolescence or changing threat environment. DSTO provides advice on the Life-of-Type of many of the systems operated by the ADF. As an example, DSTO has had a long association with assessing and evaluating the Life of Type of the F/A-18 Hornet (see **case study A.1**). DSTO, in conjunction with Defence's airworthiness authority, completed testing that yielded a wealth of high quality fatigue data which allowed the RAAF to manage their respective fleets and to plan and implement a repair/upgrade program to ensure the absence of any capability gap until the acquisition of the New Air Combat Capability.

2.2 Support to Needs Phase

In the Needs Phase DSTO conducts and supports military experimentation and analytical studies to assess the need for new capabilities. DSTO also provides advice on emerging technologies and future concepts to develop capability options that may provide significant benefits to meet those capability needs. DSTO also develops technology to provide innovative solutions for Defence in key areas as described in the Defence White Paper.

DSTO and CDG have jointly established the Joint Decision Support Centre (JDSC) to support the Needs Phase. JDSC provides an environment where simulation, analysis and decision

support can be used by Defence projects to explore future concepts and innovative capability options.

The Needs Phase is where future project risks and uncertainties can be reduced by underpinning studies to ensure that the options selected for development are appropriate, and that the S&T and technical risk implications of requirements are well understood.

SEA 1180 Offshore Combat Vessel (OCV) is an example of how DSTO is supporting Navy in the Needs Phase by studying the feasibility of a multi-role vessel to perform mine countermeasures, hydrography, oceanography, and patrol in a single modular hull (see **case study A.2**). This involves exploring future concepts enabled by developments in technology.

2.3 Support to Requirements and Acquisition Phases

DSTO supports the development of the acquisition options and the acquisition decision in a number of ways. DSTO provides analytical and technical advice on the performance and effectiveness of the systems being considered, and thereby enables a comparative assessment of the capability options. As modern military capabilities usually depend upon many technologies and sub-systems this advice can involve significant effort, and for complex system acquisitions is typically the largest component of the DSTO project support effort. DSTO also contributes through the development of technologies in key areas, as well as undertaking risk treatment activities. DSTO may participate in tender evaluations, including providing advice on multi-criteria decision analysis techniques. DSTO can be involved in the test and evaluation of systems during their development through to their acceptance into service, to provide assurance to Defence on the performance of the systems.

The degree of DSTO involvement varies with the nature of the project. Thus DSTO tends to be more heavily involved in projects where there is significant technical complexity, and may have minor involvement in a straightforward acquisition of an off-the-shelf system.

2.3.1 Analytical and Technical Advice

DSTO undertakes analytical studies to support option selection, with a recent example being fleet-sizing studies in support of AIR 9000 Ph8, the Future Naval Aviation Combat System. The study confirmed through detailed modelling that 24 helicopters would be required to provide the required operational availability.

DSTO provides technical advice on a wide range of issues to projects during the First-and Second Pass approval process and throughout the acquisition phase. Thus DSTO's support to the AIR 6000 New Air Combat Capability (NACC) project includes advice on radars, weapon systems, propulsion, structures and materials. This advice may also include identification and recommendations for mitigation of emerging technical risks. DSTO also undertakes risk treatment programs in conjunction with the DMO Project Offices. DSTO has up to six staff deployed in the US as part of the NACC project team to gain an in-depth understanding of the technical issues associated with the NACC project. A future focus for the US team is expected to be the mission system software, which will form a critical component of the overall capability.

As another example, DSTO provided significant support to the Airborne Early Warning and Control (AEW&C) aircraft under Project AIR 5077 for its radar system (see **case study A.3**). Collaborative development of the AEW&C radar is being undertaken by DSTO with the US Air Force, US research organisations, and US and Australian industry partners.

DSTO has undertaken a range of activities in support of Project LAND 121, Field Vehicles and Trailers (see **case study A.4**). These activities include support for the acquisition of

vehicles, modelling and simulation, development of tactics, techniques and procedures, and issues related to introduction into service.

2.3.2 Technical Risk Advice

In 2004 the Defence Procurement Review identified complex technology development as a source of delay to projects. As a result, the Chief Defence Scientist was given the responsibility of providing independent advice on technical risk. Since 2005 DSTO has provided government with technical risk advice on over 150 acquisition decisions.

Over that time DSTO has continued to improve its methodology for technical risk assessment. It has also worked closely with the Capability Development Group in integrating technical risk advice into project risk management, and to the capability development process as a whole. A recent innovation has been the introduction of a technical risk indicator at the Options Review Committee stage when selecting the set of options to be developed for First Pass consideration. This early advice helps shape the options and their risk management.

DSTO's technical risk advice has increased awareness of technical risks in decision-making in Defence. For example, for the proposed Seahawk Capability Assurance Program, DSTO identified that a number of the proposed activities were of high technical risk, and this advice was influential in the decision not to proceed with the project.

2.3.3 Technology Development

DSTO has an important role supporting future capability acquisition through development of key technologies. Examples include:

- the rapid development and transition into theatre of technologies to counter Improvised Explosive Devices and to enhance force protection (see **case study A.5**); and
- development of the technology for a number of key Defence capabilities, including Over The Horizon Radar (OTHR), the Nulka Ship Self-Defence System, and Cyber security.

DSTO leverages on the experience gained through its Science and Technology development programs to provide expert advice on acquisition projects and to engage with international partners.

2.4 Support to Introduction into Service

As new capabilities are introduced into service, many will offer significant advances on the systems they replace. To ensure that Defence is well-placed to take advantage of these, DSTO assists through the conduct of experiments to develop tactics and procedures for the effective employment of these new systems. As an example, for the AEW&C DSTO conducted a number of experiments involving the mission system crew, supported by computer simulations of the mission system, to develop tactics and procedures for the effective use of the AEW&C before the aircraft was introduced into service.

Another example is the work done by DSTO in conjunction with Defence agencies and international partners to provide ongoing support to the Collins Class Submarine improvement program (see **case study A.6**).

2.5 External Engagement

DSTO continues to work with industry and universities to develop innovative solutions for Defence through:

- **Capability Technology Demonstration program.** DSTO manages the CTD program which provides Australian firms and research organisations with the opportunity to demonstrate their innovative technologies to the ADF. There are currently 27 active Capability Technology Demonstrator Program projects, seven Capability Technology Demonstrator Extension Program projects and three Capability Technology Demonstrator Transition projects.
- **Defence Materials Technology Centre (DMTC).** The DMTC is a Federal Government initiative based on the successful Co-operative Research Centre (CRC) model and is a collaborative partnership approach between Defence, defence industries and research agencies. DSTO contributed to the establishment of the Centre and participates in all the core research programs.
- **University Engagement.** DSTO has a strong tradition of engagement with universities on a variety of specific research topics. DSTO typically engages with around 25 of the Australian universities each year.

DSTO maintains strong international links with other national S&T organisations, particularly in the US and UK, which provide an important source of information and opportunity for Defence. These international engagements have proved particularly useful for assessing and treating technical risks associated with proposed military off-the-shelf systems compared to developmental solutions.

The strongest multi-lateral engagement falls under The Technical Cooperation Program (TTCP), an international forum for defence science and technology collaboration between Australia, Canada, New Zealand, United Kingdom, and the United States. A prime purpose of TTCP is to enhance national defence capabilities and reduce costs. Australia has been an active participant for over 40 years and has senior representation on Technical Panels, Actions Groups and on specific project-related activities. The Chief Defence Scientist (CDS) is the Australian Principal for TTCP. Australia will host the next TTCP Principals meeting to be held in October 2011.

As outlined in **case studies A.4** and **A.6,** DSTO works in conjunction with its international partners in the development of technologies associated with major acquisition projects. Transitioning of new technologies to support ADF operations is also facilitated through strong working relationships with international partners.

3. CONTINUOUS IMPROVEMENT

DSTO is committed to ensuring that the highest quality advice and support is provided to Defence throughout the capability life cycle, and to this end has instituted a program of continuous improvement.

Examples of recent initiatives are:

- **Technical Risk Assessment Handbook**. This handbook was developed by DSTO to provide guidance to DSTO staff on the conduct of technical risk assessments to ensure consistency and quality.
- **Project Reference Group (PRG)**. The PRG provides an internal review mechanism to ensure the quality of the various products required in support of

DCP projects, including S&T Plans, Technical Risk Indicators, Technical Risk Assessments, and Technical Risk Certifications.

- **Governance.** A Group Instruction has been developed that outlines the roles and responsibilities of DSTO staff in working with DCP projects.

Future initiatives include enhancing the training provided to staff in support of DCP projects, particularly in technical risk assessment. As well, DSTO is continuing to review its procedures in support to capability development to improve efficiency and effectiveness in its support.

DSTO has engaged with the UK Defence Science and Technology Laboratory (Dstl) to arrange the exchange of a senior Dstl staff member with extensive expertise in technical risk management and Quality Management systems. This exchange will enable DSTO to gain from overseas experience with risk identification and treatment for critical safety systems.

3.1 Implementation of the Mortimer Review

The Mortimer Report of 2008 identified a need to baseline Defence acquisitions against an off-the-shelf (OTS) system. This reduces the need to influence the front-end design of Australian Defence systems, while increasing the integration required to ensure different OTS systems work together in the field.

DSTO has played a key part in assessing the interoperability of OTS systems and advising on methods of integration. A frequent problem identified by DSTO is the ability to integrate existing electronic or mechanical systems within Projects to achieve a coherent functional system. An example includes the integration of different OTS radios and sensor systems into vehicles for JP2097 (see **case study A.5**).

Systems integration for DCP projects has been recognised as a major challenge for both industry and Defence. In conjunction with DMO, DSTO established the Defence Systems Integration Technical Advisory (DSI-TA) group to assist with the identification and treatment of systems integration risks, both at the platform and capability integration levels. DSI-TA is working with selected projects to identify and manage project interdependencies and develop systems integration plans. DSI-TA is also funding early systems integration activities for a select number of DCP projects.

4. CONCLUSION

DSTO is actively engaged in partnership with Strategy Group, CDG, DMO and the Capability Managers throughout the capability development life cycle. A continuous improvement program is being pursued to refine processes and improve the timely provision of technical advice through early engagement and exchange of information.

DSTO actively engages with international science and technology agencies to improve the quality of technical advice and the identification of risk treatment approaches.

Annex A - Case Studies

Six case studies are presented which illustrate DSTO's support to core Defence capabilities across the capability life cycle, as follows:

A.1 - Life of type assessment for the F/A-18 Hornet

A.2 - Project SEA 1180 Offshore Combatant Vessels

A.3 - Radar Support to AEW&C Wedgetail Procurement

A.4 - Project LAND 121 Field Vehicles and Trailers

A.5 - Support to Special Operations Command

A.6 - Support to Collins Submarine

A.1 Life-of-Type Assessment for the F/A-18 Hornet

DSTO has had a long association with assessing and evaluating the Life-of-Type of the F/A-18 Hornet under the Royal Australian Air Force's operational conditions and environment. Early in the operational life of this aircraft, DSTO, in conjunction with Defence's airworthiness authority, assessed that the Australian usage of the aircraft was more severe than the original design basis under which it was accepted into service (namely, US Navy aircraft carrier-based operations). This meant there was a need for a structural certification program to be undertaken based on Australian usage.

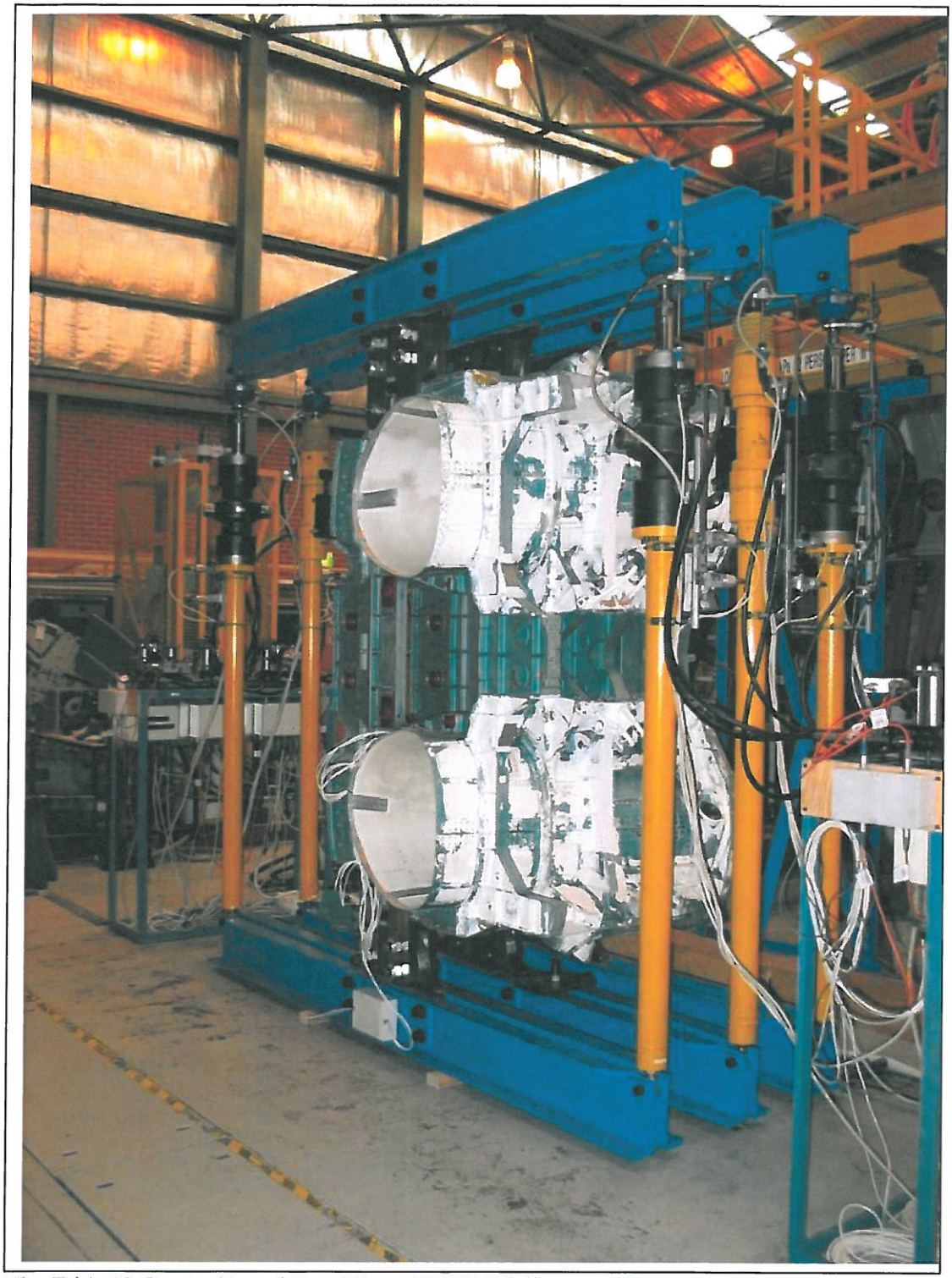
This was achieved through a number of full-scale tests conducted in collaboration with the Canadian Forces, undertaken both here in Australia and in Canada. This program confirmed (unfortunately) the suspected shortfall in life of some major structural components of the aircraft, including the centre fuselage's wing attachment bulkhead, referred to as the 'Centre Barrel'. These tests also yielded a wealth of high-quality fatigue data that allowed the RAAF and Canadian Forces to manage their respective fleets, and to plan and implement a repair/upgrade program to ensure the absence of any capability gap until the acquisition of the next generation fighters to be acquired though the New Air Combat Capability project.

A key part of this upgrade program, however, involves the replacement of the Centre Barrels at around midlife at significant cost (approx. $10M per aircraft, for the 49 aircraft most fatigued aircraft). Besides the high costs, each of these modifications can see the aircraft out of commission for up to 12 months, thus reducing the number of aircraft available for operations. Consequently, a test program was conceived and undertaken using ex-service Centre Barrels (those that progressively became available as part of the modification program, not only from the RAAF, but also from the Canadian Forces and the US Navy) and testing them to failure in simulated operation.

This test program added vital data far beyond that achieved in the original full-scale tests, and these results, together with the application of the most advanced science on fatigue analyses, has allowed prior conservatism to be trimmed, and a more accurate estimate of the safe-life of this critical structure to be determined.

As a direct consequence of this effort, the number of Centre Barrel replacements was able to be reduced from 49 to 10. This represented a saving of around $400M, as well as a significant increase in aircraft availability and the assurance that the required planned withdrawal date of the aircraft can be achieved with the desired level of airworthiness.

Throughout the conduct of these programs, project boards were used to review the integrity and rigor of both the testing and analyses. International leverage in terms of collaboration, peer review and the provision and sharing of test assets and results was extensively used to great effect. By any measure, these programs can be considered world-class technical achievements, and show the value that science and technology can bring to supporting the Australian Defence Force.



The F/A-18 Centre Barrel Test Rig at DSTO-Melbourne

A.2 Project SEA 1180 Offshore Combatant Vessels

The 2009 Defence White Paper outlined Government's intent to rationalise the existing fleet of patrol boat, mine counter measures (MCM), hydrographic and oceanographic forces into a single multi-role class of around twenty Offshore Combatant Vessels (OCV), thereby combining four classes of vessels. The White Paper indicated that Government was looking to achieve significant operational efficiencies and potential savings, reasoning that the existing relatively small fleets of vessels offer less seagoing capacity, reduced scope for installing more capable sensors or weapons, and carry higher whole-of-life ownership costs and personnel overheads.

The single multi-role class concept relies on the delivery of capability via the use of modular portable systems, capable of being used in any port or loaded on to any of the OCVs. The emerging technology which makes this concept viable is the use of unmanned maritime systems, such as unmanned underwater vehicles.

DSTO support to SEA 1180 focuses on assessing mission module requirements and effectiveness, and concepts of employment and operation for meeting the warfighting capabilities needed by the project. Once the mission modules are understood, the risks associated with system integration can then be effectively addressed, and the transport requirements and ship hull options can be better determined.

Research areas for SEA 1180 include unmanned maritime systems, rapid environmental assessment, MCM and open architecture combat systems. These activities have enabled the effectiveness of unmanned systems for MCM and hydrographic operations to be determined. Assistance has also been provided in training RAN personnel in the use of these systems. Analytical techniques have been developed for the rapid analysis of data, from advanced non-acoustic space and airborne sensor systems, to environmental assessment of littoral areas.

DSTO has also worked with Capability Development Group to define the requirements for SEA 1180. With industry support three workshops were conducted at the Joint Decision Support Centre in Canberra. The first workshop was examine the scope of the future S&T support for the project and was supported by subject matter experts in: MCM; Hydrographic and Rapid Environmental Assessment; Patrol; Army and Special Forces; and Next Generation Combatants. The second workshop explored three OCV concepts and their implications for major core systems and modularity; workforce and preparedness, and basing and support. The third workshop sought views on issues such as transition, sustainment, knowledge and information management, and the specific needs of Special Forces.

As a result of these workshops DSTO identified areas for future studies as: platforms and propulsion; ship core systems; modular mission systems; and interactions and dependencies with other projects. The need for additional studies to examine the overall effectiveness of the OCV concept was also identified.

A.3 Radar Support to AEW&C Wedgetail Procurement

Radar is the principal sensor and key enabler for the Wedgetail Airborne Early Warning and Control (AEW&C) capability. The system selected to meet the Wedgetail requirement was a developmental, first of type system which offered significant capability benefits and in particular the ability to adapt to future environments. As the major source of radar expertise within Defence, DSTO has been heavily involved supporting this program. Thus DSTO provided both a performance assessment and a technical risk assessment of the offered radar systems. These assessments were informed by detailed radar system modelling, noting that there were a number of technical risks involved in developing the system.

In support of the system procurement, DSTO seconded technical experts to the US who monitored progress on development of the AEW&C.

To address key issues associated with the development of the advanced radar, in December 2008 Boeing and the Commonwealth entered into a modified test and evaluation program. The results of the tests suggested that there were shortfalls in some radar performance aspects. An independent evaluation of the radar system was carried out by the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL). Advice from this independent evaluation, together with DSTO advice, was used to develop a radar performance optimisation program.

A collaborative research and development program is being undertaken to optimise radar performance. The primary collaborators are the Wedgetail contractors, DSTO and MIT/LL with support from the US Air Force and Australian industry (CEA Technologies).

DSTO is also working to support the introduction into service of the platform, including advice on the optimisation of radar settings and the development of effective and affordable Operational Test and Evaluation strategies that will test radar system performance over the environments of operational interest, including when operating in representative electronic warfare.

A.4 Project LAND 121 Field Vehicles and Trailers

DSTO has been providing S&T support to project LAND 121 Field Vehicles and Trailers for the past seven years. In the early years this support focussed primarily on deriving the required force structure from operational land mobility requirements. Through the use of wargaming, experimentation, simulation and operations analysis, DSTO was able to validate the project's estimates of the number and types of vehicles needed (this is called the basis of provisioning or BOP) by Army and Air Force. Analysis Support was provided to assess and evaluate capability options.

Within the broader project, Land 121 Phase 3 is intended to acquire both lightweight and medium/heavy vehicles and trailers. Throughout the LAND 121 Phase 3 tender process, DSTO supported the specification of land mobility requirements, especially in the important area of vehicle protection against landmine and emerging threats. Decision support tools were provided to enhance the LAND 121 tender evaluation working group's ability to quickly and thoroughly explore BOP options, and to assess the cost-capability tradeoffs in the various tenderers' offers.

With LAND 121 Phase 3 Second Pass approval in August 2007, and the creation of Phases 4 and 5 delivering the Protected Mobility Vehicle and unprotected light vehicles, the requirements for S&T support to the project increased dramatically. A sample of the many past S&T activities includes:

- support to Defence Trials aimed at refining Australia's requirements for the protected mobility vehicle-light and the test and evaluation of medium- and heavy-military trucks as part of Phase 3;
- investigation of user requirements for general maintenance and electric repair vehicles. This study led to a rebalancing of BOP across Phases 3, 4 and 5; and
- studies related to vehicle safety, including the diesel emissions exposure of soldiers travelling in Unimog Gun Tractor Personnel Modules; and the ambient electromagnetic fields that lightweight-light field vehicles and crews will be exposed to, both on operations and in barracks.

Current support activities to LAND 121 include: technical risk assessments; a repair pool and spares provisioning study; studies into the use of camouflage paints and nets; the development of loading, scheduling and routing algorithms; the development of a temporal risk management methodology; a sustainability study; and a training transfer study.

DSTO is in the process of establishing core S&T capabilities that will facilitate future support to land vehicle projects as follows:

- acquisition of equipment for a 3D high-speed motion capture capability will allow for the thorough study of a blast's impact on vehicle occupants;
- the LAnd Motion Platform (LAMP) will enable research into the effect of motion on human performance, and into the efficacy of vehicle training simulator;
- a human factors evaluation capability will offer Defence users the opportunity to experience virtual and mock-up vehicle spaces (including cabin spaces) so that Human Systems Integration issues can be identified early in the capability development process or can be tackled through the application of industrial design expertise; and
- establishment of a systems integration capability will enable vehicle electronics and architectures to be simulated and evaluated with regard to their capacity for hosting current and future Defence C4I equipments.

A.5 Support to Special Operations Command

DSTO provides a comprehensive research program supporting Special Operations Command (SOCOMD). This support entails:

- operational analysis for Special Operations Forces conducting war roles;
- defining the core requirements and equipment development of the regular Army Commando capability;
- defining the requirements and refining the documentation for the Future Special Operations Capability;
- provision of signature management support and technical support to the acquisition of surveillance devices; and
- provision of embedded scientists to support the science and technology needs of Special Operations Command;

Support for Project JP 2097-1A Special Reconnaissance Vehicles has included technical advice, specification and testing of the protection system (mine, blast and ballistics) for the Special Reconnaissance (Nary SupaCat) vehicle and advice of mechanical engineering aspects.

Scientific support being provided to Project JP2097-Phase1B Commando, Logistics and Support vehicles comprises five major areas:

- technical advice and Technical Risk Assessments;
- extension of Concept Definition including developing the capabilities, needs and requirements for future SOCOMD command and control (C2), developing and modelling the required architectures to support future C2 capability;
- support to the assessment of the Commando vehicle acquisition, including survivability, signature management, power management and human systems integration;
- integration of the Networked Special Operations Capability into the Commando, Support and Logistics vehicles; and
- extension of the Networked Special Operations Capability to incorporate future technologies to support future capability requirements.

A.6 Support to Collins Submarine

DSTO has continued to provide underpinning support to the Collins Class Submarines since they were introduced into service, delivering leading-edge S&T to support various upgrade projects, as well as assisting in the identification and remediation of numerous issues. DSTO has contributed to the development of an indigenous capability to support the RAN in areas such as combat systems development, weapons, propulsion and energy systems, submarine signatures, structural integrity and hydrodynamics. Some examples of support include:

- collaboration in the Joint Development Program with the United States Navy for the MK 48 MOD 7 CBASS heavy weight torpedo. The weapon now incorporates DSTO signal processing developments;
- development of an open interface port in the Thales SCYLLA Sonar system that has enabled the inclusion of sonar processing from third-party sonar suppliers, providing important capability improvements. Development of processing algorithms to enable rapid capability insertion to address emerging operational needs;
- technical evaluation of Replacement Combat System Options in support of the formal tender evaluation process. Participation in the AN/BYG-1 Combat System Joint Project Office (analysing combat system performance and developing technologies that support RAN operations);
- development of a fatigue life management plan and a safety inspection program for propellers;
- validation of the structural safety and life of type estimates for the hull steel and welds;
- underwater shock trials;
- radar cross section management; and
- remediation of propulsion systems issues.

Annex B - Background on DSTO

Overview of Science and Technology Program.

- The DSTO Science and Technology (S&T) program has four elements (called quadrants): Support to ADF Operations (OPS); Support to the Force-in-Being (FIB); Support to Capability Development and Acquisition (CD&A / Force 2030); and DSTO Enabling Research. In the first three quadrant areas the DSTO program is demand-driven, with priorities determined by the group requesting the S&T support and delivered within the capability constraints of DSTO. The fourth area is DSTO's program to 'future proof' Defence, which is also undertaken in consultation with Defence Groups. A balance of effort is maintained across these four quadrants. The program as a whole is presented annually for formal endorsement by the Defence Committee.
- **OPS**. DSTO's support to current ADF operations is given the highest priority and represents 16% of the 2011/12 program. Immediate and direct support is driven by explicit Operational Science and Technology Support Requests (OPSTSRs). A formalised OPSTSR approval process ensures that Joint Operations Command (through Deputy Chief of Joint Operations) and DSTO jointly agree the OPSTSR program. All such approved OPSTSRs are actioned by DSTO. Of relevance to CD&A, this includes support to operationally urgent acquisitions and technology insertion into theatre.
- **CD&A**. Support to the DCP is the highest priority after OPS. For the 2011/12 program, DSTO will be supporting 206 projects and phases. Support to force development and acquisition is described in the main body of this brief and represents 33% of the 2011/12 program.
- **FIB**. Support to the Force-in-Being (FIB) underpins the preparedness of the ADF and contributes to safety and cost savings. It represents 30% of the 2011/12 program. This program is the broadest of the four quadrants, covering the full spectrum of S&T support across Navy, Army, Air Force, VCDF, DMO, Intelligence & Security and CIOG. The work includes sustainment of the current force and spiral upgrades to capability.
- **Enabling Research**. The DSTO Corporate Enabling Research Program (CERP) include initiatives for future proofing Defence capability to 2030. These are linked to the 2009 Defence White Paper and the Strategic Reform Program, and represent 11% of the 2011/12 program. DSTO's CERP comprises 12 individual initiatives covering Bioterrorism Preparedness; Counter Improvised Explosive Devices; Cyber Security; Electronic Warfare; Future Under Sea Warfare; Hypersonics; Integrated Force Protection; Intelligence Surveillance & Reconnaissance; Over The Horizon Radar; Signatures, Materials and Energy; Systems Integration; and Unmanned Aerial Systems. A potential 13th CERP project on Space is currently being scoped for the 2011/12 program. The Divisional Enabling Research Program represents a further 10% of the 2011/12 program. These programs leverage and foster interactions with Australia's allies, industry, universities and research bodies to shape, transition into, and build future Defence capability.

Governance arrangements.

- **DSTO Advisory Board**. The DSTO Advisory Board was established as part of DSTO's response to the Strategic Reform Program, and met for the first time in March 2009. It meets quarterly, and provides advice to CDS on strategic issues. The Board reports annually to Minister Snowdon.
- **DSTO Probity Board**. The DSTO Probity Board has been established to advise on probity issues, particularly where a conflict of interest might be perceived to exist. It met for the first time in July 2011.

DSTO at a glance: Key facts

- Budget for 2011/12: $444 million
- Staff: 2, 548 personnel
- Eleven Research Divisions
- Seven primary geographic sites (Adelaide, Melbourne, Canberra, Sydney, Perth, Brisbane and Scottsdale)
- Public web site: http://www.dsto.defence.gov.au/