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Defence Ordnance Safety and Suitability for Service

Department of Defence

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Australian National
Audit Office

Canberra ACT
27 February 2003

Dear Mr President
Dear Mr Speaker

The Australian National Audit Office has undertaken a performance audit in accordance with the authority contained in the *Auditor-General Act 1997*. Pursuant to Senate Standing Order 166 relating to the presentation of documents when the Senate is not sitting, I present this report of this audit and the accompanying brochure. The report is titled *Defence Ordnance Safety and Suitability for Service.*

Following its presentation and receipt, the report will be placed on the Australian National Audit Office's Homepage—http://www.anao.gov.au.

Yours sincerely

P. J. Barrett
Auditor-General

The Honourable the President of the Senate
The Honourable the Speaker of the House of Representatives
Parliament House
Canberra ACT

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Abbreviations

ADF	Australian Defence Force
AEO	Authorised Engineering Organisation
ANAO	Australian National Audit Office
AOC	Australian Ordnance Council
ARDU	Aircraft Research and Development Unit
ASA	Ammunition Safety Audit
ASR	Airworthiness Standards Representative
CSP	Commercial Support Program
CJLOG	Commander Joint Logistics
DAA	Design Acceptance Authority
DAAR	Design Acceptance Authority Representative
DEOSM	Defence Explosive Ordnance Safety Manual
DGNCSA	Director General Naval Certification and Safety Agency
DGTA	Director General Technical Airworthiness
DMO	Defence Materiel Organisation
DOSG	Defence Ordnance Safety Group (UK)
DRP	Defence Reform Program
DSTO	Defence Science and Technology Organisation
DTR-A	Director Technical Regulation—Army
EEH	Electro-Explosive Hazard
EESLAC	Explosives Environmental and Service Life Advisory Committee
EO	Explosive Ordnance
ESAG	Explosive Safety Audit Group
ESTC	Explosives Storage and Transport Committee
JALO	Joint Ammunition Logistics Organisation
JCPAA	Joint Committee of Public Accounts and Audit
MAA	Maintenance Approval Authority
MTDS	Manufacture to Target Disposal Sequence
NATO	North Atlantic Treaty Organisation

NIMIC	NATO Insensitive Munitions Information Centre
OPSMAN	Operations Manual
OSG	Ordnance Safety Group (formerly the AOC)
RANTEAA	RAN Test, Evaluation and Acceptance Authority
S3	Safety and Suitability for Service
SPO	Systems Program Office
STANAGS	Standardisation Agreements (NATO)
TRAMM	Technical Regulation (Army) Materiel Manual
TRF	Technical Regulatory Framework
T&E	Test and Evaluation
UK MoD	United Kingdom Ministry of Defence
USDM	Under Secretary Defence Materiel
VCDF	Vice Chief of the Defence Force

Summary and Recommendations

Summary

Background

1. The three Services (Navy, Army and Air Force) comprise the Australian Defence Force (ADF). The Service Chiefs are accountable to the Chief of the Defence Force (CDF) for the way that equipment is used by their Service. They are also accountable for the safety, fitness for service and environmental compliance (collectively known as the 'technical integrity') of the equipment. They rely on their Service's technical regulatory organisation to establish confidence that a satisfactory level of safety, fitness for service and environmental compliance is achieved.

2. This report deals with the way that the Service Chiefs are assured of the technical integrity of Defence ordnance systems through technical regulations and ordnance safety and suitability for service assessment processes. Ordnance systems include weapon systems with their associated munitions and auxiliary materiel necessary to aim, launch and guide the munition. Ordnance is a complex multi-disciplinary field involving explosives, pyrotechnics, ballistics, aerodynamics, mechanical and electronic engineering, opto-electronics, materials and metallurgy, systems analysis, and computer techniques such as modelling and simulation.

3. Several Defence groups have responsibilities for various aspects of ordnance safety and suitability for service regulation and management. The technical integrity of ordnance systems is managed by each Service's Technical Regulatory Authority (TRA), as part of its responsibility for providing assurance of the technical integrity of ADF weapon systems and platforms. The TRAs have delegated responsibility to the Ordnance Safety Group (OSG), in Defence Materiel Organisation (DMO), for developing and controlling standards and regulations applicable to the ordnance safety and suitability.

4. The TRAs have also authorised the Director OSG to endorse ordnance safety and suitability for service cases on behalf of the Services. DMO's Systems Program Offices (SPO) are responsible for acquiring ordnance systems and providing them with in-service support. The Joint Ammunition Logistics Organisation (JALO), in DMO, with a staff of some 600, is responsible for munitions acquisition and in-service support.

5. The audit objective was to assess Defence's ordnance system safety and suitability for service arrangements and, if appropriate, to make recommendations to enhance results from this area of Defence operations.

Conclusion

6. In recent years, particularly during 2002, Defence has improved its ordnance safety and suitability for service arrangements, mainly by improving technical regulation, and administrative policy and processes. There is still much to be done especially in revising JALO's Engineering Management System. Organisational changes in Defence in recent years have led to significant reductions in the numbers of personnel experienced and skilled in ordnance systems engineering. As a result, managers in JALO with day-to-day management responsibilities are also responsible for designing and negotiating policy and procedural improvements and managing the change process. This has the participative management advantage of involving in policy development those who manage policy and practice, but it also imposes additional workloads on key personnel and lengthens the period of the improvement process. Defence was reviewing the level of resources allocated to JALO to ensure JALO can complete its improvement program in good time.

7. Training programs for ordnance personnel are now under way after extensive competency standard setting and profiling. These programs are important, given the multi-disciplinary nature of ordnance technology, and losses of corporate knowledge resulting from staff reductions in recent years.

8. Defence has found that most of the ordnance items in the ADF inventory lack a clearly identifiable audit trail of evidence to support any technical assessment having been undertaken as part of the assurance of the item's safety and suitability for service. Defence has recognised the need to re-establish auditable safety and suitability for service evidence and has advised that it is considering the best way to do so. A realistic timetable should be set for its completion.

9. A component of ordnance safety and suitability technical assessments concerns electro-explosive hazard tests and evaluations that deal with an ordnance system's ability to function safely and reliably when subjected to electro-magnetic radiation. Defence's capability to conduct such tests and evaluations has been degraded in recent years. Defence should ensure that its electro-explosive hazard test facilities are adequate for ordnance safety and suitability for service assessments.

Key Findings

Introduction (Chapter 1)

10. The financial value of the ADF's ordnance assets is difficult to estimate, given the degree to which these systems are integrated into ADF platforms. However, the ADF's munitions inventory is valued at some $1.819 billion.

11. Defence has developed technical regulatory frameworks and specialist ordnance policy, organisations and management processes to acquire and logistically support the ADF's ordnance systems. The organisational arrangements must deliver capability that is militarily effective but which also satisfies the Commonwealth's legal 'duty of care' responsibility for ensuring the ADF's ordnance systems are inherently safe to operate and that their munitions are safe to handle, store and distribute under widely varying operational environments. This introduces the need for all ordnance entering ADF service to be assessed for its inherent design safety and for its ability to remain safe, and suitable for use in the ADF's operating environment.

Technical Regulation (Chapter 2)

12. Defence's use of regulatory frameworks to establish accountability, control and compliance mechanisms related to design integrity of ADF materiel has evolved since the early 1990s. Defence requires its technical regulations to be commensurate with civil regulatory regimes applicable to similar technologies, and be in accordance with sound risk management practice.

13. Each Service's Technical Regulatory Authority (TRA) receives authority direct from the Service Chief, to whom it is accountable. Defence has developed technical regulatory frameworks and specialist ordnance policy, organisations and management processes to acquire and logistically support the ADF's ordnance systems. The organisational arrangements strive to deliver ordnance systems that are militarily effective and inherently safe to operate. As well, they have to ensure that their munitions are safe to handle, store and distribute under widely varying operational environments.

14. Most of the ordnance regulatory framework, specialist policy and management guidelines have recently evolved from the former single-Services' arrangements. Consequently, further changes may be necessary to accord with the complex multi-disciplinary nature of ordnance system development and logistic support, and to ensure appropriate merger of the different approaches to ordnance safety and suitability policy and management approaches taken in the past by each of the Services.

Ordnance Safety Group (Chapter 3)

15. Ordnance Safety Group (OSG) board and committees provide a multi-disciplinary review of progress in resolving numerous ADF ordnance safety and suitability for service issues. This is important work, given the risks and expense involved with ADF ordnance, and the wide variation in ADF operating environments, as experienced by ADF personnel operating with the United

Nations and coalition forces. The OSG was formerly known as the Australian Ordnance Council (AOC).

16. Defence has issued comprehensive new policy, instructions and guidelines on ordnance safety and suitability for service assessments, which have yet to be fully tested. OSG in conjunction, with the Services and JALO, is developing detailed policy guidance on the ordnance acceptance into service process through a proposed Defence Explosive Ordnance Safety Manual. When this work is completed, best practices from each of the Services can be brought together to unify Defence ordnance policy and management guidelines.

Joint Ammunition Logistics Organisation (Chapter 4)

17. Defence's Joint Ammunition Logistics Organisation (JALO) was formed in 1998 by amalgamating the Services' ordnance logistics organisations. As part of its ADF munitions logistics support function, JALO has major responsibilities regarding the safety and suitability for service of ADF munitions. It is endeavouring to address a multitude of systems, personnel, process and data issues arising from recent structural change in Defence and its evolving technical regulatory framework. It is important that the TRAs and JALO continue working together to develop a single set of JALO system, process and data requirements that each TRA finds acceptable.

18. JALO's ability to maintain the ADF's munitions inventories in a safe and suitable state depends largely on the skills and commitment of a large number of JALO personnel, as well as the regulations and management systems referred to above. Personnel skills and commitment and the effectiveness of new or evolving management systems are difficult to assess. However, during the audit JALO and OSG demonstrated their resolve in not releasing into service munitions found to fall short of reasonable expectations regarding safety and suitability for service.

Introduction of ordnance systems into ADF service (Chapter 5)

19. The joint OSG, JALO and single-Service development of a standard process for introduction of ordnance into service, capable of tailoring for the needs of individual projects, is a result of centralising the management of munitions in JALO. This approach appears to have advantages over the earlier single-Service processes, and should assist JALO and DMO Systems Program Offices to maintain engineering control over ordnance system designs. However, as the process is still being designed, it is not possible to be conclusive on the advantages at this stage.

20. The ANAO examined the introduction into service of selected ordnance systems of the advanced guided weapon systems class. These were the Evolved

SeaSparrow Missile (ESSM) project for Navy, the Land 40 Direct Fire Guided Weapon (DFGW) project for Army, and the F/A-18 aircraft air-to-air weapons upgrade project for Air Force.

21. The ESSM project shows that DMO and Navy are scrutinising the ESSM project's progress carefully, knowing that it is a risky project involving both missile design and development, and integration of the ANZAC Ship combat system.

22. An interim purchase of DFGW experienced an acceptance into service process shortened for operational reasons. However, the safety and suitability for service assessment was reasonable, given prevailing time and data limitations. Technical regulatory framework concessions were granted to allow the weapon to enter service. The DFGW project is now proceeding with a more comprehensive safety and suitability assessment process than that conducted for the interim purchase. Tender documents specify the need for contractors to comply with important aspects of the safety and suitability for service process, including the need to carry out hazard assessments using a recognised standard.

23. The F/A-18 air-to-air weapon upgrades demonstrate that DMO and Air Force are complying with technical regulations and ordnance safety and suitability for service assessment process. The added complexity and uncertainty in one of the air-to-air weapon upgrades will mean that the process for its acceptance into service is likely to be more expensive, given the need for Air Force and DMO to conduct more extensive tests and evaluations.

Ordnance personnel training (Chapter 6)

24. The new technical regulatory framework requires personnel skilled and experienced in the complex and multi-disciplinary field of ordnance systems and explosives. However, organisational changes in Defence in recent years have led to significant reductions in the numbers of such personnel. This has created difficulties in assessing ordnance safety and suitability for service, and was seen to jeopardise the AOC's standing as Defence's ordnance 'centre of excellence'. There were also concerns about the level of overall ordnance experience available within the ADF.

25. After some delay, Defence has begun to implement an ordnance training rationalisation program and to establish ordnance competency profiles. JALO has engaged a commercial organisation to develop and deliver munitions training courses and begun identifying appropriate training and development needed by each individual in the organisation. This is a sound approach to meeting the need to ensure JALO personnel remain competent in carrying out their duties.

26. Other areas within DMO, such as the System Program Offices that manage the integration of ordnance systems into weapons platforms, also need personnel with adequate training and experience in ordnance systems development, acquisition, maintenance and test and evaluation. The ANAO intends to consider this issue in 2003–2004, as part of a planned larger audit of the management of major equipment acquisition projects.

Ordnance safety and suitability for service records and test capability (Chapter 7)

27. A Defence investigation in 2001 found that most ordnance items in the ADF ordnance inventory lacked a clearly identifiable audit trail of evidence to support any technical assessment having been undertaken as part of the assurance of the items' safety and suitability for service. Defence has agreed that there is a need to take urgent action to address this 'legacy' explosive ordnance (EO) problem and is studying the extent of the problem and a proposed way ahead for its resolution. Meanwhile, Defence has commenced safety and suitability assessments of legacy EO items.

28. In certain circumstances, electro-explosive devices embedded as part of munitions or control devices in weapon systems may be vulnerable to inadvertent operation or failure due to electrical interference effects from the radio frequency electro-magnetic environment. A Defence study reported in 2000 that, due to organisational and staff changes, Defence's capability to conduct a complete safety assessment of electro-explosive devices has been degraded in recent years to the point where it is debatable whether Defence can fulfil its duty of care responsibilities. The study highlights the need for Defence to ensure that it has electro-explosive hazard test facilities adequate for its ordnance safety and suitability for service assessments.

Explosives safety audit (Chapter 8)

29. Explosives safety management system audits and safety compliance audit program are conducted by the OSG's Technical Regulation and Audit (TR&A) section and JALO's Ammunition Safety Audit (ASA) section. These are essential auditing and reporting functions with respect to safe storage and transport of ADF munitions. The combination of JALO and OSG safety audit resources has benefits for DMO and the Services in terms of effective and efficient implementation of ordnance safety policy and management guidelines.

30. In 1989, the then parliamentary Joint Committee of Public Accounts (JCPA), in a report on Defence explosive ordnance, recommended that all Australian Ordnance Council audit reports on adherence to Defence instructions be sent to

the Chief of the Defence Force (CDF) and the Secretary of the Department. This was in the interests of audit independence and to help avoid delays in implementing audit recommendations.

31. The AOC, since renamed the Ordnance Safety Group (OSG) and re-located in DMO's joint logistics organisation, now reports to the Commander Joint Logistics. It is therefore not as independent as it was previously. Audit independence now depends on the new technical regulatory framework, which is designed to give the Services confidence in the technical integrity of ADF weapons platforms and systems, regardless of which organisations supply and support that materiel. Therefore, if OSG is adequately supervised and resourced, its placement in DMO should not adversely affect its ability or incentive to advise the Service Chiefs of any unsafe situations arising in respect of ADF ordnance.

Response to the report

32. Defence commented that this ANAO report is balanced and that the thrusts of the recommendations are agreed and implementation action has commenced.

Recommendations

Set out below are the ANAO's recommendations, with report paragraph references and an indication of the Defence response. The recommendations are discussed at the relevant parts of this report. The ANAO considers that the Department should give priority to Recommendations Nos. 2, 3 and 4.

Recommendation No.1 Para. 4.14

The ANAO recommends that JALO and the Services examine options for using stores of guided munitions cost effectively before their safe service lives expire.

Defence response: The thrust of the recommendation is agreed and implementation action has commenced.

Recommendation No.2 Para. 4.26

The ANAO recommends that Defence endeavour to complete JALO's Engineering Management System improvement program so that JALO's systems and processes satisfy the Services' regulatory requirements as soon as practicable.

Defence response: The thrust of the recommendation is agreed and implementation action has commenced.

Recommendation No.3 Para. 4.35

The ANAO recommends that Defence endeavour to complete the program to revise JALO's and the Services' ordnance technical publications to ensure they satisfy the Services' regulatory requirements as soon as practicable.

Defence response: The thrust of the recommendation is agreed and implementation action has commenced.

Recommendation No.4 Para. 7.18

The ANAO recommends that Defence upgrade its facilities for test and evaluation of ordnance system vulnerability to electro-explosive hazard.

Defence response: The thrust of the recommendation is agreed and implementation action has commenced.

Audit Findings and Conclusions

1. Introduction

This chapter provides an overview of ordnance systems safety and suitability for service and sets out the audit objectives and scope.

Management framework

1.1 'Defence' comprises the Department of Defence and the Australian Defence Force (ADF), which in turn comprises the three Services: Navy, Army and Air Force. The Service Chiefs are accountable to the Chief of the Defence Force (CDF) for the safety, fitness for service and environmental compliance (collectively known as the 'technical integrity') of equipment (materiel) used by the ADF.[1] Consequently, they rely on their Service's technical regulatory organisation to establish confidence that a satisfactory level of technical integrity is achieved.[2]

1.2 This report deals with the way that the Service Chiefs are assured of the technical integrity of Defence ordnance systems through technical regulations and ordnance safety and suitability for service assessment processes. The NATO definition of ordnance includes weapon systems with their associated munitions and auxiliary materiel necessary to aim, launch and guide the munition. Munitions are complete devices such as missiles, shells and mines. Ordnance therefore is a complex multi-disciplinary field involving explosives, pyrotechnics, ballistics, aerodynamics, mechanical and electronic engineering, opto-electronics, materials and metallurgy, systems analysis, and computer techniques such as modelling and simulation.

1.3 Consequently, several Defence groups have responsibilities for aspects of ordnance safety and suitability for service regulation and management. Under new arrangements, the technical integrity of ordnance systems is managed by the Technical Regulatory Authority (TRA) in each of the three Services, as part of its responsibility for providing assurance on the technical integrity of the Service's weapon systems and platforms. The TRAs have delegated responsibility to the Ordnance Safety Group (OSG), located in Defence Materiel Organisation (DMO), for developing and controlling standards and regulations applicable to the ordnance safety and suitability process. The TRAs have also conferred authority to the Director OSG to endorse ordnance safety and suitability cases on behalf of the single-Services. DMO Systems Program Offices (SPO) are

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[1] They are also accountable for the way the materiel is used and its operational integrity—which is beyond the scope of this audit.

[2] Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel*, June 2002, p. 2.

responsible for acquiring ordnance systems and providing in-service support. The Joint Ammunition Logistics Organisation (JALO), located in DMO, is responsible for munitions acquisition and in-service support.

1.4 The financial value of the ADF's ordnance assets is difficult to estimate, given the degree to which these systems are integrated into ADF military equipment ('weapons platforms'). However, the ADF's munitions inventory is valued at some $1.819 billion.[3]

1.5 Defence has developed technical regulatory frameworks and specialist ordnance policy, organisations and management processes to acquire and logistically support the ADF's ordnance systems. The organisational arrangements must deliver capability that is militarily effective but which also satisfies the Commonwealth's legal 'duty of care' responsibility for ensuring the ADF's ordnance systems are inherently safe to operate, and that their munitions are safe to handle, store and distribute under widely varying operational environments. This introduces the need for all ordnance entering ADF service to be assessed for its inherent design safety and for its ability to remain safe and suitable for use in the ADF's operating environment.

1.6 In recent years Defence took the following action with respect to ordnance management:

- renamed the Australian Ordnance Council (AOC), which was Defence's ordnance advisory body, as the Ordnance Safety Group and re-located it from Defence Headquarters to the Defence Materiel Organisation (DMO);
- issued new policy and management guidelines on technical regulation of ADF materiel including ordnance;[4]
- developed a centralised munitions logistics management organisation by combining the Services' munitions organisations to form the Joint Ammunition Logistics Organisation in DMO; and
- revised its management guidelines for explosives handling[5] and for determining ordnance safety and suitability for service,[6] and begun to formulate new procedures for the introduction of ordnance into service.

1.7 Most of this is new and remains subject to modification commensurate with the complex multi-disciplinary nature of ordnance system development

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[3] Joint Ammunition Logistics Organisation, *Performance Indicator Report,* August 2002, p. 3.

[4] Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel;* June 2002; Defence Instruction (General) LOG 07-1, *Explosive Ordnance—Safety Policy and Responsibilities,* June 2002.

[5] See Glossary.

[6] Department of Defence, *Safety and Suitability for Service of Explosive Ordnance,* OPSMAN 4, June 2002, part 1. p. 1-2.

and logistic support, and to ensure appropriate merger of the different approaches to ordnance safety and suitability for service policy and management guidelines taken in the past by each of the Services.

The audit

1.8 The ANAO's earlier audits of Defence explosive ordnance focused on munitions provisioning, storage and handling and safety principles for munitions storage and handling.[7] They did not report on the technical integrity of the munitions or on their parent ordnance systems.

1.9 Ordnance systems undergo developmental, production and operational test and evaluation similar to that of other ADF equipment. The ANAO reported on the test and evaluation (T&E) of major Defence equipment acquisitions in 2002.[8] However, the T&E report did not specifically refer to ordnance systems. In view of the significant issues involved in such systems, the ANAO decided to proceed with an audit of Defence's ordnance safety and suitability for service arrangements.

1.10 The audit objective was to assess Defence's ordnance system safety and suitability for service arrangements and, if appropriate, to make recommendations to enhance results from this area of Defence operations.

1.11 It focused on the way the Service Chiefs are assured of the safety, fitness for service and environmental compliance of the ADF's ordnance systems. The audit examined the organisational structure and processes that support the delivery of ordnance-related outputs, from the perspective of control and compliance mechanisms that Defence applies to ordnance safety and suitability for service arrangements. This necessarily concerns organisational effectiveness, which, given the risks concerning ordnance, may take precedence over efficiency and economy measures.

1.12 The audit did not cover assurance that Defence has effective munitions supply chain arrangements in place so that safe and suitable munitions are available when required. However, quantitative statistics indicate JALO has achieved strong improvement in its supply chain arrangements during 2002.

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[7] Report of the Auditor-General upon audits, examinations and inspections under the Audit and other Acts, September 1983, pp. 46–52; the Auditor-General, Efficiency Audit Report, *Department of Defence: RAAF explosive ordnance,* December 1987; Efficiency Audit Report, *Department of Defence: safety principles for explosives,* April 1988; Audit Report No.5 1993–94, *Explosive Ordnance Department of Defence,* September 1993; Audit Report No.8 1995–96, *Explosive Ordnance Department of Defence,* November 1995.

[8] Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions,* January 2002.

1.13 Audit criteria were derived from accepted ordnance management standards based on Defence regulations and guidance on ordnance safety and suitability for service. The criteria covered technical regulation and ordnance safety standards setting and monitoring; ordnance logistic support and acceptance into service. They also covered personnel training; the adequacy of past practice and records; and internal audit of ordnance safety management systems and safety compliance.

1.14 The audit commenced as a preliminary study in November 2001. Audit fieldwork was carried out at:

- Director Navy Weapons Systems, Canberra;
- Director Technical Regulation—Army, Melbourne;
- Directorate General Technical Airworthiness, Laverton Vic;
- Defence Materiel Organisation, Canberra;
- Joint Ammunition Logistics Organisation, Canberra, Orchard Hills NSW, and Port Wakefield SA; and
- Aircraft Research and Development Unit, Salisbury SA.

1.15 Audit issues papers were discussed with Defence during the audit. The proposed report of the audit was given to Defence on 3 December 2002 and comments sought by 7 January 2003. The final report was completed having regard to Defence's comments provided on 28 January 2003. The audit was conducted in conformance with ANAO auditing standards and cost $347 300.

1.16 The ANAO acknowledges the valuable interaction during the audit between the audit team and Defence personnel involved with design and implementation of technical regulation, ordnance safety and suitability for service assessments and logistics support, and explosives safety audit.

1.17 However, particularly given the extent of that interaction through audit discussion papers and ongoing discussions between Defence and the ANAO, consideration needs to be given as to what can be done to meet the 28 day time limit provided under the *Auditor-General Act 1997* (section 19) for comments on a proposed audit report. While the ANAO recognises the difficulties some agencies, such as Defence, have in obtaining views of a number of stakeholders, prolonged delays significantly disrupt the audit program with flow-on effects to other agencies and organisations as well as adding costs to the audit process for all concerned.

Report structure

1.18 This report is structured as follows:

- Chapter 1 provides a general introduction to the audit;
- Chapter 2 discusses technical regulation used to provide assurance that ADF ordnance systems are safe and suitable for service;
- Chapter 3 outlines the structure and role of the Ordnance Safety Group and the committees and board that provide multi-disciplinary assessments of ordnance for safety and suitability for service;
- Chapter 4 discusses the structure and role of JALO, and outlines improvements that it is seeking in its management systems, personnel competencies and technical data integrity;
- Chapter 5 examines the process for introduction of ordnance systems into service and refers to selected ordnance system acceptance into service projects;
- Chapter 6 discusses corporate knowledge aspects of ordnance system safety and suitability assessment and ordnance personnel training, predominantly in JALO;
- Chapter 7 discusses two issues of importance to the assurance of ordnance safety and suitability for service: namely ordnance safety and suitability for service records and Defence's electro-explosive hazard test capability; and
- Chapter 8 discusses the organisation and conduct of Defence's explosives safety audits.

2. Technical Regulation

This chapter provides an overview of technical regulation of defence materiel, including ordnance system technical regulation.

Introduction

2.1 As discussed in Chapter 1, the Service Chiefs are accountable to the Chief of the Defence Force (CDF) for the safety, fitness for service and environmental compliance (collectively referred to as 'technical integrity') of materiel operated by the Services. Commonwealth statutes and regulations also require Defence to maintain the technical integrity of its materiel.[9]

2.2 Defence has introduced a technical regulation framework to monitor and control risks to technical integrity of ADF materiel, including its ordnance systems. The framework sets the criteria against which people, processes, products and organisations can be judged; and monitors and audits compliance with technical regulation policy and management guidelines.[10]

2.3 This establishes the accountability, control and compliance mechanism related to design integrity of ADF materiel. Defence requires the degree of regulation applied to be commensurate with civil regulatory regimes applicable to similar technologies, and in accordance with sound risk management practice.[11]

2.4 The framework's core principles are centred on the need for ADF materiel to be designed, constructed, maintained and operated to approved standards, by competent and approved individuals, who are acting as members of an approved organisation, and whose work is certified as correct.[12]

2.5 These long-standing requirements in Defence were achieved by organisational monitoring and control features found in hierarchical organisational structures. However, the last decade of change in Defence, the growth in Defence's Commercial Support Program (CSP) and increasing technological complexity have resulted in Defence increasingly relying on technical regulation to maintain confidence in the technical integrity of its military equipment ('weapons platforms') and systems. The key organisational changes related to technical regulation of ADF materiel are outlined in Appendix 1.

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9 The statutes include the Explosives Transport Regulations (ETR), which align the transport requirements for Commonwealth explosives (thus Defence) with the regulations of the States and Territories, and the *Occupational Health and Safety (Commonwealth Employment) Act 1991.*

10 Defence Instruction (General), *Australian Defence Force airworthiness management,* July 2000, p. 2.

11 Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel,* June 2002, p. 1.

12 Defence Instruction (General), *Australian Defence Force airworthiness management,* July 2000, p. 2.

Regulation of the technical integrity of ADF materiel

2.6 Defence developed a Technical Regulatory Framework (TRF) that applies across Defence, including the three Services, and to contractors and subcontractors involved with supply of ADF equipment or services.[13] Figure 1 shows the relationships between the key organisations involved with the acquisition and in-service management of the ADF's ordnance systems.

2.7 Each Service's Technical Regulatory Authority (TRA) receives authority direct from its Service Chief. This increases the TRAs' accountability to the Service Chiefs regarding the provision of sound independent advice on the level of regulatory compliance achieved by DMO and contracted suppliers of ADF goods and services. The following outlines the current state of each Service TRF, with reference to ordnance systems.

Air Force

2.8 In 1994 Air Force began implementing a Technical Airworthiness Regulatory Framework whereby the ADF's Director General Technical Airworthiness (DGTA) acts as the through-life technical standards manager and auditor for ADF aircraft technical airworthiness and associated equipment.[14] DGTA manages an engineering approval and surveillance arrangement that:

- controls who may undertake engineering activities with respect to State aircraft and related equipment and establishes the requirements those organisations must satisfy;
- defines the standards to be applied to the design of aircraft and related equipment; and
- assigns authority to organisations, or delegates it to individuals, to perform engineering activities (such as design approval or acceptance) on behalf of the Commonwealth and ensures those authorities are exercised in accordance with the relevant regulations.[15]

2.9 DGTA has some 220 personnel, who administer a comprehensive technical airworthiness management manual comprising airworthiness regulations and a system of surveillance and audit procedures designed to provide assurance regarding organisational compliance with the regulations. Compliance audits cover all aspects of ADF aircraft technical integrity including ordnance systems.

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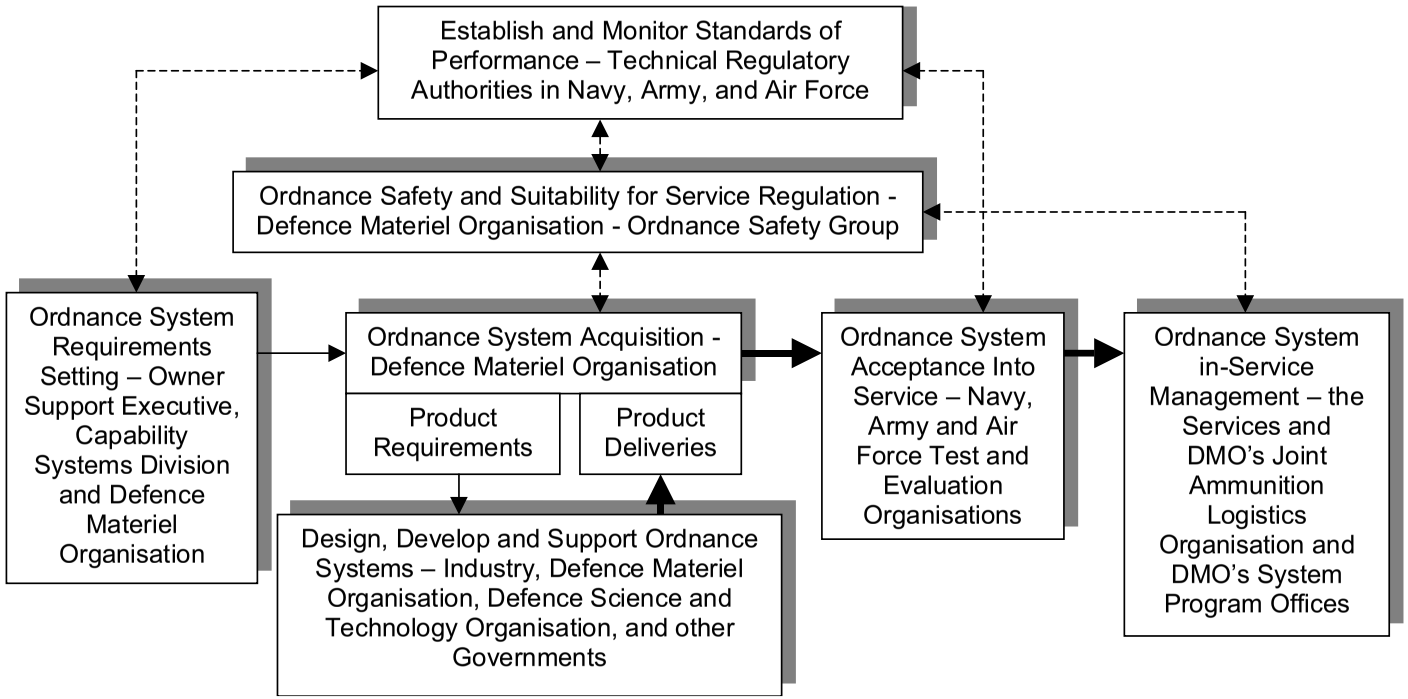
[13] Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel,* June 2002, pp. 2, 4.

[14] DGTA acts under the command of Deputy Chief of Air Force (DCAF).

[15] Australian Defence Force, Australian Air Publication 7001.053, *Technical Airworthiness Management Manual,* Section 1, Chapter 2, p. 1.

Figure 1

Ordnance Acquisition Organisational Relationships



Source: ANAO

2.10 The Aircraft Stores Compatibility Engineering Agency (ASCEA), established within the ADF's Aircraft Research and Development Unit (ARDU), is the tri-Service Approved Engineering Organisation (AEO) for ordnance integration process. ASCEA implements tri-service ADF Aerospace ordnance engineering policy, regulation and procedures.[16] The Air Force also has an ordnance publication which focuses mainly on munitions storage, handling and safety.[17] Air Force relies on DMO's JALO and Systems Program Offices to maintain engineering control over Air Force munitions and ordnance system designs.

Navy

2.11 At the time of the audit, Navy TRA had some 160 personnel oversighting the various aspects of the technical integrity of Navy materiel. It had retained Design Approval Authority (DAA) for all matters concerning its vessels ('weapons platforms') and systems, including ordnance systems. Design approval extended to the approval of designs, engineering standards, maintenance routines and repair schemes.

2.12 Navy has a Certification, Safety and Acceptance Agency (NCSA) to oversee the regulatory and certification system and to ensure the technical and operational integrity of Navy capability. NCSA manages and oversees Navy's safety program and is responsible for oversight of the RAN Test, Evaluation and Acceptance Authority (RANTEAA), including Acceptance into Naval Service (AINS) of systems and platforms.[18]

2.13 RANTEAA has some 30 Service and civilian personnel. It provides the Chief and Deputy Chief of Navy and the Maritime Commander with an independent test and evaluation service in support of recommendations for AINS of new capital equipment acquisitions. RANTEAA is the authority for Navy weapon platforms and systems operational test and evaluation.

2.14 Navy has retained a weapon system directorate of 12 Service and civilian personnel who, among other things, oversee the through-life safety and performance certification of naval armament systems in Navy's vessels. This includes identification, development and maintenance of design requirements

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[16] The policy and procedures include: Australian Defence Force, Australian Air Publication 7001.053, *Technical Airworthiness Management Manual,* Section 3, Chapter 22; Royal Australian Air Force, Australian Air Publication 7001.054, *Airworthiness Design Requirements Manual,* March 1998, Section 2, Chapter 12; and associated ARDU Engineering Management Plans and procedures.

[17] Royal Australian Air Force, Australian Air Publication 7039.001-1, *Explosive Ordnance Safety Manual,* May 1996.

[18] See Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions,* January 2002, pp.67–75.

and identification of competent and responsible authorities in accordance with Navy's technical regulations.[19]

2.15 As discussed in Appendix 1, Navy and the other Services achieved sound engineering outcomes by maintaining a hierarchical structure of experienced practising engineers who became the authoritative reference. In Navy's case, accumulated knowledge was codified in Australian Books of Reference (ABR) on each of its engineering disciplines. These formed an authoritative body of engineering knowledge that assisted Navy to maintain the technical integrity of its weapons platforms and systems.

2.16 The principal ABR for Naval ordnance comprises a comprehensive four-volume set of ordnance system engineering and logistics support instructions and requirements.[20] This ABR in effect described the engineering management system used for Navy ordnance.

2.17 In February 1999 Navy issued instructions on its new technical regulatory policy for Navy materiel and the processes by which compliance with its regulations and requirements were to be certified and audited.[21] However, its ABRs remain important references for the new regulations.

2.18 In August 2000, Navy published an interim technical regulatory framework and certification manual that sought to establish and maintain certification and safety for Navy's vessels.[22] In the meantime, Navy used its instructions on design approval, together with quality management systems, to maintain the technical integrity of its vessels and systems.[23] Navy relies on DMO's JALO and Systems Program Offices to maintain engineering control over munitions and ordnance system designs.

2.19 Navy's Chief Engineer has commissioned further development of Navy's technical regulatory system using concepts similar to those in the Air Force and Army models. Navy has engaged a firm to assist it with developing detailed instructions and guidance needed to implement its technical regulatory system and to assist in implementing the new system.[24]

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[19] Navy Systems Command Minute SUP98-15246 DNWS 30/2000, Directorate of Naval Weapon Systems—Armament Section, 26 May 2000, p. 2.

[20] ABR 862, *Royal Australian Navy Explosive Ordnance Safety Manual,* 1994. In particular, Volume 1, Part 1, *Instructions for Establishments, Commands and Navy Office,* Chapter 4, Determination of Safety and Suitability for Service.

[21] Defence Instruction (Navy) Log 47-3, *Technical Regulation of Naval Materiel,* February 1999.

[22] Australian Book of Reference, ABR 5454 (Interim), *RAN Regulatory Framework and Certification Manual,* August 2000; formerly known as ABR 5454, *RAN Logistics Support Policy Manual.*

[23] Defence Instruction (Navy), *Technical Regulation of Navy Materiel,* February 1999, p. 2.

[24] Naval Systems Command, DNWS/OUT/2002/191, *ANAO Audit Explosive Ordnance Safety and Suitability of Service—Requested information,* 25 July 2002, Annex A, p. 4.

Army

2.20 Army's Director Technical Regulation-Army (DTR-A) is responsible to Chief of Army for managing and promulgating Army's technical regulatory framework including:

- developing policy, regulations and procedures;
- endorsing delegation of technical authority; and
- accrediting and auditing of engineering and maintenance organisations.[25]

2.21 DTR-A has a directorate of 20 permanent staff, comprising four military and 16 civilians. The Defence Reform Program (which began in 1997) resulted in much of Army engineering supervision being transferred to DMO. DMO's Director of Land Engineering Agency is Army's Design Acceptance Authority and Maintenance Approval Authority for materiel in DMO and is authorised to appoint design approval and maintenance approval representatives in DMO.

2.22 In 2001, Army issued technical regulatory framework instructions, complete with detailed procedures and guidelines. It also developed a system of surveillance and audit procedures designed to provide assurance regarding organisational compliance with its technical regulations. This framework has much in common with Air Force's technical regulatory concepts.

2.23 Army expects Defence organisations to fully comply with its technical regulations, and in early 2002 begun conducting accreditation audits in DMO.

2.24 However, Army has not benefited from a manual on ordnance engineering similar to Navy's ABR for Naval ordnance.[26] Instead, it has munitions logistics instructions for each munition it has in service, and instructions covering the management of munitions such as munitions storage, facility control, safety and security.[27] Army relies on DMO's JALO and Systems Program Offices to maintain engineering control over munitions and ordnance system designs.

Common ADF technical regulation philosophy

2.25 In June 2002 the three Services received instructions from the Secretary and CDF to implement a common technical regulation approach that formally recognises the need for ADF materiel to be designed, manufactured and

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[25] TRAMM Vol 1 Section 1 *Technical Responsibilities within the Technical Regulatory Framework* Chapter 3, para 3.4.

[26] ABR 862, Volume 1, *Instructions for Establishments, Commands and Navy Office,* Part 1, Chapter 4, Determination of Safety and Suitability for Service.

[27] Army Logistics Instructions, (ALI), POL 9-1, *General Ammunition Information*, February 1998; POL 9-2, *Manual of Ammunition*, February 1998; POL 9-3, *Ammunition Serial Number, packaging and Hazard Classification Data*, November 1996; POL 9-4, *In-Service Surveillance of Ammunition Results of Tests*, February 1998.

maintained to approved standards by competent and authorised individuals acting as members of an authorised organisation and whose work is certified as correct.[28]

2.26 Defence seeks to achieve a satisfactory level of confidence in the competence of, and certifications provided by, organisations responsible for design, manufacture and maintenance of materiel and services to the ADF. The TRAs are to recognise as competent only organisations that satisfy key systems engineering elements centred on systems, process, people and data elements, which are listed in Appendix 1.[29]

2.27 The TRA may audit materiel to ensure it is properly certified by:

- reviewing the evidence recorded in support of the certificates;
- including a degree of product audit; and
- checking that recognised organisations are employing sound processes in their quality systems.[30]

2.28 That would require a continuous auditable trail of assurance extending from commercial suppliers, through DMO's Project Offices and Systems Program Offices (SPOs) to the individual Service's TRA.

Australian Ordnance Council (AOC)

2.29 The AOC commenced operations in September 1975 as an inter-Service independent advisory body. Its function was to advise responsible authorities on safety and suitability for service aspects of design, development, test and evaluation, production, and Service use of weapons and weapons systems containing explosive materiel.[31]

2.30 Its role and field of operations were revised in 1994 to include all technical assessments related to ordnance system safety and suitability for service. This was with respect to new and modified weapons, and those parts of weapon systems incorporating explosives, proposed for use by the ADF. These assessments may have included:

- design appraisals;
- hazard analysis;

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[28] Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel*, June 2002, p. 1.

[29] ibid., p. 4.

[30] ibid., p. 2.

[31] Department of Defence, Australian Ordnance Council, *Proceeding 1/76 Formation and Terms of Reference*, 12 October 1976.

- establishment of acceptance criteria;
- arrangement and/or evaluation of safety and environmental tests; and
- advice and/or recommendations to the task sponsor.[32]

2.31 The AOC was transferred from Headquarters ADF to Support Command Australia (SCA) in 1998.[33] At the same time, the three Services' ordnance organisations were rationalised to form the Joint Ammunition Logistics Organisation (JALO), which was also placed within SCA.[34] The AOC became part of DMO in July 2000, when DMO was formed by the merger of SCA with the Defence Acquisition Organisation and parts of the Defence Headquarters National Support Division.

2.32 In November 2001, the Service TRAs and DMO's Commander Joint Logistics (CJLOG) agreed that the AOC was responsible for assisting the TRAs in their audits of conformance with explosive ordnance safety and suitability for service components of the design acceptance process, and of evidence to support ordnance Safety Case. (Appendix 2 outlines the ordnance Safety Case management process.) The TRAs also agreed that, under authority delegated by the TRAs, the AOC would be responsible for developing and controlling standards and regulations to be applied to the safety and suitability for service process.[35]

2.33 A Defence instruction later formalised these agreements and mandated the requirement for safety and suitability for service assessments for all explosive materiel utilised in weapons and weapon systems.[36]

Ordnance Safety Group (OSG)

2.34 In December 2001 Defence changed the name of the Australian Ordnance Council to the Ordnance Safety Group (OSG).[37] In June 2002 Defence issued new instructions on management of its ordnance and nominated the OSG as Defence's 'centre of excellence' for ordnance safety. The OSG was authorised by the Service TRAs to develop and control standards and regulations to be applied

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[32] Defence Instruction (General) Admin 02-1, *The Australian Ordnance Council,* January 1994, AL11, pp A-2, A-3.

[33] Support Command Australia Directive 8/98, *Transfer of the Australian Ordnance Council form National Support Division to Headquarters Support Command Australia,* 20 May 1998.

[34] Support Command Australia, *The Explosives Safety Ordnance Group Annual Report 1997–1998,* p. 2.

[35] Defence Materiel Organisation, *Outcomes of the Meeting Held at JLC on 12 November to Clarify Roles and Responsibilities for Regulation of Explosive Ordnance,* 5 December 2001, p. 2.

[36] Defence Instruction (General) LOG 07-1, *Explosive Ordnance-Safety Policy and Responsibilities,* June 2002, p. 2.

[37] Department of Defence, DEFGRAM No. 489/2001, *Change of Name of Australian Ordnance Council to Ordnance Safety Group*, 20 December 2001.

to the ordnance safety and suitability for service process.[38] The OSG was also nominated as Defence's TRA for storage and transport of explosive ordnance, in accordance with Defence's technical regulation instructions.[39]

2.35 In June 2002 Defence published a procedures manual, sponsored by the OSG, which details the process needed to conduct safety and suitability for service assessments for Defence-procured ordnance systems. The manual provides guidance to the TRAs on their responsibility for ensuring ordnance system technical integrity.[40]

2.36 OSG is also developing the Defence Explosive Ordnance Safety Manual (DEOSM), which would combine individual Service ordnance safety guidelines into one manual suitable for the three Services.[41] It would set out a process for introduction of ordnance systems into ADF service to supplement Navy's ordnance acceptance-into-service process and overcome deficiencies in Army's and Air Force's ordnance acceptance into service processes.[42] It would also supplement two existing Defence ordnance manuals, namely the *Safety Principles for the Handling of Explosive Ordnance* (OPSMAN 3), which sets out Defence's policy and management guidelines on munitions handling and storage, and the *Safety and Suitability for Service of Explosive Ordnance* (OPSMAN 4), which sets out Defence's policy and management guidelines on ordnance system safety and suitability for service assessments.

Conclusion

2.37 There has been significant organisational change in Defence since the 1990s. This has necessitated a thorough review of Defence's technical regulatory framework (TRF) and ordnance system safety and logistics management instructions and guidelines.

2.38 Defence's newly developed and evolving technical regulatory systems form crucial accountability, control and compliance mechanisms for mitigating risks to defence materiel. Defence requires the degree of regulation applied to be commensurate with civil regulatory regimes applicable to similar technologies, and in accordance with sound risk management practice.

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38 Defence Instruction (General) LOG 07-1, *Explosive Ordnance—Safety Policy and Responsibilities*, June 2002, p. 1.

39 Defence Instruction (General), *Regulation of technical integrity of Australian Defence Force Materiel,* June 2002, p.1. Department of Defence, DEFGRAM No. 498/2001, *Change of Name of Australian Ordnance Council to Ordnance Safety Group*, December 2001; Defence Instruction (General) LOG 07-1, *Explosive Ordnance- Safety Policy and Responsibilities*, June 2002, p. 5.

40 Department of Defence, *Safety and Suitability for Service of Explosive Ordnance,* OPSMAN 4, June 2002. CJLOG/OUT/2002/157, 21 June 2002.

41 Department of Defence, ADF TP XX, *Defence EO Safety Manual*, draft, July 2002.

42 ibid.

2.39 The overall aim is to prevent irregularities in the integrity of Defence materiel and to have any detected irregularities corrected before materiel enters ADF service. As such, the TRF needs to be firmly linked to test and evaluation policy and management guidelines for assessing the extent to which the risks have been effectively treated.

2.40 The Services' technical integrity regulations and regulatory framework are of growing importance, given that Defence materiel is now almost exclusively acquired by DMO from industry. Most often, acquisition contracts require industry to design, manufacture and logistically support ADF equipment and consumables on the basis of Defence's performance specifications and standards. The Services rely on assurance provided by suppliers (including DMO) that they have adhered to approved standards.

2.41 That assurance needs to be based on management systems that include a process for verifying the quality and acceptance of equipment designs and changes to designs.[43] Furthermore, there needs to be an auditable trail of assurance from suppliers, through DMO's Systems Program Offices (SPOs) to the individual Service's TRA. The audit trail is necessary to enable the Service TRAs to monitor compliance with ADF equipment design, manufacture and maintenance standards.

2.42 Air Force is satisfying those general technical regulatory requirements, with DGTA's staff administering a well-developed set of airworthiness regulations and auditing the organisations that influence the technical integrity of ADF aircraft. Army and Navy are following that lead by developing similar technical regulatory arrangements.

2.43 Prior to the Defence Reform Program, the Services achieved engineering outcomes by maintaining a hierarchical structure of experienced practising engineers who became the authoritative reference. In Navy's case, accumulated knowledge was codified in Australian Books of Reference (ABR) on each of its engineering disciplines, and these formed an authoritative body of engineering knowledge for Navy technical regulations. The principal ABR for Naval ordnance comprises a comprehensive four-volume set of ordnance systems engineering and logistics support instructions and requirements. Army and Air Force did not develop similar books of reference for their ordnance systems.

2.44 OSG is developing an ADF-wide ordnance safety manual to supplement two existing Defence ordnance manuals dealing with the storage and handling of munitions and ordnance system safety and suitability for service assessments. The new manual should promote a better understanding in DMO and industry of the Services' ordnance acceptance into service processes. Further changes to

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[43] Defence Instruction (Navy) LOG 47-3, *Technical Regulation of Naval Materiel*, February 1999, p. 2.

the manuals may be necessary to accord with the complex multi-disciplinary nature of ordnance system development and logistic support, and to ensure appropriate merger of the different approaches to ordnance safety and suitability policy and management approaches taken in the past by each of the Services.

3. Ordnance Safety Group

This chapter provides an overview of the Defence Materiel Organisation's Ordnance Safety Group and its role in ADF ordnance safety and suitability for service management.

Introduction

3.1 Generally speaking, given that ordnance would be regarded by courts as a dangerous substance, and its handling a dangerous activity, the standard of care required by the Commonwealth's duty of care to members of the ADF and others, may, depending upon the actual magnitude of the danger in the particular case, involve a degree of diligence so stringent as to amount practically to a guarantee of safety.[44] However, no absolute guarantee of safety (freedom from conditions that may cause unintentional injury or death to people, or damage to property) can be given for ordnance and, in particular, for munitions. Hence, Defence must apply sound technical regulation and risk management to achieve a continuously effective balance between operational effectiveness and safety.

3.2 This chapter focuses on the organisational design and strategy Defence selected to satisfy ordnance system-related technical regulation and risk management. It describes the structure and processes of the Ordnance Safety Group (OSG), located in DMO, to which the Services' Technical Regulatory Authorities have delegated responsibility for developing and controlling standards and regulations to be applied to the ordnance safety and suitability for service process.[45]

3.3 The OSG's 19 personnel comprise the Director; four technical regulation and audit personnel; seven safety and suitability for service assessment personnel; four corporate services personnel; and two publications personnel.

3.4 OSG receives assistance from the Services, DMO's System Program Offices, JALO, Land Engineering Agency and DSTO during safety and suitability for service assessments and testing.

3.5 The individual Service TRAs have confirmed DMO's OSG as a competent organisation able to demonstrate its compliance with Defence's technical regulations. In recognition of this compliance, the TRA's have conferred authority to DOSG to endorse ordnance safety and suitability for service Safety Cases on

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[44] Australian Government Solicitor, *Performance Audit under Section 19 of the Auditor-General Act 1997—Defence Ordnance Safety and Suitability for Service*, 19 December 2002, p. 2.

[45] Department Instruction (General) Log 07-1, *Explosive ordnance—safety policy and responsibilities*, June 2002, p. 3. The OSG is also the ordnance safety and suitability for service centre of excellence (COE) responsible for developing and maintaining ADF ordnance safety policy and procedures.

behalf of the single Services.[46] Ordnance Safety Case management is outlined in Appendix 2.

OSG responsibilities

3.6 The OSG is responsible for determining the standards applicable to ordnance safety and suitability for service assessment process and auditing the integrity of ordnance Safety Cases, such as the 'low-risk' ordnance Safety Cases that were not submitted to Defence's Ordnance Safety Review Board (OSRB—see below). The Services, JALO and OSG are jointly developing detailed policy guidance on the ordnance acceptance-into-service process, which will be described in the Defence Explosive Ordnance Safety Manual (DEOSM). As mentioned in Chapter 2, at the time of the audit the DEOSM was still at draft stage.

3.7 The OSG is also responsible for auditing and reporting Defence compliance with Defence policy for storage and transport of explosives, through its own Technical Regulation and Audit (TR&A) section in conjunction with JALO's Ammunition Safety Audit (ASA) section (see Chapter 8).

3.8 OSG is charged with ensuring that the level of rigour applied to the ordnance safety and suitability for service process is acceptable to the Services' TRAs. OSG achieves this by developing policy and procedures and by reviewing and endorsing, with assistance from the OSRB, the ordnance Safety Cases that OSG considers involve significant risk.[47]

3.9 OSG, through its Chairmanship of Defence's Explosives Environmental and Service Life Advisory Committee (EESLAC), is revising munitions service life assessment policy, including policy related to in-service surveillance of munitions. The OSRB and EESLAC are discussed below.

Ordnance Safety Review Board and Explosive Committees

3.10 Ordnance system design, manufacture and logistic support are a complex multi-disciplinary field. It includes explosives, pyrotechnics, propellants, storage and handling systems, and weapon aiming, launch and guidance equipment. Consequently, the technical skills required to achieve and maintain ordnance system technical integrity include a complex combination of chemistry, physics, metallurgy, electronic systems hardware and software, and precisely controlled heavy machinery. This mixture of engineering disciplines precludes any one set

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[46] Department of Defence, *Safety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1–6.

[47] Department of Defence, *Safety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1-1.

of model answers to the technical challenges faced by ordnance system specialists. Hence ordnance safety management strategies seek to exclude parochial approaches to complex technical risks inherent in ordnance technology.

3.11 To manage ordnance systems risks effectively, Defence relies on the OSG's technical expertise. This is supplemented by a multi-disciplinary safety board and multi-disciplinary committee, namely the Ordnance Safety Review Board (OSRB) and the Explosives Environmental Service and Life Advisory Committee (EESLAC), which are discussed below.

3.12 The OSG also relies on the Explosive Storage and Transport Committee (ESTC), its own Technical Regulation and Audit (TR&A) section and on JALO's Ammunition Safety Compliance (ASC) section. These are discussed in Chapter 8.

Ordnance Safety Review Board

3.13 The Ordnance Safety Review Board (OSRB) reviews Safety Cases of high risk EO and assists DMO's System Program Offices to complete ordnance Safety Cases. The OSRB is convened by the OSG and comprises the following specialist officers:

- Director Ordnance Safety Group (chair);
- Head-Safety and Suitability for Service OSG;
- Chief Engineer JALO;
- DSTO representative;
- Secretary Explosives Storage and Transport Committee, and Head TR&A;
- Business Support Manager OSG;
- SPO Director (non-executive member) representing acquisition management; and
- single-Service representatives.

3.14 ANAO examination of OSRB meeting minutes indicates that the board provides a multi-disciplinary review of progress in resolving numerous ordnance safety issues of concern to a range of Defence functional groups. For example, at the time of the ANAO audit, the OSRB was reviewing the following:

- ongoing test and evaluation of Air Force's C-130J-30 Hercules military transport aircraft[48] and was considering the C-130J's vibration spectrum with regard to the safe and suitable carriage of munitions. (OSG developed, for TRA consideration, suggested guidelines for the carriage of the ADF munitions in C-130J aircraft);

[48] Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions*, January 2002, pp. 95–96.

- safety cases of a range of ordnance being acquired for the ADF;
- safety case for unloading, removal and transport of HMS *Nottingham's* munitions, which may have experienced physical damage. (Navy advised the ANAO that the UK's safety and suitability for service records greatly assisted the development and assessment of the ordnance safety case);
- reports on Army's 105mm Hamel Gun accident, and possible damage to the Hamel's ammunition from severe transport conditions between the munitions' holding points to the firing points; and
- newly developed military standards (MIL-STDs) and NATO Standardisation Agreements (STANAGS) that may potentially replace earlier MIL-STDs. (Such assessments are necessary in deciding whether to refer to the STANAGS and MIL-STDs in future request for tenders and other contract documents.)

Explosives Environmental and Service Life Advisory Committee

3.15 Explosives Environmental and Service Life Advisory Committee (EESLAC) provides specialist advice to Defence concerning assessments of the environmental and service life aspects of munitions. Its Chairman, Secretary and secretarial support are drawn from the OSG.[49]

3.16 EESLAC membership normally comprises representatives from:

- the JALO product lines, safety and surveillance team and Proof and Experimental Establishment;
- DSTO's Weapons Systems Division;
- ADI Mulwala; and
- Single Service representatives—ARDU, DNWS, LEA.

3.17 The ANAO examined EESLAC's records and found the committee provided a forum for resolving environmental issues affecting not only ordnance but also Defence materiel in general. For example, it sponsored the development of the Defence standard pertaining to all ADF materiel, and monitored the development of Defence materiel environmental test facilities. It also dealt with policy regarding the service life of ordnance materiel, such as rocket motors, munitions and pyrotechnics.

3.18 This is important work, given the risks and expense involved with ADF ordnance, and given the wide variation in ADF operating environments, as

[49] Department of Defence, *Safety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1–10.

experienced by ADF personnel operating with the United Nations and coalition forces.

OSG's international liaison on ordnance safety and suitability

3.19 OSG provides representation to and liaison with international agencies with ordnance safety and suitability for service responsibilities. The OSG seeks guidance from the international ordnance safety community to ensure that Defence follows 'world best practice' in ordnance management.

3.20 Links with international agencies, ordnance bodies and stakeholders are important, as most Defence ordnance systems are imported. Also, as the scope of military conflict has changed, the ADF increasingly finds itself involved in coalition or joint operations. This necessitates sharing of munitions and logistic support. The OSG's international ties provide Defence with access to standards (such as STANAGS), which Defence considers constitute best international practice.

3.21 Not least in importance is the rotational tri-Service exchange officer arrangements that the OSG has with its counterpart in the UK. Defence has benefited from having UK military personnel posted into OSG. The most recent UK exchange officer to complete an exchange posting was instrumental in the development and implementation of Defence's new ordnance safety and suitability for service policy and management processes (OPSMAN 4).

3.22 Defence posts ADF officers to the UK on exchange to represent Australia and the UK on NATO ordnance committees and to gain further knowledge of ordnance safety and suitability for service policy, standards and management processes. On return to Australia the exchange officer normally takes up the position of Director OSG.

3.23 Defence also benefits from ordnance training courses available in the UK, as well as experience gained by ADF personnel posted to the OSG's counterpart in the UK.

Conclusion

3.24 Ordnance is a complex multi-disciplinary field, which justifies the OSG relying on its committees and board to regulate and manage the safety and suitability for service of the ADF's ordnance. These provide a multi-disciplinary review of progress in resolving numerous ADF ordnance safety and suitability for service issues. This is important work, given the risks and expense involved with ADF ordnance, and the wide variation in ADF operating environments, as

experienced by ADF personnel operating with the United Nations and coalition forces.

3.25 Defence has issued new policy, instructions and guidelines on ordnance safety and suitability for service assessments. These have yet to be fully tested. OSG in conjunction, with the Services and JALO, is developing detailed policy guidance on the ordnance acceptance into service process through the Defence Explosive Ordnance Safety Manual (DEOSM—the ordnance safety manual), which at the time of the audit had not reached a final draft stage. When this work is completed, best practices from each of the Services can be brought together to unify Defence's ordnance policy and management guidelines.

4. Joint Ammunition Logistics Organisation

This chapter provides an overview of Defence's Joint Ammunition Logistics Organisation and its role in ordnance management.

Introduction

4.1 The Defence Efficiency Review (1997) recommended that Defence's acquisition organisation be reorganised into functional groups aligned with broad Defence technology themes—ships, aircraft, submarines, land vehicles, electronic systems and missiles and ammunition.[50] Later in 1997 a review of ADF ordnance supported the establishment of a single ammunition logistics organisation, and in February 1998 the Joint Ammunition Logistics Organisation (JALO) was formed as a branch of DMO's Joint Logistics Command.

4.2 JALO's formation resulted in the Services each giving up varying degrees of ordnance system engineering management capability. For example, in 1997 the ADF explosive ordnance project proposed that 'the lines of reporting' regarding some 38 Navy, 16 Army, and 19 Air Force 'areas' responsible for ordnance systems should be transferred to DMO or to other Defence Groups.[51]

4.3 JALO employs some 514 civilian and 101 uniformed personnel[52] in Defence establishments throughout Australia, with most located at Orchard Hills west of Sydney. JALO procures and logistically supports the ADF's munitions and, in conjunction with OSG, conducts audits of munitions safety and regulatory compliance.[53] JALO logistically supports the ADF's munitions inventory, which, as indicated at paragraph 1.3, was valued at some $1.819 billion.

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[50] Department of Defence, *Future Directions for the Management of Australia's Defence, Report of the Defence Efficiency Review,* 1997, p. 28. Department of Defence, *Future Directions for the Management of Australia's Defence, Addendum to the Report of the Defence Efficiency Review, Secretariat Papers*, 1997, p. 150.

[51] Department of Defence, *ADF Explosive Ordnance Project*—Final Report, 4 December 1997, Annex H.

[52] Joint Ammunition Logistics Organisation, *Performance Indicator Report,* July 2002, p. 37.

[53] Department of Defence, DEFGRAM No.370/2002, *Joint Ammunition Logistics Organisation—Organisational Structure and Function,* 7 August 2002, p. 1.

JALO's organisational responsibilities

4.4 JALO's responsibilities have evolved to include the following:

- procuring and logistically supporting munitions for Defence, which includes providing technical and engineering services for all munitions to ensure that they are safe and suitable for service;[54]
- managing munitions safety requirements in conjunction with the OSG;
- licensing, safety monitoring, certifying and auditing all Defence munitions storage and handling establishments;
- proofing and test and evaluation of munitions as required by the ADF;[55] and
- managing Defence's contract with ADI Ltd for manufacture, storage, transport, handling and maintenance of munitions.[56]

Munitions inventory management

4.5 During 2002 JALO began an extensive performance improvement program that includes monthly performance indicator reports. A major element of the reports is the munitions inventory data collection and analysis, by which JALO seeks to better program the resources it needs to maintain adequate stocks of serviceable munitions, and to better manage the munitions' safety and suitability for service aspects.

4.6 The ANAO noted that JALO's performance indicator reports improved during 2002 in terms of revealing the overall status of the ADF's munitions inventory. An important indicator JALO uses to manage the munitions' life cycle[57] is the munitions' stock profile and analysis data. This data informs JALO of the overall status of the munitions inventory and allows it to trace individual munitions as they transit each life-cycle phase.

4.7 The ANAO examined munitions stock data and other reports and found that munitions are not released into service if found to fall short of reasonable expectations regarding safety and suitability for service.

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[54] Defence Instruction (General) 07-1, *Explosive ordnance—safety policy and responsibilities,* June 2002, p. 4.

[55] Department of Defence, Joint Ammunition Logistics Organisation, *Engineering Management Plan,* Draft AL2, September 2002, p. 2.

[56] ibid., p. 2.

[57] The Defence Materiel life cycle includes; concept, acquisition, in-service and disposal. See Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions,* January 2002, p. 35.

4.8 Scope remains for further improvements in the way JALO defines the munitions inventory. For example the inventory management data indicated that guided weapons valued at some $340 million had an 'Other than Serviceable' status. That status results from JALO's regular use of quarantine accounts for inventory management purposes.[58] For example, serviceable Penguin Missiles are assigned a quarantine status to prevent them being issued to an operational unit pending their full introduction into ADF service. Similarly, Harpoon missiles are categorised as 'restricted service' because the ADF's strategic reserves of Harpoon missiles need to be configured as either air launched or surface launched variants.

4.9 Accordingly the 'Other than Serviceable' status for such missiles is not entirely clear. This indicates that, although JALO has achieved significant improvements in its performance indicator system, there is still scope for refining munition stock categories to achieve more accurate inventory status reporting. This in turn should lead to further improvements in munitions inventory management at the strategic level.

Improved munitions' life-cycle management

4.10 JALO's performance indicator reports during the period January to August 2002 revealed that JALO doubled the number of munitions deliveries that ADF 'customers' received on time and in full.[59] This is an important indicator of JALO's performance improvement during 2002 and provides tangible evidence of JALO's success in the direction it has chosen to establish itself as continuously reliable and effective.

4.11 The munitions inventory comprises contingency reserves and other stock. Consequently a considerable amount of stock will become unserviceable each year because of expired service life. The ANAO was advised that, over the last two years, there has been little physical disposal of such unserviceable munitions, and this has increased the inventory's 'out of service' stock. There are costs and risks involved in continuing to store such stock.

4.12 The ANAO considers that JALO should take steps to remove unserviceable stock from its inventory more frequently than has occurred under established practice. The ANAO was advised that JALO is putting processes and procedures in place to effect a bi-annual disposal program and an 'out of service' disposal activity. Some 'out of service' munitions were disposed of in November 2002, and additional disposals are scheduled for 2003.

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[58] Defence has advised that, in the context of its annual financial statement, this 'Other than Serviceable' status does not adversely affect the valuation of explosive ordnance.

[59] Joint Ammunition Logistics Organisation, *Performance Indicator Report,* August 2002, p. 11, indicates an improvement from 43 to 87 per cent from January to August 2002.

4.13 The ANAO also considers that JALO should proceed further in assisting the Services to increase the use of guided weapon system serviceability checks by live firing of guided munitions nearing the end of their service lives. This would be preferable to allowing expensive guided munitions to be taken 'out of service' because of excessive age while in storage.

Recommendation No.1

4.14 The ANAO recommends that JALO and the Services examine options for using stores of guided munitions cost effectively before their safe service lives expire.

Defence response:

4.15 The thrust of the recommendation is agreed and implementation action has commenced.

Technical regulation of JALO activities

4.16 As discussed in Chapter 2 and Appendix 1, Defence has introduced technical regulation frameworks that seek to control the risks to the technical integrity of ADF materiel, including ordnance systems.

4.17 Each Service's TRA is the authority with ultimate responsibility for ensuring the allocation of design responsibility and deciding the technical acceptability of an item intended for Service use. JALO's Chief Engineer is assessed by each TRA for appointment as the TRA Representative (TRAR). On appointment, the TRAR exercises TRA responsibilities on the understanding that he/she is personally accountable for the execution of design management activities performed within JALO. Specifically, these responsibilities include ensuring that:

- design and other associated technical activities conducted on relevant munitions are undertaken by authorised personnel and agencies; and
- relevant munitions systems are technically acceptable to each Service by ensuring that authorised design code standards are not compromised, specifications are authorised within such codes and designs are adequately qualified.

4.18 At the time of the audit JALO was operating under interim Engineering Authority (EA), which authorises the Chief Engineer to approve and accept designs of all in-service munitions (or components) associated with Navy, Army and Air Force platforms. JALO's logistics authority includes technical activities such as publication maintenance, and munitions configuration management.

JALO's interim EA status requires the TRAs to monitor JALO more closely than would be the case once it receives full Authorised Engineering Organisation status discussed below. JALO's ordnance system design approval delegations are discussed further in Appendix 1.

JALO and Authorised Engineering Organisation status

4.19 JALO is improving the systems, personnel, processes, and data elements of its operations so that the Services can have confidence in the certifications it provides in regard to ordnance safety and suitability for service. Appendix 1 places the systems, personnel, processes and data elements into context with Defence's overall technical regulatory framework.

JALO's systems and processes

4.20 Early in 2002, JALO established a wide-ranging review of JALO's Engineering Management System (EMS) in terms of its engineering approach and procedures, and its personnel management. Specifically, the review sought to identify ways to improve the safety and suitability for service of ADF munitions, and to gain the Authorised Engineering Organisation (AEO) status from each of the Service's technical regulatory authorities. The review identified several systemic deficiencies in JALO's EMS, which are now being addressed.

4.21 In August 2002, the TRAs conducted a desktop review of JALO's engineering management plan and engineering procedures and provided JALO with feedback to assist the development and implementation of its revised EMS. The review concluded that JALO's EMS will require ongoing attention to resolve a number of key issues, and an audit was programmed for February or March 2003.[60]

4.22 JALO's EMS consists of the following key documents:

- Engineering Management Plan (EMP). The EMP defines the organisational structure, outlines individual responsibilities, and refers to procedures, processes and resources for conducting and managing ordnance engineering within JALO.
- Configuration Management Plan (CMP). The CMP details JALO's policy regarding the application of Configuration Management[61] principles to ordnance systems. Individual munitions have their own CMP detailing the implementation of the higher-level configuration management policy.

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[60] Department of Defence, Directorate General Technical Airworthiness—ADF, *Visit Report—AIRREG VISIT TO JALO—26 August 2002*, September 2002, pp. 1–2; Army Headquarters Directorate of Technical Regulation—Army, *Visit Report to JALO 26–27 August 2002*, 29 August 2002.

[61] See Glossary.

- Maintenance Management Plan (MMP). The MMP details JALO's policy regarding the use/authorisation of Authorised Maintenance Organisations (AMO) for ordnance. Maintenance policy for individual munitions is published in various Technical Maintenance Plans as required by individual Services.
- Engineering Procedures. The engineering procedures detail how JALO conducts engineering activities.

4.23 The EMS improvements under way at the time of the audit included the following:[62]

- Design Change Management Process (DCMP) streamlining and clarification in terms of Executive Authority roles and requirements, assigning engineering management responsibility, and providing guidance on priorities. The EMP had been rewritten and subject to initial review by TRA representatives. JALO planned to incorporate the representative's feedback into a revised EMP by November 2002.
- Configuration Management System (CMS) and Configuration Management Plan (CMP) improvements covering the way various elements of JALO contribute to ongoing configuration management of ADF munitions, in terms of defining each munition's Configuration Status Account, Build Standard and Build State. This is required by JALO Product Line Managers to allow improved management of the ADF's munitions. The 'legacy' EO project being undertaken by the OSG (see Chapter 7) is assisting JALO to collect and validate configuration management data on all munitions managed by JALO.
- Engineering procedures and process manual improvements in terms of written clarity, output focus and the facilitation of a common set of procedures across all JALO Product Lines. At the time of the audit, completed sections of the JALO Procedures Manual had been implemented, as others were being prepared.[63]
- Engineering design decisions recording system (EMERALD) upgrade that reflected the revised engineering procedures.[64]
- Quality Management System improvements covering matters identified by Air Force's Technical Regulation auditors. JALO's EMP includes a

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[62] Department of Defence, Directorate General of Technical Airworthiness, AIRREG/4078/04/02 Pt 1 (19), *Visit Report—AIRREG Visit to JALO—26 August 2002,* September 2002; Army Headquarters, Directorate of Technical Regulation—Army, *Visit Report to JALO 26–27 AUG 2002,* 29 August 2002.

[63] Joint Ammunition Logistics Organisation, *Engineering Procedures Manual*, 5 August 2002.

[64] Army Headquarters, Directorate of Technical Regulation—Army,—*Visit Report to JALO 26—27 AUG 2002*, 29 August 2002, pp. 2–3.

planning goal of achieving certification to the quality standard AS/NZS ISO 9001 by December 2003. The EMP aims to achieve compliance with the relevant clauses in the standard.[65]

4.24 These are important improvements to the ordnance safety and suitability for service process. However, managers in JALO with day-to-day management responsibilities are also responsible for designing and negotiating policy and process improvements and managing the change process. This has the participative management advantage of involving in policy development those who manage policy and process, but it also imposes additional workloads on key personnel and lengthens the improvement process. Defence was reviewing the level of resources allocated to JALO to ensure JALO can complete its improvement program in good time.

4.25 The TRAs have been working with JALO to provide a single set of system, process and data requirements that each TRA finds acceptable. This work is important to the Services as it relates to the confidence that can be placed in the certifications JALO provides in regard to ordnance safety and suitability for service.

Recommendation No.2

4.26 The ANAO recommends that Defence endeavour to complete JALO's Engineering Management System improvement program so that JALO's systems and processes satisfy the Services' regulatory requirements as soon as practicable.

Defence response:

4.27 The thrust of the recommendation is agreed and implementation action has commenced.

JALO's technical publications and data

4.28 Defence must have technical publications and data sufficient for effective and efficient in-service logistics support of its weapon systems and platforms. The data must be authorised by either the Technical Regulatory Authorities or by an AEO. Use of unauthorised publications or technical data could result in damage to equipment and injury to personnel.[66]

4.29 On its formation in 1998, JALO became the sponsor of a number of single-Service technical publications on ordnance policy, procedures and item descriptions. In many cases, publication sponsorship was not formally

[65] Joint Ammunition Logistics Organisation, *Engineering Management Plan,* Draft, July 2002, Section 1, Chapter 1, p. 3.

[66] Defence Materiel Organisation, *Report on Project C2.67—Review of JALO's Management of its Technical Data and Publications,* 12 August 2002.

transferred to JALO or, if sponsorship was transferred, no position was identified within JALO to take responsibility for the publication. Consequently, many JALO technical publications were not current and, in many cases, JALO did not have the technical data needed to produce authoritative item publications to meet its obligations to support the ADF.

4.30 In 2001, JALO considered that the status of technical publications was inadequate to ensure technical integrity of the munitions it logistically supported. Consequently, JALO management ordered a review of the status of all munitions publications, including policy, procedural and technical item publications. The single-Service TRAs were involved with this review.[67]

4.31 The status of technical data was included in the publication review, since it forms major portions of technical item manuals. The availability and integrity of technical data, including publications, are important in meeting Defence's obligations under the contract with ADI Ltd. Consequently, a decision was made to initiate a project that would scope the issues associated with the technical data publications in JALO. The single Service TRAs were also involved with this project.

4.32 In September 2001, OSG's Explosive Safety Audit Group (ESAG—see Chapter 8) reported that JALO's Product Groups had been trying to fulfil their obligations to maintain single-Service manuals under their control. ESAG found that this had proved difficult as the organisational transition to JALO, combined with difficulties in recruiting, lack of resources and the immediacy of daily business, had adversely affected priorities. This reduced technical publication writing and updating. ESAG's report for 2000–01 recommended that ordnance publications be reviewed and made current as a matter of urgency.[68]

4.33 JALO has been deciding on a strategy to overcome its publication and data integrity deficiencies.[69] This included identifying and establishing processes capable of maintaining and improving the control and management of its technical publications and data.

4.34 Technical data integrity is closely related to the 'legacy' EO issue discussed in Chapter 7.

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[67] ibid.

[68] Department of Defence, *Explosives Safety Audit Group, Annual Report 2000–2001*, September 2001, p. 4.

[69] Defence Materiel Organisation, *Report on Project C2.67—Review of JALO's Management of its Technical Data and Publications*, 12 August 2002.

Recommendation No.3

4.35 The ANAO recommends that Defence endeavour to complete the program to revise JALO's and the Services' ordnance technical publications to ensure they satisfy the Services' regulatory requirements as soon as practicable.

Defence response:

4.36 The thrust of the recommendation is agreed and implementation action has commenced.

JALO personnel

4.37 The formation of JALO involved civilianising much of the ordnance support workforce and disestablishing ordnance organisations in Canberra and elsewhere. About the time of the Defence Reform Program (which began 1997), many Navy and Army ordnance specialists were unwilling to move to JALO. This resulted in a significant loss of ordnance corporate knowledge at the para-professional and professional levels. This is discussed in Chapter 6.

4.38 JALO has begun implementing an improved personnel management system, which includes:

- more-rigorous selection processes for technical/engineering staff;
- a pro-active professional development program for engineers and technical officers; and
- a performance management system to better manage engineering workload for individuals and for Product Lines.

4.39 JALO personnel training is discussed in Chapter 6.

Ordnance test and evaluation

4.40 Defence formed an ordnance proof and experimental establishment in 1926, when the munitions factory at Maribyrnong (Victoria) began refurbishing large quantities of ammunition procured overseas. In 1997 the proof and experimental functions establishment amalgamated with the Environmental Test Facility (ETF) in the Defence Science and Technology Organisation. In 1998 it became JALO's Proof and Experimental Group (PEG).

4.41 PEG provides an ordnance system test and evaluation service to support ADF materiel acquisition and support. PEG assesses ordnance systems for safety, specification compliance and suitability for service. Its capabilities include munitions test and evaluation, environmental assessments, development and maintenance of munitions reference standards and munitions in-service surveillance and investigations. In carrying out its role PEG:

- manages static and dynamic test and evaluation of munitions, weapon systems and environmental testing of munitions and explosives for Defence and government approved organisations; and
- provides advice to Defence and government-approved organisations on test and evaluation of weapon systems and environmental testing of munitions and explosives.

4.42 Most of the PEG workload is undertaken for JALO product groups and spans the ordnance held by the three Services. PEG's test and evaluation capabilities are situated mainly at Port Wakefield, in South Australia, and Graytown, in Victoria, with detachments at ADI-Benalla, Victoria and ADI-Mulwala, NSW.[70]

4.43 PEG has been revising its engineering and maintenance procedures relating to its munitions proofing activities. New procedures are to take the form of single documents, based mainly on Army technical regulatory requirements, but which would also satisfy Navy and Air Force technical regulatory requirements.[71]

Conclusion

4.44 JALO has major responsibilities regarding the safety and suitability for service of ADF munitions, as part of its ADF munitions logistics support function. JALO is endeavouring to address a multitude of systems, personnel, process and data issues arising from the organisational transition to JALO and Defence's evolving technical regulatory framework.

4.45 The Services' TRAs have been working with JALO to provide a single set of JALO system, process and data requirements that each TRA finds acceptable. JALO is making a significant effort to improve its performance management, inventory management and munitions life-cycle management. It is also facing significant technical publication and data integrity issues that need to be resolved soon.

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[70] Joint Ammunition Logistics Organisation, *Engineering Management Plan.*

[71] Army Headquarters, Directorate of Technical Regulation—Army, *Visit Report to JALO 26–27 AUG 2002*, 29 August 2002, p. 3.

4.46 JALO's ability to maintain the ADF's munitions inventories in a safe and suitable state depends largely on the skills and commitment of a large number of DMO and Service personnel, as well as systems, process and data elements discussed above. Personnel skills and commitment and the effectiveness of new and evolving management systems are difficult to assess. However, during the audit, JALO and OSG demonstrated their resolve in not releasing into service munitions found to fall short of reasonable expectations regarding safety and suitability for service.

5. Introduction of Ordnance Systems into ADF Service

This chapter outlines Defence Materiel Organisation management of ordnance projects by reference to selected ordnance system projects related to each of the Services.

Introduction

5.1 The inherent risks associated with ordnance justify the use of rigorous processes for introduction into service. Defence instructions require a safety and suitability for service assessment before ordnance is procured, modified, acceptance tested or introduced into service. Ordnance to be used for trials, demonstrations or other special purposes must also be assessed as safe for those purposes.[72]

5.2 The formation of JALO in 1998 increased the need, and opportunity, for a standard tri-Service engineering, logistics and operational management process for introducing ordnance into ADF service. JALO, OSG and the single-Service TRAs are working together to develop such a process. It would replace the individual Services' processes referred to in Appendix 3.

5.3 The ANAO examined the introduction into service of selected ordnance systems of the advanced guided weapon systems class. These were the Evolved SeaSparrow Missile (ESSM) project for Navy, the Land 40 Direct Fire Guided Weapon (DFGW) project for Army, and the F/A-18 aircraft air-to-air weapons upgrade project for Air Force.

Ordnance acceptance into service process

5.4 JALO, OSG and the Services are developing a process to:

- reduce logistics costs by eliminating single Service duplication and increasing process efficiency and effectiveness through organisational learning;
- increase defence capability effectiveness by reducing the time taken to introduce ordnance into service and by eliminating 'capability degraders' such as deficient logistics support; and
- mitigate risks associated with capital acquisitions by organisations remote from those responsible for logistically supporting the ordnance.[73]

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[72] Defence Instruction (General) 07-1, *Explosive ordnance—safety policy and responsibilities*, June 2002, p. 3.

[73] Department of Defence, ADFTP XXX, *Defence EO Safety Manual*, Chapter 1, Part 1, Section 3; JALO—*Introduction of Explosive Ordnance into ADF Service a Process Approach*, p. 1.

5.5 JALO is writing engineering procedures for introduction of ordnance into service that address the establishment of a certification basis (consisting of design requirements, design data and logistics data) against which a design is accepted. OSG's detailed instructions on ordnance design safety assessment sub-process were published in June 2002.[74] OSG is now developing detailed policy guidance on the ordnance acceptance into service process through the proposed Defence Explosive Ordnance Safety Manual (DEOSM). As stated in Chapter 2, the Services rely on DMO's JALO and Systems Program Offices to maintain engineering control over munitions and ordnance system designs.

5.6 Figure 2 is a flow chart of the ordnance acceptance into service process that is being developed. The process proceeds from source selection and ends with ordnance acceptance into service. It must be carried out by competent individuals, with the Engineering Authority (EA) to perform engineering or design change tasks using guidelines and principles in the single Services' ordnance engineering policy and processes.[75]

5.7 The new process would include development of a single data requirements document to assist DMO to develop Requests for Proposals or Tenders and to assist DMO Systems Program Offices to tailor the data requirements to project needs and the type of ordnance being sought. It should also assist JALO and Systems Program Offices to maintain engineering control over ordnance system designs.

Conclusion

5.8 The joint OSG, JALO and single-Service development of a standard process for the introduction of ordnance into service, capable of being tailored to the needs of individual projects, is a result of centralising the management of munitions in JALO. This is expected to have advantages over the earlier single-Service processes.

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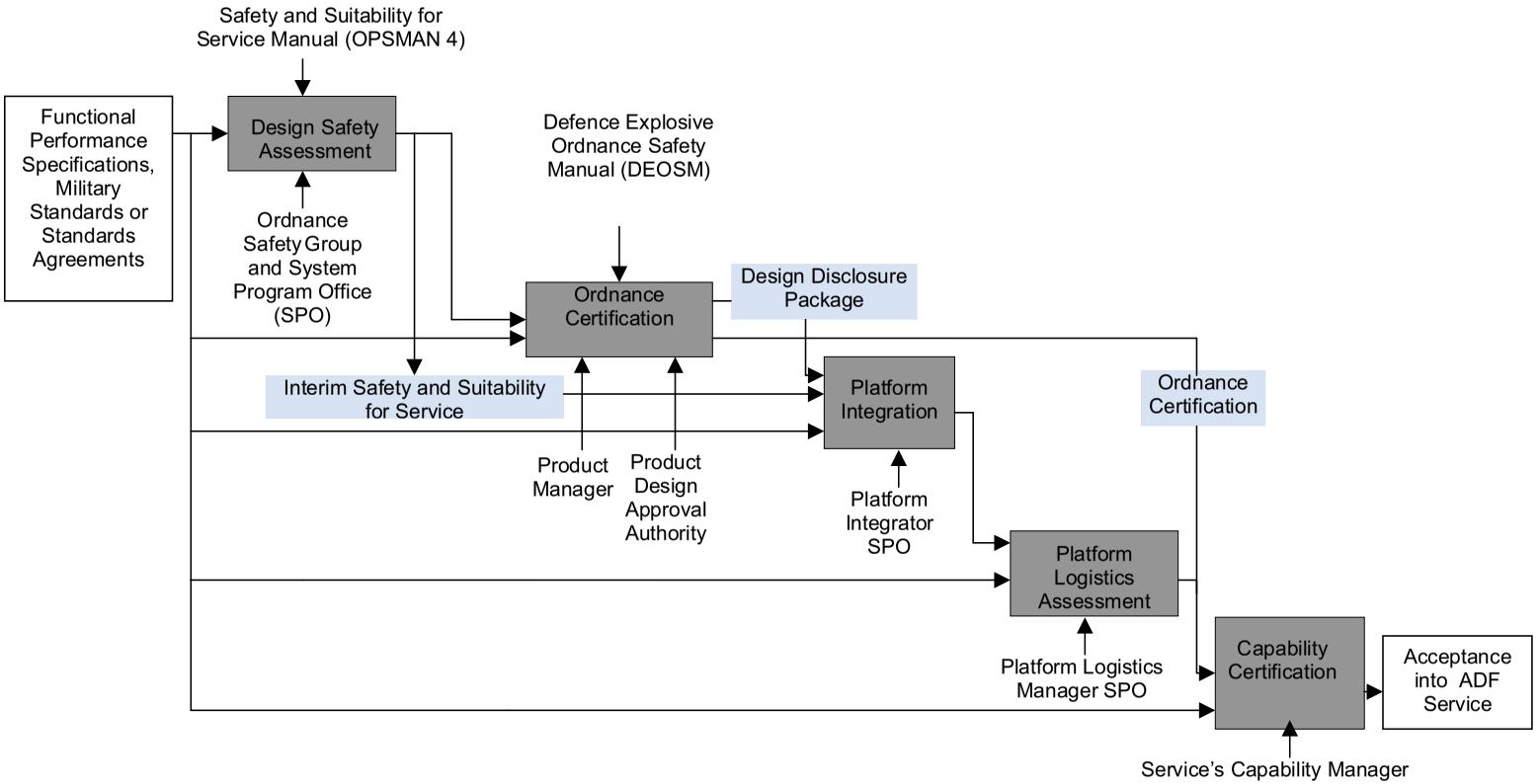
[74] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002.

[75] Joint Ammunition Logistics Organisation, *Engineering Management Plan*, Draft July 2002, Section 1, Chapter 2, p. 1. These include Defence Instruction (General) (OPS) 2-2 and AAP 7001.053 for the RAAF, DI(N) Log 47-3 and ABR 862 for the RAN, and Defence Instruction (Army) LOG 12-1 and the Technical Regulation of Army Materiel Manual (TRAMM) for Army.

Figure 2

Introduction of Ordnance into ADF Service—Proposed process.



Source: Adapted from Hersey, C. and Wilcock G., *Introduction of Explosive Ordnance into ADF Service: A process approach*, unpublished paper, Joint Ammunition Logistics Organisation, 2001.

Navy ordnance acceptance into service

5.9 The Chief Navy Engineer has delegated Design Approval Authority (DAA) to Navy's Director of Navy Weapons Systems (DNWS) for weapons systems.[76] DNWS's Assistant Director Armament (ADARM) holds this delegation for ordnance system safety and suitability for service. DNWS drafts Navy ordnance safety requirements including munition magazine safety requirements.[77]

5.10 Navy also has a Certification, Safety and Acceptance Agency (NCSA) to oversee the regulatory and certification system and to ensure the technical and operational integrity of Naval capability. NCSA manages and oversees Navy's safety program and is responsible for oversight of the RAN Test, Evaluation and Acceptance Authority (RANTEAA), including Acceptance into Naval Service (AINS) of systems and platforms.[78]

5.11 As mentioned in Chapter 4, an Engineering Management Plan (EMP) defines an engineering organisation's structure, outlines individual responsibilities, and refers to procedures and resources for conducting and managing engineering tasks. Navy informed the ANAO that, even though several DMO organisations were developing EMPs for certification, neither JALO nor a DMO System Program Office had formally submitted an EMP to Navy for certification as a competent organisation with respect to ordnance.[79]

5.12 However, that does not mean that those Systems Program Offices and JALO are not competent or that they do not have competent personnel. It means, for purposes of technical regulation, that they have not successfully passed a formal evaluation by the Navy TRA. Thus DNWS-ADARM is required to validate the accuracy of advice coming from DMO ordnance projects. This places a great deal of responsibility and work on DNWS, which, although only a small organisation, must deal with numerous complex maritime ordnance system projects.

5.13 DNWS intends to use the ordnance competency profiles developed by Defence Education and Training and other recognised engineering competency standards to assess the competency of personnel in DMO and in other organisations. DNWS also expects that an organisation's engineering

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[76] In accordance with Defence Instruction (Navy) TECH 9-1, *Design Approval of RAN Systems and Equipment*, March 1999.

[77] Navy Systems Command, *ANAO Audit Explosive Ordnance Safety and Suitability for Service*, 25 July 2002, Enclosure 1.

[78] For RANTEAA and AINS see Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions,* January 2002, pp.67–75. Navy Systems Command, *ANAO Audit Explosive Ordnance Safety and Suitability for Service*, 25 July 2002, Enclosure 1.

[79] Navy Systems Command, *ANAO Audit Explosive Ordnance Safety and Suitability for Service*, 25 July 2002, Annex A.

management system would formally document the competencies required of key decision-making positions and also demonstrate that incumbents comply with these competencies. Assurances to that effect would need to be achieved through compliance audits with respect to Navy's technical regulation manual, which has not yet been published.

5.14 Ordnance fitted to Navy platforms requires material and operational certification prior to Acceptance into Naval Service (AINS). Re-certification will be required when aspects of the design or manufacture of an item could potentially affect ordnance safety. Certification generally follows three stages:

- The OSG, or their authorised delegate, conducts a safety and suitability for service assessment of the ordnance design in the RAN environment.
- A Design Safety and Acceptance Certificate (DS&AC) is issued to authorise Navy to store, handle and use the ordnance for operational or other specified purposes, and to certify that the ordnance is safe and acceptable for introduction into service. This process was under review to decide which aspects are to be certified by JALO and DNWS. DNWS was to act as point of contact for DMO Projects during this review.
- The final stage is certification for AINS. This involves the assessment of platform integration issues, such as safety and standard operating procedures, storage and handling, ammunitioning guides and promulgation of details of the ordnance in Service publications. The authority for the AINS process is RANTEAA, which receives assistance from DNWS and JALO.[80]

Navy ordnance system case study—Evolved SeaSparrow Missile project

5.15 The audit included a case study of the Evolved SeaSparrow Missile (ESSM) fitted to Navy's ANZAC-class destroyers to enhance their capability. This $341 million (December 2001 prices)[81] acquisition project is managed by DMO's ANZAC Ship System Program Office. The ESSM is an upgrade variant of the NATO SeaSparrow Missile (NSSM).

5.16 The ESSM has completed the Engineering and Manufacturing Development phase of production and has proceeded to Low Rate Initial Production (LRIP) Phase. Separately, the US Navy is continuing performance trials with a view to progressing to ship firings. The RAN is monitoring the outcomes of these activities.

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[80] Navy Systems Command, *ANAO Audit Explosive Ordnance Safety and Suitability for Service*, 25 July 2002, Enclosure 1.

[81] Department of Defence, *Defence Annual Report 2001-02*, October 2002, pp. 189, 191.

5.17 At the time of the audit, the US-based Weapon Systems Explosive Safety Review Board (WSESRB) had assessed the ESSM for the US Navy and had approved ESSM only for stowage onboard and firings from an unmanned Self-Defence Test Ship (SDTS).

5.18 Defence records indicate that the ESSM's Engineering and Manufacturing Development program Safety Case development and assessments have proceeded in accordance with US Defense requirements and practices. However, program delays have arisen because of technical difficulties combined with extraordinary conditions, such as international industry participation and requirements to consider more than just US Navy intended use of the missile.

5.19 The ESSM's ordnance safety and suitability for service certification process in Australia has, besides program delays overseas, encountered difficulties arising from the demise of agencies such as the Navy's Directorate of Armament Engineering, together with the recent development and promulgation of relevant technical regulation instructions and publications, such as Defence's ordnance safety and suitability for service manual.

5.20 It is unlikely that DMO will complete the ESSM Safety Case until the ESSM design and the Safety Case hazard analysis are complete for both the missile and its integration into the ANZAC ships' combat system.

5.21 The ESSM case study indicates that DMO and Navy are scrutinising the ESSM program's progress carefully, knowing that it is a risky project involving both missile design and development and ANZAC combat system integration.

5.22 As Navy's technical regulatory requirements are continuing to evolve, the ANAO is unable to assess whether the outputs of safety and suitability for service process could deliver the evidence required by Navy to assess the ESSM's technical integrity. However, the evidence indicates that DMO has sought to provide Safety Case data sufficient to enable reasonable safety and suitability for service assessments.

Army ordnance acceptance into service

5.23 Army has delegated all ordnance system design and maintenance authority to the Chief Engineer of DMO's Land Engineering Agency (LEA).[82] Unlike Navy and Air Force, Army has not retained a test and evaluation agency. It relies on DMO to acquire, test and evaluate its equipment, including armaments.

[82] LEA was formerly the Army Technology and Engineering Agency (ATEA) and later Support Command Australia's Army Engineering Agency (AEA).

5.24 Army considers ordnance safety and suitability for service assessments as part of the technical integrity assessment of land weapon systems. Design Acceptance Authority Representatives (DAAR) assigned to DMO System Program Offices (SPOs) are responsible for accepting designs of new ordnance systems. As part of that responsibility, DAARs are required to ensure ordnance safety and suitability for service assessments are included in Technical Certification Plans (TCPs) and that OSG and JALO conduct the assessments. Overall design acceptance of ordnance systems remains the responsibility of the DAAR in the SPO.[83]

5.25 Army had not fully implemented its technical regulatory framework at the time of the audit.

Army ordnance system case study—Land 40-1 Direct Fire Guided Weapon Project

5.26 Army's Land 40 Direct Fire Guided Weapon (DFGW) project is to provide infantry, cavalry and commando units with man-portable guided missile systems for attacking bunkers, buildings and armoured vehicles. The project is estimated to cost $150–200 million.[84]

5.27 Prior to commencement of the project, Defence procured a small number of similar weapon systems through the US Foreign Military Sales (FMS) program. These interim purchases were relatively low risk, given that the US Army and Aviation and Missile Command had released the weapon into service with conditions regarding depot level maintenance and parachute operations.[85]

5.28 As part of the interim weapon acceptance into service process, the AOC reviewed technical data relevant to the weapon system's safety and suitability for service. Data and time limitations prevented the AOC from conducting a complete safety and suitability for service assessment. However, the AOC decided that the system was acceptably safe for deployment with trained ADF personnel, subject to a number of operational and logistics caveats.[86]

5.29 The Assistant Program Manager and the Chief Engineer of DMO's Land Systems Division Armament SPO approved a design acceptance concession to conform with the Army technical regulatory framework. The weapons have entered service with the Army for a limited period.[87]

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[83] TRAMM Vol 1 Section 2 *Specialist advice in the Technical regulation of Land Material* Chapter 9, para 9.5.

[84] Department of Defence, *Defence Capability Plan 2001-2010*, Public Version, p. 165.

[85] Joint Logistics Command, Australian Ordnance Council, *Australian Ordnance Council Safety Advice,* November 2001, p. 2.

[86] ibid.

[87] ARMY TRF Design Acceptance Concession Form, 144/02, 145/02. April 2002.

5.30 With respect to the Land 40 project's acquisition of much larger numbers of guided missile systems, the DMO Armament SPO has included in the project's System Requirements Specification a need for contractors to comply with OPSMAN 4 and for the systems to satisfy operational, functional, physical and integrated logistic support requirements that relate to the ordnance system technical integrity.[88]

5.31 The contractors are also required to conduct a system safety program which includes the need to carry out hazard assessments using a recognised standard such as MIL-STD-882C- Safety Program Requirements.[89]

5.32 Interim DFGW acceptance into service process was shortened for operational reasons. However, a safety and suitability for service assessment by OSG and the Armament SPO was reasonable, given prevailing time and data limitations. Technical regulatory framework concessions were granted to allow the weapon to enter service.

5.33 The DFGW project is proceeding with a more comprehensive safety and suitability assessment process. The Armament SPO, after consulting the OSG, specified in tender documents the need for contractors to comply with important aspects of the safety and suitability for service process, including the need to carry out hazard assessments using a recognised standard. Defence is working toward signing the acquisition contract in 2004.

Air Force ordnance acceptance into service

5.34 ADF Airworthiness technical regulations cover, among other things, design, production and maintenance for ordnance systems fitted to ADF aircraft, and aircraft-related systems. Requirements include safety and suitability for service assessments, as they are part of the design acceptance process for ordnance systems.[90]

5.35 Organisations that have ADF aircraft ordnance systems responsibilities include JALO, ADF's Aircraft Research and Development Unit (ARDU) and DMO System Program Offices (SPO) with ADF aircraft engineering responsibilities.[91] ARDU's Aircraft Stores Compatibility Engineering Agency (ASCEA) manages the ADF aircraft weapon test program and carriage and release certification in partnership with the test and evaluation community, DMO

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88 Defence Materiel, Land 40-1 Project, *Systems Requirements Specification,* April 2002.

89 ibid., pp. G-3, G-4.

90 DGTA, *Development of an ADF Technical Airworthiness Management System*, Presentation to the ANAO, April 2002.

91 Department of Defence, Directorate General Technical Airworthiness—ADF, *ANAO Audit of Defence EO Safety and Suitability For Servic*e, 13 August 2002, Annex A.

SPOs and ADF Force Element Groups. Each aircraft type has its own Design Acceptance Representative (DAR), who is delegated responsibility for the process of design acceptance by the DGTA. This delegation entails determination of the technical acceptability of aircraft and aircraft related equipment for ADF use. Design Acceptance Certification may only be performed by a Commonwealth employee.

5.36 The relevant DMO SPO is responsible for engineering support for the aircraft type, and following an evaluation by DGTA each SPO is awarded Authorised Engineering Organisation (AEO) status. DGTA has appointed JALO as the authority for EO within the Airworthiness environment. JALO and ASCENG are both AEOs.

5.37 As noted, the safety and suitability for service assessment is a task subordinate to the overall design process.[92] Once the assessment has been completed, it is the responsibility of the Aircraft Research and Development Unit (ARDU) to perform T&E functions for aircraft stores clearance activities for the ADF. This function fits within the platform integration process.

Air Force ordnance system case study—acquisition of advanced within visual range and beyond visual range weapons

5.38 The $497 million (December 2001 prices)[93] Project AIR 5400 seeks to upgrade the air-to-air weapons capability for the F/A-18 Hornet aircraft.

5.39 The project involves DMO acquiring the Matra BAE Dynamics AIM-132A Advanced Short Range Air-to-Air Missile (ASRAAM) and the AIM-120B Advanced Medium Range Air-to-Air Missile (AMRAAM) and fitting them to Air Force's F/A-18 aircraft. In terms of the acceptance into service process, the principal difference between the ASRAAM and AMRAAM is the required level of testing, given the relative maturity of the two weapons systems.

ASRAAM acceptance into service process

5.40 ASRAAM requires modification of the aircraft and its flight programs and simulators. This requires Air Force to conduct a comprehensive type certification and service release process to mitigate project risks. At the time of the audit ASRAAM was undergoing development test and evaluation and had been fitted to an F/A-18 Hornet aircraft in the US.

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[92] AIRREG/4301/06/04 Pt 1 (21), *Provision of S3 assessments for ADF Aviation EO,* May 2001.

[93] Department of Defence, *Defence Annual Report 2001-02*, October 2002, pp. 189, 196.

5.41 The US Navy is integrating the ASRAAM into the F/A-18 Operational Flight Program and has agreed to provide a carriage and mid-g employment flight clearance recommendation for the F/A-18 fighter escort configuration. ARDU is to conduct the remainder of the stores clearance program involving a mix of configurations. This requires ARDU to conduct Development and Acceptance Test and Evaluation and issue an Aircraft Stores Capability Clearance prior to Operational Test and Evaluation (OT&E).

5.42 The DMO ASRAAM project is working from a comprehensive Project Design Acceptance Strategy and Test and Evaluation Master Plan. These documents describe the acceptance into service process, including the roles of the organisations involved with type certification and service release. Even though both documents preceded the publication of the ordnance safety and suitability for service manual, they appear to address adequately the issues that need to be considered in introducing ordnance into service.

AMRAAM acceptance into service process

5.43 The AMRAAM weapon system first entered service in the US in 1991. Consequently its introduction into RAAF service does not involve extensive modifications to the F/A-18 aircraft or to its Operational Flight Programs or simulators. However, there is a need for new operational and technical procedures and logistics to support AMRAAM operations.

5.44 The provision of US Navy test and evaluation data and flight clearance rationale supported ARDU's AMRAAM compatibility, enabling operational test and evaluation of the missile.

5.45 The ASRAAM and AMRAAM projects demonstrate that DMO and Air Force are complying with technical regulations and the ordnance safety and suitability for service assessment process. The added complexity and uncertainty in the ASRAAM program will mean that the process for its acceptance into service is likely to be more expensive than for AMRAAM, given the need for Air Force and DMO to conduct more extensive tests and evaluations.

6. Ordnance Personnel Training

This chapter provides an overview of arrangements for ordnance training in the Ordnance Safety Group and the Joint Ammunition Logistics Organisation.

Introduction

6.1 As discussed earlier, the Service Chiefs have amongst other things prime responsibility for the safety and suitability for service of the ADF's ordnance systems. To discharge that responsibility they need to rely on adequately trained and skilled personnel in Defence and its suppliers.

6.2 In its annual report for 2000–01 Defence stated:

> Improvement in safety performance and the development of a safety culture, particularly in the ADF, are major priorities. The cost and consequences of poor performance in this area continue to be unacceptable to both Defence and the community. Specific improvement strategies have focused on the development of safety standards and supporting information and reporting systems, as well as improvement in the level and coverage of safety training.[94]

6.3 Subsequently, an ANAO report[95] recommended that Defence aim to ensure that its personnel responsible for safety-critical system development, acquisition, maintenance and test and evaluation have training and skills adequate for their responsibilities. Defence disagreed with the recommendation on the grounds that it was impossibly wide and that compliance would be difficult to assess.[96] However, it is apparent to the ANAO that, despite the difficulties involved, Defence should endeavour to ensure that such personnel receive adequate training and skills.

6.4 This chapter discusses Defence's ordnance personnel training. The audit focused mainly on OSG's and JALO's personnel training, since these organisations have the main ordnance personnel training needs.

6.5 Other organisations in Defence, such as DMO's Systems Program Offices managing integration of ordnance systems into weapons platforms, also need personnel with adequate training and experience in ordnance systems development, acquisition, maintenance and test and evaluation. The ANAO last considered technical and professional training in DMO in the audit report referred to above. The ANAO intends to consider this issue again, in 2003–2004, as part of a planned larger audit of the management of major equipment acquisition projects.

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[94] Department of Defence, *Defence Annual Report 2000–01*, October 2001, pp. 8–9.

[95] ANAO Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions*, January 2002.

[96] ibid., p. 114.

Ordnance personnel training

Technical regulatory requirements

6.6 Defence's technical regulatory framework requires the Services' TRAs to assess the competency of suppliers, to audit their compliance with regulatory requirements and, if necessary, to audit materiel to ensure that it is properly certified. This requires Defence's suppliers of materiel to employ personnel who are competent in their work. The TRAs are to recognise as competent those individuals who have appropriate training, qualifications, experience, demonstrated competence and integrity to undertake the activities required. They must be authorised to perform those activities within quality and other technical management systems that are appropriate to the type of work they perform. The TRAs need to decide the required degree of regulation using sound risk management practice.[97]

6.7 As stated earlier, the fundamental aim of the regulatory framework is to assist the Services to achieve a satisfactory level of confidence in the certifications provided by organisations responsible for the design, manufacture or maintenance of ADF material.

Ordnance corporate knowledge

6.8 Ordnance is a complex multi-disciplinary field that requires personnel competent in engineering disciplines ranging from the physics and chemistry of explosives to the verification of safety-critical software used in weapon control or safety and arming systems. DMO, JALO, OSG and Service personnel involved in acquisition, integration, test and evaluation, and maintenance of ordnance systems into weapons platforms require many of these skills.

6.9 Defence records indicate that most ordnance training is specific to Defence, and there were no formal training courses conducted by industry that meet the needs of Defence.[98] In February 2000 the then President of the Australian Ordnance Council (PAOC) commented that, although many of the civilian staff in areas that deal with ordnance come from the Services, and hence bring with them relevant experience and training, this channel of recruitment will decrease.[99]

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97 Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel*, June 2002, pp. 2, 4.

98 School of Military Engineering, Army Combat Arms Training Centre, *Rationalisation Study of Explosive Ordnance Training*, Minute 1241/01, 3 October 2001, p. 7.

99 Australian Ordnance Council, *Reduction in Explosive Ordnance Knowledge in the Australian Defence Organisation*, Minute, AOC 98/20386, p. 2.

6.10 The Defence Reform Program led to the establishment of JALO, in Sydney. This involved civilianising much of the ordnance support workforce and disestablishing ordnance organisations in Canberra and elsewhere. Defence records indicate that this caused a large-scale loss of experienced personnel who, for personal reasons, were unwilling to move to JALO because of its location in the west of Sydney. Defence records indicate that the loss was estimated to be 800 man-years of ordnance experience in the para-professional and professional levels.[100] Similarly, DSTO's relocation of part of its Maribyrnong facility to Salisbury in 1997 resulted in an estimated loss of 700 man-years of ordnance experience. Other losses included four Colonel-equivalent ordnance specialist positions, which reduced military personnel input to ordnance policy, standards setting and the acceptance and/or approval of ordnance systems.[101]

6.11 At the time, the AOC had some 90 tasks, ranging from small-scale munitions assessments to large projects such as the Navy's Nulka anti-ship missile active decoy. AOC was concerned that it could lose visibility of some projects and that weapons systems might be brought into service without correct ordnance safety considerations being taken into account. Difficulties were experienced in obtaining Air Force personnel with requisite competencies for specialist postings in JALO and AOC. Also, JALO's accumulated ordnance knowledge was insufficient in preventing its personnel experiencing difficulties in making decisions on damaged/stressed munitions.[102]

6.12 PAOC also reported that the high rate of resignations of Service members experienced and trained in explosives, and the difficulty in finding replacements for them, was creating problems for the AOC in assessing ordnance safety and suitability for service. This situation was seen to jeopardise the AOC's status as Defence's ordnance 'centre of excellence', given the high level of ordnance experience and expertise needed to maintain that status. The PAOC was also concerned about the level of overall ordnance experience available within the ADF.[103]

Ordnance training rationalisation

6.13 Defence addressed the needs of ordnance personnel training as part of a wider Defence personnel training strategy. The Defence Efficiency Review (DER) recommended that Defence establish joint schools where gains in effectiveness

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[100] ibid.

[101] ibid.

[102] Support Command Australia, Australian Ordnance Council, AOC 63/2000, *Additional AOC Documentation*, February 2000, p. 1.

[103] Support Command Australia, Australian Ordnance Council, *An Overview of AOC Activities*, Minute AOC 371/99, 2 November 1999, p. 2.

and efficiency could be demonstrated.[104] Subsequently, as part of the Defence Reform Program initiated in responses to the DER, the Defence Personnel Executive (DPE) in March 2000 began a study on rationalising the training of ordnance personnel, in terms of training courses, facilities and accommodation and competency standards.[105] Proposals to rationalise ordnance training were not new, since in 1966 Navy had proposed a joint ordnance school.[106]

6.14 Phase 1 of the study reported the status of current Defence-wide ordnance training, and led to development of competency profiles for ordnance personnel, including missile maintenance, proof and experimental and the OSG.[107] The profiles were completed by March 2002. The project provided two outcomes: development of a full range of competencies related to ordnance work; and a training package for those competencies directly related to ordnance. The training packages updated ordnance training courses that had not been updated since the late 1980s.[108] The ordnance training rationalisation study was limited to common training needs and excluded specialised training such as weapon systems courses attended by ADF and DMO SPO personnel.

OSG personnel training

6.15 OSG's status as Defence's ordnance safety 'centre of excellence', together with newly developed ordnance management processes discussed in this report, places increased demands on OSG.

6.16 The OSG advised the ANAO that there was no planned increase in the numbers of OSG personnel available in the safety and suitability for service area to meet these increased demands, or to overcome the dilution of experience resulting from the ADF personnel posting cycle. However, work had begun on formulating a case for an increase in personnel to cover specifically the areas of electro-explosive hazard and safety critical software, and to develop safety and suitability for service induction training for new staff.

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[104] Department of Defence, *Future Directions for the Management of Australia's Defence, Addendum to the Report of the Defence Efficiency Review*, Secretariat Papers, 1997, pp. 303, 321.

[105] Defence Personnel Executive, *Terms of Reference—Continued Feasibility Study for Rationalisation of Explosive Ordnance Jul02-Feb03*, Draft 12 July 2002. Defence Personnel Executive, *Explosive Ordnance Training Rationalisation Project: Major Decisions and Milestones*, February 2001.

[106] Department of Defence, *Completion Report for the Rationalisation of Explosive Ordnance Training*, 03 October 2001, p. 7.

[107] Department of Defence, *Explosive Ordnance Project Final Report*, August 2001, p. 2.

[108] Department of Defence, *Explosive Ordnance Competency Project: Final Report*, 8 August 2001.

JALO personnel training

6.17 At the time of audit, JALO had commenced its personnel training needs analysis, and selected personnel had completed the first in a series of a training courses developed and delivered by a commercial organisation. The training courses cover JALO's need for skilled munitions personnel, and do not include weapon system specialist training such as that needed by DMO Systems Program Office personnel.

6.18 The analysis involved identifying, by a facilitated survey process, the competencies required by each position in JALO's organisational structure. On completion of the survey, JALO will profile the competencies of its personnel with a view to identifying appropriate training and development needed by each individual.

6.19 JALO has assigned high priority to profiling positions that require the occupant to hold engineering delegations and that require competency assessments by JALO's Chief Engineer. The aim is to achieve sustainable workloads between JALO's engineers through a timely process that gives sufficient regard to the need for engineering authority to be delegated only to personnel who satisfy specified competency standards. To this end, newly selected civilian engineers receive provisional promotions prior to confirmation of their competency, and newly recruited civilian engineers are placed on probation pending confirmation of their competency.

6.20 JALO's Chief Engineer has also implemented a mentoring program among engineering staff and commissioned a commercial organisation to develop and deliver ordnance training packages. The first of these packages was delivered to JALO staff during July-August 2002. JALO recognises the need for succession planning because of the specialised skills required by ordnance personnel, the limited pool of externally trained ordnance staff and the increasing age of its most experienced personnel.

6.21 JALO is considering innovative approaches to satisfying its future skilled personnel needs. These include:

- linking in-house training and development programs with civil technical training institutions and universities;
- working with the Services to identify training opportunities, such as attendance at the Royal Military College of Science, Shrivenham UK;
- encouraging staff to participate in Departmental and DMO sponsored graduate development programs; and
- establishing trainee or apprenticeship positions.

Conclusion

6.22 Defence's technical regulatory framework requires that Defence's materiel suppliers employ personnel who have appropriate training, qualifications, experience, demonstrated competence and integrity to undertake the activities required. Ordnance system specialists need to be competent in engineering disciplines ranging from physics and chemistry of explosives to verification of safety-critical software used in weapon control or safety and arming systems.

6.23 Organisational changes led to significant reductions in the numbers of Defence personnel having extensive ordnance system experience. The losses of personnel experienced and trained in explosives created difficulties in assessing ordnance safety and suitability for service, and was seen to jeopardise the AOC's standing as Defence's ordnance 'centre of excellence'. There were also concerns about the level of overall ordnance experience available within the ADF.

6.24 Ordnance is a complex multi-disciplinary field, and it has taken Defence almost five years (since the Defence Efficiency Review) to begin implementing an ordnance training rationalisation program and to establish ordnance competency profiles. JALO has engaged a commercial organisation to develop and deliver ordnance training courses and begun identifying appropriate training and development needed by each individual in the organisation. This is a sound approach to meeting the need to ensure its personnel remain competent in carrying out their duties.

6.25 Other areas within DMO, such as the System Program Offices that manage the integration of ordnance systems into weapons platforms, also need personnel with adequate training and experience in ordnance systems development, acquisition, maintenance and test and evaluation. The ANAO last considered technical and professional training in DMO in 2001, as part of an audit of test and evaluation of major Defence equipment acquisitions. ANAO intends to consider this issue again, in 2003–2004, as part of a planned larger audit of the management of major equipment acquisition projects.

7. Ordnance Safety and Suitability for Service Records and Test Capability

This chapter covers two recent developments related to ordnance safety and suitability for service record keeping and test facilities.

Legacy explosive ordnance

7.1 'Legacy' explosive ordnance (EO) is ordnance currently in ADF service for which there is no clearly identifiable audit trail regarding its safety and suitability for service assessment. In April 2001, after a brief investigation into legacy EO, a joint OSG-JALO team found that most ordnance items in the ADF inventory lacked a clearly identifiable audit trail of evidence to support any technical assessment having been undertaken as part of the assurance of the items' safety and suitability for service.[109]

7.2 The need for Defence to undertake safety and suitability for service assessments is derived from, among other things, the *Occupational Health and Safety (Commonwealth Employment) Act 1991*. Section 16 of the Act provides that an agency must take all reasonably practical steps to provide and maintain a working environment, including systems of work and plant, that is safe for employees. Regulations under the Act envisage that such steps would include hazard identification, risk assessment and risk control.[110]

7.3 The overall magnitude of the legacy EO problem is indicated in Figure 3. It shows the percentage of the total ADF munitions product lines that, at the time of the audit, lacked a clearly identifiable formal trail of evidence to support a safety and suitability for service assessment.

7.4 The legacy EO issue raises doubts regarding the effectiveness of the management policy and processes Defence applied to ordnance safety and suitability for service assessments and related records maintenance. The ANAO sought comment from Defence on this issue.

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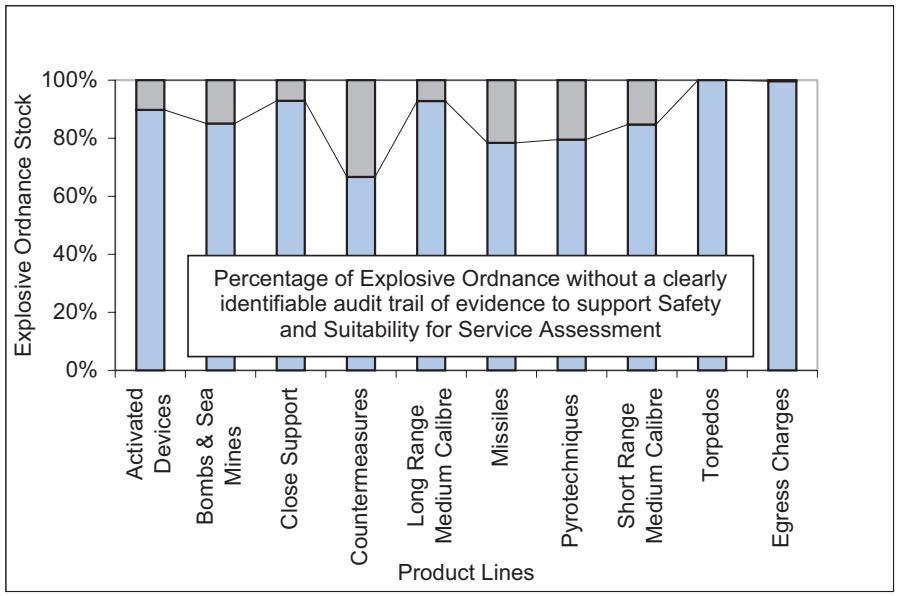
[109] Joint Logistics Command, The Australian Ordnance Council, AOC 2000/32889/1 AOC 100/2001, *Position Paper on 'Legacy' Explosive Ordnance*, 30 April 2001, pp. 2, 4.

[110] Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations (1994), regulations 4.11-4.15 and Division 7.

Figure 3

Legacy explosive ordnance stocks as a percentage of total ADF stock.



Source: adapted from Defence's Ordnance Safety Group—Legacy EO Team Report August 2002.

7.5 In a response in October 2002 the Under Secretary Defence Materiel (USDM) agreed that there was a need to take urgent action to address the legacy EO problem. USDM advised the ANAO that:

- Defence recognised the need to re-establish auditable safety and suitability for service evidence;
- most items in the legacy EO category were introduced into service under the single-Service safety and suitability for service arrangements applying at the time of their introduction, and that the legacy EO problem is largely therefore the lack of documentation establishing the basis for original introduction into service;
- previous and current domestic and international use of items in the legacy EO category support their continued use, while robust safety and suitability for service assessments are re-established;
- most major ordnance systems in use in the ADF have been bought from either the USA or the UK, or at least have been cleared by those nations for use with their Armed forces, and that, although this does not necessarily imply they would automatically be cleared for use in the environments required by the ADF, it would be most unusual if such munitions were to fail to achieve clearance for use by the ADF; and

- the ADF has in place safety reporting arrangements with our major allies regarding ordnance issues and these arrangements have not highlighted any safety and suitability for service assessments of concern.

7.6 A Legacy EO Team, formed by OSG, was due to report to Commander Joint Logistics in November 2002 on the extent of the legacy EO problem, and on a proposed way ahead for its resolution. Meanwhile, Defence has commenced safety and suitability for service assessments of legacy EO items, with priority being given to those produced in Australia. Defence expects that the assessment program will not adversely affect ADF operational capabilities. However, Defence considers that the assessments may reveal a need to amend procedures to facilitate compliance with current safety and suitability for service standards.

7.7 Defence advised the ANAO that the Legacy EO Project is not expected to result in stock being removed from operational service and that, as a result, legacy EO is not expected to materially affect Defence's financial position. Defence acknowledged that the transfer of documentation from various single-Service agencies to JALO could have been better handled. Defence advised that it will continue reviewing historical documentation and seeking to locate extant single-Service safety related certificates, and that improvements to JALO's Engineering Management System, technical data management and configuration management will include ordnance safety case registration and storage.

Electro-explosive hazard assessment capability

7.8 Ordnance safety and suitability for service technical assessments include electro-explosive hazard tests and evaluations that deal with an ordnance system's ability to function safely and reliably when subjected to electro-magnetic radiation.

7.9 In certain circumstances, electro-explosive devices embedded in munitions, or in control devices in weapon systems, may be vulnerable to inadvertent operation or failures due to electrical interference effects from the radio frequency electro-magnetic environment.[111] The consequences of inadvertent initiation of munitions can be severe, involving injury, loss of life, damage to or loss of launch platform, mission failure, litigation and compensation.[112] This necessitates the use of a special set of ordnance safety

[111] Department of Defence, Army Engineering Agency, *Electro-explosive Hazards Assessment—Study into Defence Requirements*, February 2000, p. 5.

[112] ibid., p. 8.

and suitability for service assessment techniques known as electro-explosive hazard (EEH) assessments.[113]

7.10 The ANAO was advised that the majority of EEH assessments are theoretically based, and that practical assessments (trials) are necessary when firing circuit redesign and or protection is considered impractical.[114] JALO advised that if there is insufficient data to complete the theoretical assessment, practical assessments (trials) are performed. As JALO does not perform EEH trials, munitions requiring such trials will be passed to DMO's Land Engineering Agency (LEA) (formerly Army Engineering Agency (AEA)).

7.11 The AEA studied Defence's current capability and future need for assessments of the hazards posed to ordnance by the electro-magnetic environment in 1999–2000. AEA reported that:

> Substantial EEH trials assessment work is required to be performed on behalf of all three services. This work relates to new Defence acquisitions, design modifications to existing stores and platforms, as well as a backlog of service stores containing EED [electro-explosive devices] which need assessment trials.[115]

7.12 AEA found that Defence's capability to conduct a complete safety assessment of electro-explosive devices:

> ...has been degraded in recent years due to organisational and staff changes, to the point where it is debatable whether the ADO [Australian Defence Organisation] can fulfil its duty of care responsibilities.[116]

7.13 AEA noted that some in the ADF held concerns that the electro-magnetic risk environment at various ADF sites had not been reviewed for a long time. With the proliferation of communications and radar installations in recent years, spectrum use and electro-magnetic radiation field strengths have increased, creating additional risk to stores containing electro-explosive devices as well as additional electro-magnetic risk to the platforms themselves.[117]

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[113] A broader range of hazards includes radiation hazards (RADHAZ), which are defined as the risk of harmful effects in humans, and of inadvertent ignition of flammables or electro-explosive devices, resulting from electro-magnetic radiation in the radio frequency band of up to 300 GHz. (Department of Defence, *Safety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, Part 3 Chapter 3, p.3-1.) Defence's capability regarding RADHAZ was being reviewed by Defence's Radio Frequency Radiation Safety Subcommittee. (Department of Defence, Army Engineering Agency, *Electro-explosive Hazards Assessment—Study into Defence Requirements*, February 2000, p. 13.) RADHAZ is beyond the scope of this audit.

[114] E-mail King DNWS-McNally ANAO, 10 October 2002.

[115] Department of Defence, Army Engineering Agency, *Electro-explosive Hazards Assessment—Study into Defence Requirements*, February 2000, p. 17.

[116] ibid., p. 8.

[117] ibid., p. 13.

Advice from Defence

7.14 Defence advised the ANAO that EEH test facilities are expensive. However, they have wide ranging uses, such as testing EEH vulnerability of munitions, vehicles and other systems that have electronic controls. Such vulnerability testing was gaining prominence after several vehicle-related incidents possibly attributable to electro-magnetic effects.

7.15 Navy ordnance systems are often located in close proximity to high power radio and radar transmitters. Hence they require EEH assessments which may often be more extensive than that required for other Services' ordnance. Navy no longer maintains an EEH instrumented trials capability, but Fleet In Service Trial (FIST) regularly conducts personnel radio frequency hazard measurement surveys of RAN ships, submarines, aircraft, shore establishments and occasionally conducts such surveys of other Defence platforms and facilities. FIST has a limited capability to conduct measurement surveys of radio frequency power densities required for ordnance clearances.

7.16 Navy's DNWS maintains the necessary expertise to undertake EEH theoretical assessments and determine ordnance minimum safe separation distances from radio frequency sources. The latter is based primarily on susceptibility data published in the UK or US or provided by SPOs, OSG and JALO. Minimum safe separation distances are used to develop ship class emission control procedures appropriate for all activities involving ordnance.

7.17 Navy has not identified any unacceptable operational restrictions that have resulted from the implementation of these procedures. Minimum safe distances based on theoretical assessments yield a more conservative result than those based on measurement.

Recommendation No.4

7.18 The ANAO recommends that Defence upgrade its facilities for test and evaluation of ordnance system vulnerability to electro-explosive hazard.

Defence response:

7.19 The thrust of the recommendation is agreed and implementation action has commenced.

Conclusion

7.20 A Defence investigation in 2001 found that most ordnance items in the ADF ordnance inventory lacked a clearly identifiable audit trail of evidence to support any technical assessment having been undertaken as part of the assurance of the items' safety and suitability for service. Defence has agreed that there is a need to take urgent action to address this 'legacy' EO problem and is studying the extent of the problem and a proposed way ahead for its resolution. Meanwhile, Defence has commenced safety and suitability assessments of legacy EO items. The ANAO considers that Defence should continue to act on this issue until the risks are known and any excessive risk is mitigated to acceptable levels. A realistic timetable should be set for the completion of these actions.

7.21 A Defence study reported in 2000 that, due to organisational and staff changes, Defence's capability to conduct a complete safety assessment of electro-explosive devices has been degraded in recent years to the point where it is debatable whether Defence can fulfil its duty of care responsibilities. The study highlights the need for Defence to ensure that it has electro-explosive hazard test facilities adequate for its ordnance safety and suitability for service assessments.

8. Explosives Safety Audit

This chapter considers ordnance safety and suitability for service from the perspective of transport and storage of munitions and the accreditation of ordnance maintenance establishments. It also revisits safety audit independence, which was raised as an issue in 1989 by the then Joint Committee of Public Accounts.

Introduction

8.1 In 1989 the then parliamentary Joint Committee of Public Accounts reported on Defence's management of explosive ordnance (EO).[118] Following that report, the Australian Ordnance Council (AOC) was given responsibility for auditing and reporting Defence compliance with Defence policy on storage and transport of explosives, through the Explosives Safety Audit Group (ESAG).

8.2 Since then the AOC has become the Ordnance Safety Group (OSG), which is Defence's Technical Regulatory Authority (TRA) for storage and transport of explosives in accordance with Defence's technical regulation instructions.[119] ESAG has become the Technical Regulation and Audit (TR&A) and its function is supplemented by JALO's Ammunition Safety Compliance (ASC) section, which is responsible for munitions safety compliance audits and periodic inspections of munitions storage and transport.

Ordnance safety audit policy and procedures

8.3 The OSG has been developing an ADF-wide ordnance safety manual which would combine the individual Service ordnance safety policy and management guidelines into one manual suitable for the three Services.[120] This manual will supplement two existing Defence ordnance manuals mentioned earlier—the *Safety Principles for the Handling of Explosive Ordnance* (OPSMAN 3) and the *Safety and Suitability for Service of Explosive Ordnance* (OPSMAN 4).

8.4 The ordnance safety manual is to provide instructions on safety audits and facility inspection requirements, and certification and audit of complex weapons facilities.[121] In the meantime, OSG and JALO are implementing an audit program based on procedures that evolved from the AOC and the Services.

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[118] Joint Committee of Public Accounts, Report 303 *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance*, November 1989, p. 34.

[119] Defence Instruction (General) LOG 08-15, *Regulation of technical integrity of Australian Defence Force Materiel*, June 2002, p.1.

[120] Department of Defence, ADF TP XX, *Defence EO Safety Manual*, draft, July 2002.

[121] ibid., Part 2, Section 14.

Explosives Storage and Transport Committee (ESTC)

8.5 The Explosives Storage and Transport Committee (ESTC) is a semi-autonomous OSG committee established to provide specialist advice to Defence, and other departments as authorised, on safety aspects of storage and transport of Defence ammunition and explosives.[122] The ESTC develops policy, resolves conflict and interprets Defence policy on storage, transport, handling and use of ammunition and explosives in Defence establishments and units. This incudes matters concerning:

- EO risk management, facility licensing, explosives quantity distances and safeguards for storage facilities;
- waiver applications reviews;
- design, siting and construction of storage facilities, magazines, storehouses, laboratories and process buildings;
- effects of explosions on people, property and other explosives; and
- safety aspects of powered explosives mechanical handling equipment.[123]

8.6 ESTC is responsible for the classification of EO for storage and transport. The classifications are published in the Defence Explosive Ordnance Classification Listing (DEOCL). ESTC maintains a register of all military EO and commercial explosives and pyrotechnics used by the ADF and visiting forces.

8.7 Normally chaired by the Director of OSG (DOSG), the ESTC has members drawn from:

- Headquarters 1ST Joint Movement Group;
- DMO's Land Engineering Agency (LEA);
- JALO;
- DSTO;
- Corporate Services and Infrastructure Group (CSIG);
- Department of Transport and Regional Services; and
- ADI Ltd and other industry representatives.[124]

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[122] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1-8—1-11.

[123] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1-11.

[124] ibid.

8.8 ESTC liaises with the Advisory Council for the Transport of Dangerous Goods (ACTDG) and its drafting sub-committees. It also liaises with other relevant authorities, including the UK Ministry of Defence's Explosives Storage and Transport Committee and the US Department of Defense's Explosives Safety Board.

8.9 The ANAO examined records of the ESTC and found that it provided an essential forum for resolution of issues related to explosive transportation and area regulations and development of explosive ordnance storage and handling guidelines.

Explosives Safety Audit Group (ESAG)

8.10 At the time of the ANAO's 1993 and 1995 audits of EO, the AOC's Explosives Safety Audit Group (ESAG) conducted safety compliance audits of ADF explosives holdings and facilities. The ANAO's 1993 report on EO recommended that audits by ESAG should include a small number undertaken at random with minimal prior notice, and that major ESAG activities and findings be reported to the Secretary of the Department and the Chief of the Defence Force (CDF).[125] The ANAO's 1995 audit found that Defence had implemented that recommendation.[126]

8.11 In April 2002, Defence advised the ANAO that ordnance policy allows for random safety audits and that audits by the TR&A (formerly known as ESAG) include random audits performed with minimum prior notice.[127] ESAG's 1996–1997 annual report indicated that, even though ESAG had adopted a policy of providing minimal notice of all audits, it meant in practice that units received a minium two or three weeks' notice.[128] Furthermore, an audit of ESAG by Defence's Management Audit Branch (MAB) in 1996 estimated that ESAG would take eight years to complete an audit cycle of all ordnance units. MAB considered that interval to be excessive.[129]

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[125] ANAO Audit Report No.5 1993–94, *Explosive Ordnance, Department of Defence*, September 1993, pp. 17, 56.

[126] ANAO Audit Report No.8 1995–96, *Explosive Ordnance, Department of Defence*, November 1995, pp. 21–22.

[127] Defence Inspector General, 2001/38795/1, IG 098/02, *ANAO Discussion Paper On Explosive Ordnance: Safety and Suitability for Service,* 29 April 2002, Attachment 3 Joint Logistics Command Response, p. C-3.

[128] Headquarters Australian Defence Force, Explosives Safety Audit Group, *Annual Report 1996–1997*, p. 2.

[129] Inspector-General Division, Management Audit Branch, *Explosive Safety Audit Group*, Task No. 96014, p. 4.

Recent changes in ordnance safety compliance auditing

8.12 Defence's Inspector-General advised the ANAO that, when JALO was created, the three Service ordnance safety compliance monitoring authorities were disbanded and their responsibilities transferred to JALO. Business process re-engineering for this transfer highlighted that JALO would take on an explosives safety compliance audit function similar to that of ESAG.[130] A MAB report on ESAG in 1996 had endorsed that approach.[131]

8.13 MAB had recommended that ESAG adopt a systems audit methodology focused on higher-level explosives safety management systems and quality management systems. Combined with the systems audit were minimum notice compliance audits designed to certify that the various Defence organisations with ordnance safety responsibilities were implementing the safety systems adequately. ESAG annual reports indicate that this is occurring.

8.14 Changes since then have resulted in the minimum notice for ordnance safety audits reducing to one week for high-level safety management system audits and to a day or less for safety compliance audits, especially those related to transport of munitions. The time taken to complete a compliance audit cycle of all ordnance units has also been reduced by the amalgamation of the single-Service munitions organisations into JALO and the additional audit resources available through JALO and its Regional Services.

8.15 Defence advised the ANAO that safety audit reports are sent to the person in charge of the audited organisation and to the Commander Joint Logistics (CJLOG).[132] CJLOG is required to advise the Chief of the Defence Force and the Secretary of the Department of any major explosive ordnance safety system deficiencies and action necessary to correct them.[133]

8.16 OSG's reorganisation, together with the formation of JALO's ASC section, resulted in OSG's higher-level ordnance safety management audit role passing from ESAG to OSG's newly-formed Technical Regulation and Audit (TR&A) section. The acronym of ESAG was replaced by TR&A to avoid confusion between the different audit foci of the OSG and JALO. At the time of the audit the TR&A section consisted of two personnel dedicated to audit duties.

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[130] Defence Inspector General, 2001/38795/1, IG 098/02, *ANAO Discussion Paper On Explosive Ordnance: Safety and Suitability for Service,* 29 April 2002, Attachment 3 Joint Logistics Command Response, pp.C-3, C-4.

[131] Inspector-General Division, Management Audit Branch, *Explosive Safety Audit Group*, Task No. 96014, pp.4–5, 10–12, 14.

[132] Defence Inspector General, 2001/38795/1, IG 098/02, *ANAO Discussion Paper On Explosive Ordnance: Safety and Suitability for Service,* 29 April 2002, Attachment 3 Joint Logistics Command Response, p.C-3.

[133] Department of Defence, *Safety Principles for the Handling of Explosive Ordnance* (OPSMAN 3), 2000, p. 6-3.

ESAG annual reports

8.17 The ANAO examined selected ESAG annual reports and found they provided useful summaries of explosives safety management system audits covering the personnel, processes and procedures used by Defence's explosives monitoring authorities. The annual reports also covered organisational compliance with Defence's explosives safety policy.

8.18 In 1997, ESAG reported a continuing absence of the basics of an explosives safety program. It reported that it continued to find explosives being stored in unlicensed facilities, inadequate management control at both Defence and contractor ordnance facilities. ESAG considered that this indicated a lack of adequate management control which, with inadequate training, could create a potential for serious accidents. Indeed, during the period, serious accidents occurred at ADI Mulwala and at DSTO's Weapon Systems Division.[134]

8.19 The ESAG report for 2000–01 indicated improvements in explosives safety compliance. However, this must be qualified by the reduction in ESAG's audit scope and totality, which occurred in 2000–01.

8.20 The report concentrated on deficiencies at an Army EO storage area and at an Air Force EO storage area. There were also deficiencies in the three Defence Corporate Services Garrison Support contracts, which to ESAG appeared to make little reference to explosives policy.[135] That issue is beyond the scope of this audit.

8.21 Other areas audited by ESAG in 2000–2001 included DSTO explosives policy and management manuals, and explosives storage and handling. Deficiencies in JALO's technical publications were also noted (see Chapter 4 above).

Technical Regulation and Audit (TR&A) Annual Reports

8.22 During 2001–2002, OSG's TR&A section conducted explosives safety audits in Air Force, DSTO, Navy vessels and explosives transportation.

8.23 TR&A reported that reductions in the numbers of Weapons Specialist (WS) personnel and experience at the Strike Reconnaissance Group (SRG) RAAF Amberley (including deployments to Darwin) made the potential for a serious ordnance-related incident occurring very high. The SRG audit, which Defence advised was conducted at the request of Air Force, confirmed Air Force's belief that additional resources were needed for adequate management of ordnance

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[134] Headquarters Australian Defence Force, Explosives Safety Audit Group, *Annual Report 1996–1997*, pp. 1, 4.

[135] Defence Materiel Organisation, Joint Logistics Command, Australian Ordnance Council, *Explosives Safety Audit Group Annual Report 2000-2001*, September 2001, p. 3.

safety. Subsequently Air Force increased the numbers of WS personnel at SRG and announced formation of the Explosive Ordnance Employment stream in Air Force to address the need for growth in the ordnance specialist category.[136]

8.24 TR&A also audited the licensing of a number of ships' magazines, management of munitions in those magazines and general ordnance safety practices. The audits found deficiencies in crew personnel training and minor shortcomings in management practices. However, the report indicated that munitions storage on Navy ships was at a level permitted by the relevant standards.[137] Defence advised that similarly, data for Navy and Air Force units, and DMO managed contractor facilities located on Navy and Air Force bases.

Ammunition Safety Compliance (ASC) section

8.25 Commander Joint Logistics (CJLOG), on behalf of the ADF, is to ensure that technically competent personnel, who are independent of the Licensing Authority,[138] monitor and audit compliance with explosives legislative and regulatory requirements.

8.26 JALO's Ammunition Safety Compliance (ASC) section has 36 personnel responsible for the safety of munitions operations and facilities, and a further seven personnel responsible for licensing and munitions risk assessments.[139] ASC assists the OSG with safety policy development, conducts munitions safety compliance audits in conjunction with the periodic inspection of munitions storage and transport, and munitions licensing. ASC also assists JALO product lines with advice on handling, storage and life surveillance, and general technical advice on ADF ordnance.[140]

Ammunition Safety Audits

8.27 Defence policy requires safety audits of Defence units and contractors who store, handle, maintain or transport munitions. These audits must occur at least every two years, or at some other frequency approved by the Director Ordnance Safety Group.[141]

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[136] Defence Material Organistion, Joint Logistics Command Ordnance Safety Group, Technical Regulation Audit Section, *Annual Audit Report 2001–2002*, September 2002, p. 2. Air Force Headquarters, *Formation of the Explosive Ordnance Employment Stream*, 29 August 2002.

[137] Defence Material Organistion, Joint Logistics Command Ordnance Safety Group, Technical Regulation Audit Section, *Annual Audit Report 2001–2002*, September 2002, p. 2. OPSMAN 3 and ABR 862.

[138] See Glossary.

[139] Joint Ammunition Logistics Organisation, *Performance Indicator Report*, July 2002, p. 36.

[140] Joint Ammunition Logistics Organisation, *Engineering Management Plan,* Inspector-General Division, Management Audit Branch, *Explosive Safety Audit Group*, Task No. 96014, pp. 12–14.

[141] Department of Defence, *Safety Principles for the Handling of Explosive Ordnance* (OPSMAN 3), 2000, Part 1, Chapter 6.

8.28 JALO's Ammunition Safety Audit (ASA) section performs the audit activity on behalf of the ADF Group Heads. ASA has 10 auditors, assisted by 31 personnel from JALO's Regional Services.[142] ASA uses a compliance audit approach to verify that organisations have complied with regulations relating to explosives. Responsibility for complying with regulations relating to ordnance activities rests primarily with Group Heads, exercised through commanding officers or site managers of the establishment conducting Defence ordnance activities. These responsibilities include, but are not restricted to:

- ensuring that their responsibilities and related procedures for ordnance management are accurately defined and adhere to the requirements of extant Defence policies and applicable Commonwealth, State or Territory law;
- contributing to development and implementation of ordnance procedures and any action required to improve the procedures; and
- ensuring, by means of effective internal reviews and training programs, that ordnance management procedures are implemented properly at unit level and that any deficiencies are reported to management.

This level of activity may also involve, not only the unit and specialist staff, but also JALO Regional Services in an advisory capacity.

Ordnance facilities certification audits

8.29 Certification audits of complex maintenance facilities in general consider issues that contribute to technical integrity of ADF materiel. Defence uses certification audits to ensure that maintenance facilities for complex munitions, such as torpedos and guided missiles, can achieve required maintenance and safety standards. Certification audits include all ordnance safety aspects as well as unique building arrangements, test equipment maintenance and usage, documentation, personnel skills and training, throughput of weapons, spares, and any other aspect that could affect availability of weapons to customers.

8.30 At the time of the ANAO audit, ordnance facilities for processing weapons of US origin, such as Navy's Mk 48 torpedos, were certified using a joint ADF-USN certification audit team headed by JALO.[143]

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[142] Joint Ammunition Logistics Organisation, *Performance Indicator Report*, July 2002, pp. 36–37.

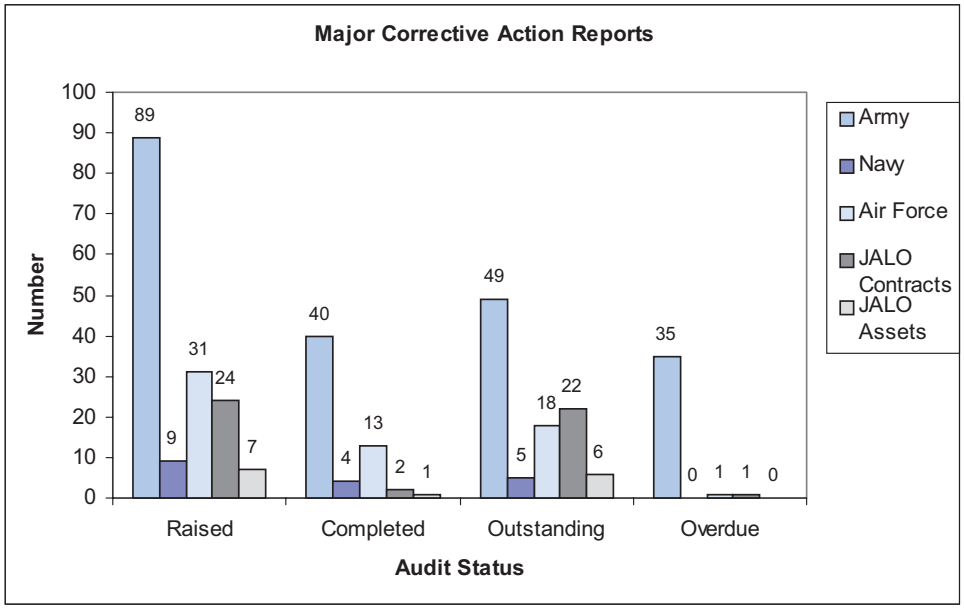
[143] Department of Defence, ADF TP XX, *Defence EO Safety Manual*, draft, July 2002, Part 2, Section 14, Chapter 13.

Audit Corrective Action Requests

8.31 On completion of an ordnance safety audit or an ordnance facilities certification audit, any non-conformance or departure from established policy requirements and standards found during the audit is recorded on Corrective Action Request (CAR) forms. The auditor and auditee endeavour to agree on the findings and on a date by which the auditee is to have taken corrective action. Any delay in completing that action is to be reported quarterly, and agreed deficiencies in areas of EO management are to be eliminated as soon as possible.[144]

8.32 Figure 4 shows July 2002 statistics on JALO's safety compliance audits. The large number in respect of Army reflects the large number of Army reserve units that generally hold only small quantities of munitions. Army has also experienced high levels of operational commitments and a large personnel posting turnover. Defence advised the ANAO that some 20 per cent of the major CARs addressed to Army were for DMO and Corporate Services and Infrastructure Group.[145]

Figure 4
Joint Ammunition Logistics Organisation Safety Compliance Audit Results July 2002



Source: Joint Ammunition Logistics Organisation

Note: These statistics are based on the following populations: 357 Army units; 86 Navy units; 135 Air Force units; 14 JALO contracted facilities; and 6 JALO assets.

[144] Department of Defence, *Safety Principles for the Handling of Explosive Ordnance* (OPSMAN 3), 2000, Part 1, Chapter 6, paragraph 6.10.

[145] Department of Defence, Inspector-General 347/02, *Australian National Audit Office (ANAO) Audit of Defence Ordnance Safety and Suitability for Service—Comments on Discussion Paper No.* 2, 22 November 2002, Annex A. p. 2.

Conclusion

8.33 The OSG's development of an ADF-wide ordnance safety manual, which will combine individual Service ordnance safety policy guidelines into one manual, should assist ordnance personnel throughout Defence.

8.34 OSG records show the Explosive Storage and Transport Committee provides an essential forum for resolving issues related to explosives transport and area regulations, and the development of explosive ordnance storage and handling guidelines.

8.35 Similarly, the explosives safety management system audits and safety compliance audit program conducted by the OSG's Technical Regulation and Audit (TR&A) section and the explosives safety compliance audit program conducted by JALO's Ammunition Safety Audit (ASA) section, are essential for safe storage, transport and maintenance of ADF munitions. The combination of OSG and JALO safety audit resources has benefits for DMO and the Services in terms of effective and efficient implementation of ordnance safety policy and management guidelines.

Explosives safety audit independence

8.36 As mentioned earlier, the OSG is Defence's TRA for storage and transport of explosives in accordance with Defence's technical regulation instructions.[146] Following the report in 1989 on Defence EO management by the then Joint Committee of Public Accounts (JCPA),[147] the AOC (now the OSG) was made responsible for auditing and reporting Defence compliance with Defence policy for storage and transport of explosives, through the Explosives Safety Audit Group (ESAG).

8.37 The OSG is located in the Joint Logistics Command of DMO. The Director OSG reports direct to the Commander Joint Logistics. This affords the OSG some independence from the ordnance procurement and logistic support carried out by DMO's JALO and DMO's System Program Offices, but the OSG is not as independent as it was when it reported direct to Vice Chief of the Defence Force (VCDF).[148] However, since then, Defence has introduced the technical regulatory framework and, with it, the prospect of better technical integrity outcomes than from the former reliance on hierarchical command and control structures.

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[146] Defence Instruction (General), *Regulation of technical integrity of Australian Defence Force Materiel*, June 2002, p. 1.

[147] Joint Committee of Public Accounts, *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance,* Report 303, Parliament of the Commonwealth of Australia, November 1989, p. 34.

[148] Defence Instruction (General) Admin 02-1 *The Australian Ordnance Council*, 1994, AL11, p. 1.

JCPA consideration of Defence explosives safety management and audit

8.38 The JCPA's 1989 report raised the general issue of compliance with NATO safety principles for storage and handling of munitions and, in particular, the need for verification by a body independent of the management responsible for explosive operations.[149] At the time, AOC reported on inconsistencies or deficiencies in explosives transport or storage direct to the then Assistant Chief of Logistics (ACLOG) in Defence Headquarters.

8.39 The JCPA considered that verification by a body independent of the management responsible for explosive operations was very important because, if correctly implemented, it should ensure that Defence is complying with NATO safety principles and thereby reducing the possibility of an accident occurring in relation to storage and handling of explosives.[150]

8.40 ACLOG's responsibility for ordnance logistics led the JCPA to comment that it was not satisfied that the recommendations of the AOC would be given sufficient consideration to ensure its independent role. The JCPA recommended that:

> All Australian Ordnance Council audit reports on adherence to Departmental Instructions be sent in the first instance to the Chief of the Defence Force and the Secretary.[151]

8.41 The JCPA considered that this would help ensure there would be no delays in implementing audit recommendations. The JCPA made this recommendation even though Defence had advised the JCPA that AOC had direct access to the Chief of the Defence Force and had no direct line of management responsibility to any individual Service Chief.[152]

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[149] Joint Committee of Public Accounts, *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance,* Report 303, Parliament of the Commonwealth of Australia, November 1989, p. 32; Auditor-General, Efficiency Audit Report, *Department of Defence: Safety Principles for Explosives,* April 1988, p. 17.

[150] Joint Committee of Public Accounts, *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance,* Report 303, Parliament of the Commonwealth of Australia, November 1989, p. 32.

[151] Joint Committee of Public Accounts, Report 303, *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance,* November 1989, p. 34.

[152] Joint Committee of Public Accounts, Report 303, *Review of Auditor-General's Efficiency Audits—Department of Defence: Safety Principles for Explosives and RAAF Explosive Ordnance,* November 1989, p. 33. At the time, the individual Services were responsible for the application of defence explosive safety policy and for EO logistics within their own organisational boundaries. See Audit Report No.5 1993–94, *Explosive Ordnance, Department of Defence*, 1993, pp. 57, 59, 87.

8.42 Defence's EO-related organisational changes since then include:

- transfer of responsibility for ordnance engineering and logistics including ordnance safety and suitability for service assessments from the Services to the DMO;
- establishment of technical regulatory frameworks managed by the Services and accountable to the Service Chiefs; and
- re-location of the AOC (now the OSG) from the CDF and VCDF Executive Support area of the former Defence Headquarters to DMO's Joint Logistics Command.

8.43 The Director of OSG now reports direct to the Commander Joint Logistics. This affords the OSG some independence of the ordnance procurement and logistic support carried out by DMO's JALO and DMO System Program Offices, but the OSG is not as independent as it was when it reported direct to VCDF.

8.44 These changes result in the OSG, as the body responsible for ordnance policy, standards, safety and suitability assessments and compliance audit, being situated in DMO's logistics line management structure, rather than having direct reporting responsibility to CDF and the Secretary, which the JCPA had recommended in 1989. This raises questions concerning auditor independence regarding ordnance policy and standards matters, and whether audit corrective action requests will always receive adequate response from DMO's System Program Offices, which operate under time, cost and delivery imperatives.

8.45 The organisational design remedy for this issue is Defence's technical regulatory framework. This was to ensure the technical integrity of ADF materiel regardless of which organisations supply and support the materiel. The TRAs are independent of materiel supply and support organisations and are accountable to the individual Service Chiefs for:

- monitoring the performance of organisations that supply and support ADF materiel; and
- ensuring policy, standards, safety and suitability assessments and compliance audits remain effective in maintaining technical integrity.

8.46 The technical regulatory framework's core features related to regulatory independence include the need for the suppliers of goods and services to:

- comply with policy and guidelines contained in technical regulation management manuals, which were developed as requirements independent of financial and logistics pressures, and endorsed by the Service Chiefs;

- ensure that reviews of materiel designs are conducted by competent and authorised personnel who are independent of the personnel who conducted the materiel's design and development; and
- submit to compliance audits of relevant engineering management systems, and to have regard to the TRA's corrective action requests.

Conclusion

8.47 OSG's placement in the joint logistics organisation gives it closer access to DMO's ordnance acquisition and logistics projects and maintains it in DMO's chain of command. Thus DMO's senior executives are accountable for monitoring OSG's resources and performance, and for maintaining these at satisfactory levels. Audit independence now depends on the technical regulatory framework, which is designed to give the Services confidence in the technical integrity of ADF weapons platforms and systems, regardless of which organisations supply and support the materiel. Therefore, if OSG is adequately supervised and resourced, its placement in DMO should not adversely affect its ability or incentive to advise the DMO executive or the Service Chiefs of any unsafe situations arising with respect to ADF ordnance.

8.48 This issue and the majority of others raised in this audit report underscore the importance of Defence's technical regulatory framework, in terms of ordnance safety and suitability for service.

Canberra ACT
27 February 2003

P. J. Barrett
Auditor-General

Appendices

Appendix 1

Regulation of the technical integrity of ADF materiel

Historical context

1. Given the risks and complexity of ADF weapons platforms and systems, the Service Chiefs need assurance that they may accept equipment into service based on certifications that the materiel complies with regulatory requirements.

2. To meet that need, the individual Services until the early 1990s maintained large engineering and logistics divisions, each headed by an Assistant Chief Materiel (ACMAT). Each of the three ACMATs (Navy, Army and Air Force) operated under complex dual accountability to their respective Service Chief for ADF capability matters, and to the Deputy Secretary Acquisition and Logistics for project management matters.[153]

3. The ACMATs were responsible for acquiring capital equipment, developing logistic policies and engineering requirements, and providing engineering services and facilities.[154] As policy authorities, they were also responsible for monitoring policy adherence.[155] The ACMATs in turn delegated Design Approval Authority (DAA) to personnel in their own acquisition and logistics branches.[156] The DAAs approved designs as suitable for procurement or production and approved the design of modifications, alterations and additions to in-service systems and equipment.[157] Defence relied on external Design Authorities (DAs), generally the original equipment manufacturers (OEMs) or contracted organisations, to provide professional engineering advice on weapon systems and platforms.[158]

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[153] Department of Defence, *Future Directions for the Management of Australia's Defence, Addendum to the Report of the Defence Efficiency Review,* Secretariat Papers, 1997, pp. 149, 165; Department of Defence, *The Capital Equipment Procurement Manual (CEPMAN 1*), 1992, Part 1 Chapter 2, pp. 2-1—2-4.

[154] Department of Defence, *Capital Equipment Procurement Manual 1* (CEPMAN 1) April 1992, Part 1, Chapter 1, pp. 2-3, 2-4. Defence Systems Management Course, Student Note DSM 3J4, November 1993, p. 3.

[155] Department of Defence, *Explosive Ordnance Management Review,* Final Report, DGNLP, November 1993.

[156] See Glossary.

[157] Defence Instruction (Navy) TECH 9-1, *Design Approval of RAN Systems and Equipment*, March 1999.

[158] See Glossary.

4. Sound engineering outcomes were achieved using a hierarchical body of experienced practicing engineers, with the 'best' engineers becoming the authoritative reference on engineering policy and practice. This hierarchy of engineering expertise and supervision enabled engineering issues to be monitored and controlled at appropriate levels. This structure provided the Services with a significant degree of visibility and control over design, development, production and logistics support of their weapons platforms and systems. This included ordnance safety and suitability for service assessments, which were conducted with advice from the Australian Ordnance Council (AOC now the OSG).

5. Design authority and approval concepts have not changed since then. However, over the last decade, Defence has experienced significant organisational structure and policy change that affected the Services' ability to supervise the design, development, production and logistics support of their weapons platforms and systems. Key changes included abolishing the Services' ACMAT organisations,[159] and increasing the Services' reliance on external organisations for design and integrated logistic support of weapon systems and platforms, through Defence's Commercial Support Program. In Navy's case, the Commonwealth divested itself of dockyards,[160] outsourced Navy design work and decentralised Navy engineering management functions and logistics support to System Program Offices and Project Offices in DMO. DMO largely oversees the work of contractors.

6. Army and Air Force also rely on DMO for their materiel acquisition and logistics, and similarly the Commonwealth has divested itself of military aircraft and guided weapons factories[161] and munitions and ordnance factories.[162]

7. The Commonwealth now predominantly relies on industry to design, construct and maintain ADF equipment and consumables based on functional performance specifications and military standards specified by Defence.

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[159] Department of Defence, *Future Directions for the Management of Australia's Defence, Addendum to the Report of the Defence Efficiency Review*, Secretariat Papers, 1997, pp. 149, 165; Department of Defence, *The Capital Equipment Procurement Manual (CEPMAN 1)*, 1992, Part 1 Chapter 2, pp. 2-1—2-4.

[160] Department of Defence, *Defence Report 1988–89*, Australian Government Printing Service, 1989, pp. 60–61; Department of Defence, *Defence Report 1987-88*, Australian Government Printing Service, 1988, p. 50.

[161] In 1983 the Commonwealth had Government Aircraft Factories (GAF) at Fisherman's Bend and Avalon in Victoria and the Aircraft Engineering Workshop at Pooraka in South Australia for the design, development manufacture and maintenance of aircraft and guided weapons for the ADF and for export. A Government owned company took over GAF operations in 1987. Report of the Auditor-General upon audits, examinations and inspections under the Audit and other Acts, September 1983, p. 62; Department of Defence, *Defence Report 1987-88*, Australian Government Printing Service, 1988, p. 50.

[162] Department of Defence, *Defence Report 1988–89*, Australian Government Printing Service, 1989, pp. 60–61.

Evolution of ADF's technical regulatory framework

8. These changes resulted in the Air Force recognising a need to develop a technical regulation framework that has its Design Approval Authorities concentrating on the approval and surveillance of organisations and the process they follow, rather than approving the work itself. This increased the need for a wide-reaching regulatory framework capable of sustaining satisfactory levels of confidence in the certifications provided by organisations responsible for design, manufacture or maintenance of ADF materiel. The key defence materiel management principles are that Defence materiel must be designed, manufactured, and maintained to approved standards by competent and authorised individuals acting as members of an authorised organisation, and whose work is certified as correct.

9. Defence is seeking satisfactory levels of confidence in certifications given by organisations, by recognising only organisations that meet the following criteria:

- **Systems:** technical management systems appropriate to the type of work being performed. These include quality management systems, technical management systems, engineering management systems and configuration management systems.
- **Personnel** having appropriate authority, training, qualifications, experience, demonstrated competence and integrity to undertake the activities required.
- **Processes** that include project management procedures and plans to specify and define technical activities must be controlled and approved by an appropriately qualified individual, nominated within the quality system.
- **Data** applied to, and derived from, technical activities that is accessible, authoritative, accurate, appropriate and complete.[163]

Ordnance system regulation

10. At the time of the audit the three Services differed with regard to technical regulations applied to ordnance system design, as outlined below. However, the TRAs were working together, with DGTA in the lead, to provide a single set of requirements that each TRA finds acceptable.

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[163] Department of Defence DI (G) LOG 08-15, *Regulation of technical integrity of Australian Defence Force materiel*, June 2002, p. 4.

Navy

11. For Navy munitions, JALO's Chief Engineer has delegated authority to approve:

- design and design changes of all Navy in-service munitions, including packaging, handling and test equipment;
- production permits and concessions;
- surveillance programs;
- trials procedures, other than trials to be conducted on Navy platforms or establishments; and
- technical maintenance routines and repair schemes, and the designs of associated packaging, handling and test equipment.

12. JALO does not hold delegations for new munitions acquisitions unless this delegation is agreed with Navy as part of a DMO Systems program Offices Project Management and Acquisition Plan (PMAP).

13. Instances where designs do not comply with Navy engineering practice or standards, or which would result in operational limitations, are to be referred to Navy for agreement prior to acceptance.[164] Principally this requires JALO to comply with the principles and guidelines contained in Navy's ordnance engineering policy and procedures.[165]

Army

14. In late 2001, DMO's Director of Land Engineering Agency received delegated authority from Director Technical Regulation—Army, to act as the Army's Design Acceptance Authority (DAA). Army's DAA has in turn provided—JALO's Chief Engineer delegated authority as the DAA Representative for the technical integrity of Army ammunition.[166]

15. Army assigns authority to organisations in terms of Authorised Engineering Organisations (AEO) and/or Authorised Maintenance Organisations (AMO). JALO is seeking AMO status under the Army regulatory system. It has appointed a Maintenance Policy Manager under the Chief Engineer, and at the time of the audit was producing a Maintenance Management Plan (MMP) that explained in detail how JALO satisfies the Services' differing AMO requirements.

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[164] Directorate of Naval Weapons Systems, *Delegation of Design Approval Authority for Naval Ordnance and Explosive Ordnance*, 10 Jan 2002.

[165] Joint Ammunition Logistics Organisation, *Engineering Management Plan*, Draft July 2002, Section 1, Chapter 2, p. 1.

[166] Defence Materiel Organisation,'*Land Support Systems Branch, Interim Appointment as Design Acceptance Authority Representative*, 21 December 2001.

16. JALO must comply with the principles and guidelines contained in Army's technical regulations.[167]

ADF aircraft

17. Director General Air Worthiness (DGTA) assigns Airworthiness Engineering Organisation (AEO) and Airworthiness Maintenance Organisation (AMO) status to competent Service and commercial organisations following formal evaluation.

18. At the time of the audit JALO had interim AEO and AMO for all aircraft munitions based on the former 1CAMD AEO status, and this was subject to ongoing evaluation and surveillance by DGTA.

19. JALO's Chief Engineer was appointed by DGTA as JALO's Airworthiness Standards Representative (ASR) for ordnance with respect to all ADF aircraft. He provides authoritative design advice to Systems Program Office and Force Element Group Chief Engineers or to delegated Senior Design Engineers in Project Offices. He is authorised to:

- prescribe and revise the minimum design standards for ordnance fitted to ADF aircraft;
- perform compliance audits against prescribed ordnance standards;
- provide authoritative airworthiness advice on the interpretation of ordnance standards; and
- provide authoritative airworthiness advice on exceptions requested against prescribe ordnance standards.

20. Any designs approved by JALO that have an effect on the interface with an aircraft, need Design Acceptance Certification by the aircraft Chief Engineer (as the Design Acceptance Representative).

21. JALO must comply with the principles and guidelines contained in the ADF's technical airworthiness regulations.[168]

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[167] Joint Ammunition Logistics Organisation, *Engineering Management Plan*, Draft July 2002, Section 1, Chapter 2, p. 1.

[168] ibid., Section 1, Chapter 2, p. 1.

Appendix 2

Ordnance Safety Case Management

1. An important component of Defence's ordnance system technical regulation is an engineering design evaluation process known as the ordnance safety and suitability for service assessment process. This process requires organisations introducing ordnance into service, or modifying ordnance already in service, to develop a Safety Case that seeks to reduce risks to a reasonably practicable low level.

2. Safety Cases include:

- system descriptions, which include likely hazards encountered during the system's lifecycle;
- design assessments aligned to internationally recognised criteria for safety and suitability for service;
- analysis of the system's performance data with respect to its design and environmental parameters; and
- descriptions of the design safety requirements and presentation of evidence showing the success of the safety features.[169]

3. This assessment is based on the development of a Safety Case containing two discrete elements:

- safety assessments involving appraisals of the inherent freedom from explosive hazard of the item's design, evaluations of the risk attendant on deploying the item in the prescribed environments throughout its expected service life, and consideration of the acceptability of the risks in meeting the operational requirements; and
- suitability for service assessments involving: objective evidence that the item or associated elements of a weapon or equipment are capable of functioning as designed, and that functioning will not be unacceptably degraded by the service environments encountered throughout its expected service life. This definition generally excludes operational effectiveness and lethality but may include certain performance characteristics if these aspects are deemed to be part of the design function. The expected service life is defined as the whole life environment for the particular store, which is known as the Manufacture to Target or Disposal Sequence (MTDS) or life cycle.[170]

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[169] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1-2.

[170] ibid.

4. These assessments are a sub process of the design disclosure and acceptance process for materiel, and hence, when considering ordnance systems for acceptance into ADF service, Defence personnel must consider the design characteristics of aiming, launch and guidance systems, as well as the design characteristics of any explosive materiel in the system.[171] They must also consider the logistic support[172] provided to ordnance systems with respect to agreed performance and operational availability specifications.

5. The OSG and JALO, and DMO's System Program Offices (SPOs) that acquire ordnance systems and munitions, share responsibility for determining the risk involved with the acquisition of ordnance through the Safety Case assessment process. As outlined in Chapter 4, JALO or the applicable SPO is responsible for producing the ordnance safety and suitability for service assessment in accordance with policy and standards established and maintained by the OSG.[173]

6. For ordnance assessed by a SPO and the OSG as 'low-risk', and thus not requiring higher-level review, the SPO may assess the ordnance Safety Case. If a SPO considers that particular ordnance involves high risk, the OSG is responsible for convening the Ordnance Safety Review Board (OSRB) to review the ordnance's Safety Case, including the safety and suitability for service assessment.

7. In all cases SPOs must conduct initial ordnance safety and suitability for service assessments before acquisition contracts are signed, and they must pass the assessment to OSG for validation. This enables the OSG to assess the need for contractors to provide additional information such as design data, safety and hazard analyses, and the results of safety and environmental trials.[174] The TRAs are required to seek specialist advice from the OSG, whenever they are auditing ordnance Safety Cases.

8. OSG is required to maintain a capability to perform ordnance safety and suitability for service assessments to ensure it retains its professional expertise, and to provide a safety and suitability for service assessment capability, particularly during the transition period while JALO and the SPOs develop safety and suitability for service assessment competencies and procedures. The OSG's safety and suitability for service role can include the integration of the munition into systems and platforms, where the interface can induce a hazard to the munitions.[175]

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[171] Department of Defence, *Safety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, part 1. p. 1–6.

[172] See Glossary.

[173] Meeting CJLOG and TRAs, October 2001.

[174] Defence Instruction (General) Admin 02-1, *The Australian Ordnance Council*, January 1994, AL11, p. 2.

[175] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, p. 1–2.

9. The OSG's responsibilities regarding Safety Case assessments include:

- assisting ordnance procurers to develop the requirements for an ordnance Safety Case;
- determining, in conjunction with the Safety Case developer and the single Services, the Manufacture to Target or Disposal Sequence (MTDS or life cycle) of particular ordnance products;
- maintaining appropriate international data exchange agreements which facilitate the collection of Safety Case data;
- defining ADF policy and standards regarding ordnance Safety and Suitability for Service assessments;
- assisting ordnance Safety Case developers to determine and apply relevant standards;
- reviewing ordnance Safety Cases prior to their presentation to the OSRB for its assessment;
- conducting technical audits to determine the level of evidence held in support of the ordnance Safety Cases, in cases where ordnance lack an OSRB assessment;
- recommending courses of action to the single-Service authority in cases where an ordnance item fails to have robust Safety Cases in support of its safety and suitability for service assessments;
- promulgating OSRB safety and suitability for service assessments;
- maintaining a register of all explosive ordnance procured and their status; and
- recommending to Under Secretary Defence Materiel on implementation of EO policy and promoting the requirement for Safety and Suitability for Service assessment in the ADF.[176]

[176] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002, pp. 1-8–1-9.

Appendix 3

Introducing ordnance into service

1. The three Services each developed their own policy and procedures for introducing ordnance into service. Navy developed specialist ordnance engineering management processes, which it recorded in a comprehensive four-volume set of ordnance system engineering and logistics support instructions and requirements, known as ABR 862. ABR 862 in effect describes the ordnance engineering organisational structure and management system that covers Navy's ordnance safety and suitability for service processes and acceptance into service process.[177] Navy requires JALO to comply with ABR 862.[178]

2. The Army had not developed a manual on ordnance engineering. Instead it developed munitions logistics instructions for each munition it had in service, and also instructions covering the management of munitions; such as munitions storage, facility control, safety and security.[179] The ANAO was unable to locate a description of Army's ordnance safety and suitability for service assessment process and acceptance into service process. However, as discussed in Chapter 4, JALO's Proof and Experimentation Group conducts ordnance system test and evaluations. Many of the procedures, specialist skills and purpose-built facilities provide a basis for acceptance-into-service test and evaluation of Army weapons and munitions.

3. Air Force also had not developed a publication on ordnance engineering. Instead, it developed an ordnance publication focused mainly on munitions storage, handling and safety.[180] The ANAO was unable to locate a description of Air Force's ordnance safety and suitability for service assessment and acceptance into service process. However, as discussed in Chapter 2, Air Force developed a comprehensive technical regulatory framework that was not organisational-structure specific and that provided a standard approach to technical integrity of all ADF aircraft systems. It also developed an Aircraft Stores Capability Certification (ASCCERT) process, which is an integral part of the test and evaluation of ADF aircraft stores. Aircraft stores include ordnance systems.[181]

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[177] ABR 862, *Royal Australian Navy Explosive Ordnance Safety Manual*, 1994. In particular, Volume 1, Part 1, *Instructions for Establishments, Commands and Navy Office,* Chapter 4, Determination of Safety and Suitability for Service.

[178] Joint Ammunition Logistics Organisation, *Engineering Management Plan*, Draft July 2002, Section 1, Chapter 2, p. 1.; ABR 862, Volume 1, *Instructions for Establishments, Commands and Navy Office,* Part 1, Chapter 4, Determination of Safety and Suitability for Service.

[179] Army Logistics Instructions; (ALI) POL 9-1, *General Ammunition Information*, Feb 1998, POL 9-2, *Manual of Ammunition*, February 1998; POL 9-3, *Ammunition Serial Number, packaging and Hazard Classification Data*, November 1996; POL 9-4, *In-Service Surveillance of Ammunition Results of Tests*, February 1998.

[180] Royal Australian Air Force, Australian Air Publication 7039.001-1, *Explosive Ordnance Safety Manual*, May 1996.

[181] ANAO Audit Report No.30 2001–02, *Test and Evaluation of Major Defence Equipment Acquisitions,* January 2002, pp. 90–91, 136–137.

4. The need for DMO Systems Program Offices or Project Offices to conduct safety and suitability for service assessments was not mandated until April 2001.[182] Until then acquisition Project Managers were responsible for specifying in tender and contractual documents acceptance test criteria for weapons, explosives and related stores. Project Managers were also advised that they should establish a 'System Safety Program' in accordance with MIL-STD-882B-*Safety Program Requirements*, as a part of the safety and suitability for service process, and to consult with the AOC for advice.[183]

5. Defence published its ordnance safety and suitability for service guidelines in July 2002.[184]

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[182] Department of Defence, Circular Memorandum No. 13/2001, *Explosives Safety Assessments and Procurement within the Defence Materiel Organisation*, 18 April 2001, Defence Instruction (General) LOG 07-1, *Explosive Ordnance—Safety Policy and Responsibilities,* June 2002.

[183] Department of Defence, *Capital Procurement Manual* 1 (CEPMAN 1), Part 2, p. 16-1. DMOKS Safety and Suitability for Service (S3).

[184] Department of Defence, S*afety and Suitability for Service of Explosive Ordnance*, OPSMAN 4, June 2002.

Appendix 4

Previous performance audits in Defence

Set out below are the titles of the ANAO's previous performance audit reports on the Department of Defence and the Australian Defence Force (ADF) tabled in the Parliament in the last five financial years.

Audit Report No.5 1997–98 *Performance Management of Defence inventory*

Audit Report No.34 1997–98 *New Submarine Project*

Audit Report No.43 1997–98 *Life-cycle costing in Defence*

Audit Report No.2 1998–99 *Commercial Support Program*

Audit Report No.17 1998–99 *Acquisition of Aerospace Simulators*

Audit Report No.41 1998–99 *General Service Vehicle Fleet*

Audit Report No.44 1998–99 *Naval Aviation Force*

Audit Report No.46 1998–99 *Redress of Grievances in the Australian Defence Force*

Audit Report No.13 1999–2000 *Management of Major Equipment Acquisition Projects*

Audit Report No.26 1999–2000 *Army Individual Readiness Notice*

Audit Report No.35 1999–2000 *Retention of Military Personnel*

Audit Report No.37 1999–2000 *Defence Estate Project Delivery*

Audit Report No.40 1999–2000 *Tactical Fighter Operations*

Audit Report No.41 1999–2000 *Commonwealth Emergency Management Arrangements*

Audit Report No.45 1999–2000 *Commonwealth Foreign Exchange Risk Management Practices*

Audit Report No.50 1999–2000 *Management Audit Branch—follow-up*

Audit Report No.3 2000–01 *Environmental Management of Commonwealth Land—follow-up*

Audit Report No.8 2000–01 *Amphibious Transport Ship Project*

Audit Report No.11 2000–01 *Knowledge System Equipment Acquisition Projects in Defence*

Audit Report No.22 2000–01 *Fraud Control in Defence*

Audit Report No.26 2000–01 *Defence Estate Facilities Operations*

Audit Report No.32 2000–01 *Defence Cooperation Program*

Audit Report No.33 2000–01 *Australian Defence Force Reserves*

Audit Report No.41 2000–01 *Causes and Consequences of Personnel Postings in the ADF*

Audit Report No.51 2000–01 *Australian Defence Force Health Services—follow-up*

Audit Report No.16 2001–02 *Defence Reform Program—Management and Outcomes*

Audit Report No.24 2001–02 *Status Reporting of Major Defence Equipment Projects*

Audit Report No.30 2001–02 *Test and Evaluation of Major Defence Equipment Acquisitions*

Audit Report No.38 2001–02 *Management of ADF Deployments to East Timor*

Audit Report No.44 2001–02 *Australian Defence Force Fuel Management*

Audit Report No.58 2001–02 *Defence Property Management*

Audit Report No.3 2002–03 *Facilities Management at HMAS Cerberus*

Glossary

Ammunition. An item containing one or more projectiles, together with propellent needed to impart velocity to the projectile(s), which are propelled from a reusable launcher. The projectiles may be an inert or contain a high explosive, smoke generator or other energetic composition. The launcher may be a gun. Ammunition is a sub-set of munitions.

Australian Ordnance Council (AOC). See **Ordnance Safety Group**.

Configuration management. This system engineering process permits orderly development of a system, sub-system or configuration item. Good configuration management ensures designs and products are traceable to systems engineering requirements and to configuration and capability baselines. Configuration management includes technical data management and management visibility of what is to be produced, what is being produced and what modifications have been made to what was produced. This enables products to be tested and evaluated to assess compliance with approved specifications.

Consequence. The most severe outcome of a hazard or threat and includes injury and property damage and relates to the significance of an adverse consequence on the achievement of the operation. It is expressed qualitatively or quantitatively.

Corporate governance. This is an integrated strategic management framework designed to support corporate objectives. It is about maximising the value of an organization, subject to meeting its financial, legal and contractual obligations.

Design Acceptance Authority Representative. See **Design Approval Authority.**

Design Approval Authority. Each Service's Design Approval Authority (DAA) is responsible for assessment and approval of product design and associated engineering aspects in meeting contractual performance specifications, and assessment of the acceptability of the product design as a basis for Acceptance into Service. The DAA is also responsible for approving all subsequent modifications, changes and Configuration Control items concerned or associated with a weapon, system, explosive Ordnance or related goods.

Design Authority. The Design Authority (DA) is an approved firm or establishment who is responsible for the detailed design of the explosive item, weapon or explosives related goods. The DA is authorised to sign certificates of design and to certify sealed drawings. When a prime contractor is involved, the contractor is normally appointed as the DA. When all design work is undertaken 'in-house', the research establishment concerned will normally be appointed as the DA during the developmental phase, i.e. before transition to a prime

contractor for production. The selection of the DA is approved by the Project Manager in consultation with the respective Design Approval Authority. DAs owe a duty of care regarding design safety and suitability.

Explosive ordnance (EO). Incorporates all weapon and weapon systems which utilise explosive materiel and includes all the hardware and software required for the operation and support of the EO through its life cycle.

Explosives. The term 'explosive' or 'explosives' includes any chemical, compound or mechanical mixture which, when subjected to heat, impact, friction, detonation or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressures in the surrounding medium. The term applies to high explosives, propellants and pyrotechnics that detonate, deflagrate, burn vigorously and generate heat, light, smoke or sound.

Explosives safety. The process used to prevent premature, unintentional, or unauthorised initiation of explosives and devices containing explosives; and with minimising the effects of explosions, combustion, toxicity, and any other deleterious effects. It refers to all mechanical, chemical, biological, electrical and environmental hazards associated with explosives; hazards of electro-magnetic radiation to ordnance; and combinations of the foregoing. Equipment, systems, or procedures and processes whose malfunction would hazard the safe manufacturing, handling, maintenance, storage, transfer, release, testing, delivery, firing or disposal of explosives are also included.

Handling includes munitions loading, unloading, discharging, stacking, stowing, storing, transporting and any operation incidental to, or arising out of, any of these operations.

Hazard. A condition that is prerequisite to a mishap or a situation or activity involving events whose consequences are undesirable to some unknown degree and whose future occurrence is uncertain.

Legacy EO. This is ordnance currently in ADF service for which there is no clearly identifiable audit trail regarding its safety and suitability for service assessment.

Licensing. Licensing is the process of providing munitions storage facilities with formal authorisation to store, maintain and distribute munitions in quantities subject to specified limits. All ADF munitions facilities must be formally licensed.

Logistic support. Typically consists of the following six key elements:

- logistic engineering, which evaluates safety, reliability, maintainability and determines the most effective through life support plan;
- maintenance engineering, which determines maintenance procedures and schedules;
- technical documentation, covering equipment operation and maintenance manuals and parts lists;
- supply support analysis, which determines the range and depth of spare parts, test equipment items, and provides the initial spares support. This analysis leads to what maintenance will be done at:
    1. the organisational-level—by the armament system's crew;
    2. intermediate-level—by the Service's maintenance authority; and
    3. depot-level—by the DMO or its contractors.
- training for operators and maintainers; and
- information technology development to support each of the above five ILS elements.

Munition: A complete device, e.g. missile, shell, mine demolition store etc, charged with explosives, propellents and pyrotechnics. Includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket and small arms ammunition, all mines, torpedoes and depth charges, demolition charges, cluster and dispensers, cartridge and propellant actuated devices, electro-explosive devices and all similar or related items or components that are explosive in nature.

Ordnance. A weapon system with its associated munitions and auxiliary materiel needed to fire the munition.

Ordnance Safety Group (OSG). The body in Defence responsible for ensuring that the level of rigour applied to the Ordnance Safety and Suitability for Service process is acceptable to meet corporate governance required of Defence by the Commonwealth. This mandatory requirement encompasses all EO during procurement, trials and modification. The OSG is also Defence's Technical Regulatory Authority for storage and transport of EO in accordance with Commonwealth Explosive Regulations.

Replenishment buys. Procurement of EO of a kind already introduced into service with the ADF. The EO may be a variant of the in-service item and may vary in configuration.

Risk. An expression of the possibility of a mishap in terms of hazard severity and hazard probability or the compounding of the probability that a hazardous event will occur and its likely consequences should it occur.

Risk analysis. The systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences.

Risk assessment. The overall process of risk analysis and risk evaluation.

Risk evaluation. The process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other criteria.

Safety and suitability for service (S3). A general term used to summarise the requirements for EO to be acceptably free from hazards and to have inherent characteristics that meet specified requirements during its agreed life cycle. It does not include operational effectiveness.

Safety and suitability for service assessment. An authoritative statement provided by a competent, authorised individual or organization stating that an item of EO meets minimum design safety requirements and will remain safe in a defined ADF operating environment over a set life.

Safety critical. A term applied to a condition, event, operation, process, or item whose proper recognition, control, performance or tolerance is essential to safe system operation or use; e.g., safety critical function, safety critical path, safety critical component.

Technical data. Technical data may be in the form of records, information, specifications, standards, engineering drawings, operating, maintenance, overhaul instructions and manuals, test results, calibration reports, tabular data and software documentation required to support a configuration item through its life cycle.

Technical regulatory frameworks set criteria against which people, processes, products and organisations can be judged; and monitors and audits compliance.

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