The Auditor-General Audit Report No.11 2007–08 Performance Audit

# Management of the FFG Capability Upgrade

**Department of Defence** 

**Defence Materiel Organisation** 

Australian National Audit Office

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ISSN 1036-7632

ISBN 0 642 80987 9

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Canberra ACT 31 October 2007

Dear Mr President Dear Mr Speaker

The Australian National Audit Office has undertaken a performance audit in the Department of Defence and Defence Materiel Organisation 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 the report of this audit and the accompanying brochure. The report is titled *Management of the FFG Capability Upgrade*.

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

K

lan McPhee 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**

| ABR      | Australian Book of Reference (Navy)                           |
|----------|---|
| ADACS    | Australian Distributed Architecture Combat System             |
| ADF      | Australian Defence Force.                                     |
| AEO      | Authorised Engineering Organisation                           |
| ANAO     | Australian National Audit Office                              |
| APS      | Australian Public Service                                     |
| CIOG     | Chief Information Officer Group                               |
| DMO      | Defence Materiel Organisation.                                |
| DRMS     | Defence Records Management System                             |
| EVM      | Earned Value Management                                       |
| EVMS     | Earned Value Management System                                |
| FFG      | Guided Missile Frigate  |
| FFGSPO   | FFG System Program Office                                     |
| FMS      | United States Government Foreign Military Sales               |
| GMLS     | Guided Missile Launching System                               |
| GST      | Goods and Services Tax  |
| ILS      | Integrated Logistics Support                                  |
| ISO      | International Standards Organisation                          |
| HMAS     | Her Majesty's Australian Ship                                 |
| QMS      | Quality Management System                                     |
| RANTEAA  | Royal Australian Navy Test, Evaluation and Analysis Authority |
| SEA 1390 | Guided Missile Frigates (FFG) Upgrade Programme               |
| SM-1     | Standard Missile-1  |
| SM-2     | Standard Missile-2  |
| SPO      | System Program Office   |
| TI-338   | Report of Materiel and Equipment Performance State            |
| TRF      | Technical Regulatory Framework                                |

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# Summary and Recommendations

# Summary

# Introduction

1. The Defence Materiel Organisation's (DMO's) management of the \$2.097 billion SEA 1390 Programme seeks to regain the original relative capability of four of the Royal Australian Navy's remaining five Guided Missile Frigates (FFGs). It is also to ensure the FFGs' associated facilities and logistics support remain effective until the FFGs are withdrawn from service between 2015 and 2021. The audit focuses on SEA 1390's Phase 2.1–FFG Upgrade Implementation Project and Phase 4B–SM-1 Missile Replacement Project. In July 2007, these projects had approved budgets of \$1.497 billion and \$600 million respectively.

2. Phase 2.1's \$1.497 billion budget includes an allowance for annual labour and materials price variations of \$191 million and for foreign exchange variations of \$194 million. These allowances reflect major Defence multi-year contract policy, which allows for variations in labour and/or material costs and foreign currency exchange rates in accordance with agreed price variation formula and indices.

3. Phase 2.1 commenced in June 1999 and its cumulative expenditure reached \$1.064 billion in June 2007. Of that amount, \$1.005 billion was for a variable priced Prime Contract signed on 1 June 1999 covering the design, development and integration of the FFGs' upgraded systems, and the service life extension (see Table 1). The total remaining Prime Contract budget was \$208.4 million as at mid June 2007. On that basis 83 per cent of the Prime Contract Budget had been spent.

4. A Prime Contract change in mid 2006 included a six ship to four ship scope reduction flowing from the Government's decision in November 2003 to withdraw from service the oldest two FFGs, prior to their planned upgrade and life extension. This contract change also included the settlement of Prime Contractor delay claims; changes to the Project's Contract Master Schedule and milestones, and changes to the Upgraded FFGs' Provisional Acceptance from the Prime Contractor by DMO. The overall financial impact was a \$54.4 million (2006 prices) reduction in the Prime Contract price.

#### Table 1

#### Project SEA 1390 Phase 2.1 and Phase 4B Elements.

#### Combat Data System

The original FFG command and control system, known as the Naval Combat Data System, is to be replaced by the Australian Distributed Architecture Combat System. The FFGs are also to receive a modified Weapon Control System, an additional communications system, upgraded operator consoles, more capable servers and local area network.

#### Surveillance

The FFGs' Anti-Ship Missile detection system is being upgraded through modifications to the FFGs' search radars and the addition of a newly developed Radar Integrated Automatic Detection and Tracking System, and a Command and Control Picture Compilation System. The FFGs' Electro-Optical Tracking System is being integrated with the Combat Data System, and the FFGs' Electronic Support System is being replaced.

#### **Above Water Warfare**

The FFGs' Anti-Surface Warfare capability, based on the Harpoon guided missile system, is being retained and the Anti-Ship Missile Defence capabilities are being upgraded by the addition of Evolved Sea Sparrow Missiles and a Vertical Launching System. The FFGs' radar decoy capability is being upgraded by additional decoy launchers, launch control systems and improved long-range chaff and infrared decoys.

The FFGs' SM-1 Area Air Defence missile systems are being replaced by the next generation SM-2 Block IIIA missile system. This is the SEA 1390 Phase 4B element.

#### **Underwater Warfare**

The FFGs' original Hull-Mounted Sonar will be replaced, and their torpedo defence improved by provision of more effective torpedo warning systems and torpedo countermeasures. A multilayered approach to torpedo detection will be provided by the Hull-Mounted Sonar's active and passive modes, by integration of a new towed array system, and by the use of the FFGs' existing helicopter systems, including sonobuoys and the helicopter data link. The FFGs' Underwater Warfare System will also receive new special processing equipment for torpedo detection and torpedo countermeasures will be upgraded by provision of ship-launched, expendable acoustic decoys. The FFGs' ability to detect sub-surface and surface floating mines is to be upgraded by a combination of ship-mounted electro-optical sensors, visual means and a dedicated Mine and Obstacle Avoidance Sonar.

#### **On-Board Training**

The FFGs are to receive an On-Board Training System integrated with the Combat System and sensors. This system stimulates the ship's sensors and simulates the FFG's weapons and their operational, geographical and climatic environments. It will allow the Command Team to simulate the FFGs' warfare capabilities.

#### **Shore Facilities**

The FFGs' Combat Team Trainer and Operator Trainer facilities located in HMAS *Watson* at South Head, Sydney, will be upgraded, and a Warfare System Support Centre established at Garden Island, Sydney.

#### Life-of-type Extension

HMA Ships *Sydney* and *Darwin* are to receive a Life-of-Type Extension of five years, through hull, mechanical and electrical refurbishments and upgraded diesel generators, air conditioning, and electrical power converters. HMA Ships *Melbourne* and *Newcastle* will also receive the same platform upgrades, but will not have their service life extended.

Source: ANAO, adapted from Defence Materiel Organisation, FFG System Program Office records.

5. SEA 1390 Phase 4B has an approved budget of \$600 million and is to replace the FFGs' SM-1 Area Air Defence missile system with the next generation SM-2 Block IIIA missile system. Unlike Phase 2.1, which has a Prime Contractor responsible for all systems integration tasks, Phase 4B's systems integration is being managed by DMO's FFG System Program Office (FFGSPO) with DMO's Guided Weapons Acquisition Branch responsible for acquiring the SM-2 missiles. Phase 4B's expenditure reached \$85.45 million or 14 per cent of its approved budget by mid June 2007, and it was three to 18 months behind schedule on some milestones by June 2007. Phase 4B is linked to Phase 2.1, and in some respects Phase 2.1 is a precursor to the system integration and software development necessary for the delivery of Phase 4B.

# SEA 1390 Phase 2.1 Prime Contract Arrangements<sup>1</sup>

6. Phase 2.1's Prime Contract (the Contract) was entered into by the parties on 1 June 1999, and it provides for the Prime Contractor to have Total Contract Performance Responsibility. Consistent with that responsibility, the Contract is structured in such a way that the Prime Contractor effectively has sole responsibility for the upgrade of each FFG from the time of each FFG's 'Handover' until the Prime Contractor offers the FFG for Provisional Acceptance by DMO. During that period, the role of the Project Authority (FFGSPO Director) in relation to the technical aspects of the upgrade is generally limited to reviewing and commenting upon activities proposed to be conducted by the contractor.<sup>2</sup>

7. This limited role of the Project Authority relates to the original contract drafters' aim of preventing the contractor's Total Contract Performance Responsibility being diluted by more direct input from the Project Authority. In practice, this has created difficulties for the Project Authority in maintaining a sufficient degree of technical involvement, control and understanding of what is being done by the contractor so as to be satisfied, on an ongoing basis, that the FFGs and software are being upgraded in accordance with the

<sup>&</sup>lt;sup>1</sup> The information provided in this section was drawn from legal advice provided to the DMO in August 2007, in response to an ANAO Discussion Paper.

<sup>&</sup>lt;sup>2</sup> The Prime Contractor advised the ANAO in October 2007 that it relies heavily on constructive feedback from FFGSPO to ensure that what is delivered meets the customer's expectations.

Contract's provisions and so as to meet the Contract requirements and Navy's technical regulations.<sup>3</sup>

8. The Contract required a comprehensive inspection, test and trials programme to be implemented and maintained by the contractor. It was intended that the Project Authority would assess compliance of the supplies with the requirements of the Contract by reference to the results of the tests conducted. The Contract did not deal with the situation where (as occurred) the Project Authority was not satisfied as to the sufficiency of the test procedures proposed by the contractor to produce results that demonstrate compliance.

9. Disagreements between the parties as to the degree of testing required to demonstrate contractual compliance and a lack of design disclosure on the part of the contractor has led to the DMO refusing to approve or agree upon test procedures. Rather than these disputes being resolved through the dispute resolution mechanism provided in the Contract at that time, the contractor elected to proceed (at its own risk) with a test and trial regime outside of the Contract. By mid 2006, this had led to the situation where the upgrade of HMAS *Sydney* was substantially complete, and both parties required return of HMAS *Sydney* to the DMO, but there was a material lack of contractually compliant test data to demonstrate that Contract requirements and Navy technical regulations had been met. Instead, the DMO was being requested by

<sup>&</sup>lt;sup>3</sup> The Prime Contractor advised the ANAO in October 2007 that both parties have experienced great difficulty reconciling the Contract's 'Total Contract Performance Responsibility' provisions with the Project Authority's interest in maintaining a sufficient degree of technical involvement, control and understanding. The contractor advised that the full meaning of both phrases has eluded many working on the project. The Prime Contractor also advised that it is important to note that Navy's Technical Regulations (and other regulatory frameworks) were not in existence at the time of Contract signature in 1999, and despite the Prime Contractor raising concerns over the lack of Technical Regulatory requirements in the contract (Problem Identification Report 143, November 2004 refers), the Project Authority has chosen not to incorporate requirements for Technical Regulation into the Contract. The Prime Contractor believes this has lead to a dichotomy between compliant contract deliverables (form and content) and the requirements of the current Regulators. This in turn has resulted in re-work within the FFGSPO's own organisation to convert or generate regulatory framework compliant products.

the contractor to assess Contract compliance on the basis of the test results derived by the contractor by its testing outside of the Contract provisions.<sup>4</sup>

10. In October 2007 the Prime Contractor advised the ANAO that it had elected to proceed 'at his own risk' because the Project Authority representatives were urging cessation of all activities until 100 per cent compliance was achieved across all aspects of what is a complex and confusing contract. The Prime Contractor further advised that it should be recognised for opting for such an onerous approach as the alternate would not have delivered any capability to the ADF within a reasonable timeframe. It is the Prime Contractor's opinion that its 'pragmatic' proceed at own risk approach, was the only feasible approach in order for the Project to proceed and be completed.

11. The absence of any provisions in the Contract allowing the Project Authority to stop the contractor from proceeding down this route is at the centre of the difficulties now being faced with the return of HMAS *Sydney* to Initial Operational Release.<sup>5</sup> The Contract did not adequately provide for the Project Authority to exercise the necessary degree of control required. The Prime Contractor advised the ANAO in October 2007 that Initial Operational Release was not a concept in existence at the time of contract signature. As stated previously, the lack of alignment of the Phase 2.1 contract with Navy regulatory framework is, in part, one of the difficulties the Project Authority has regarding HMAS *Sydney's* Initial Operational Release.

12. In addition to these difficulties with the acceptance regime under the Contract, DMO was also required to manage the contractor's performance

<sup>&</sup>lt;sup>4</sup> In May 2006 the parties agreed to amend the contract (CCP255) to incorporate an improved test and acceptance process known as the B-TAP process (see paragraph 3.32). The B-TAP process aims to address issues of concern and provide confidence that correct processes had delivered the contracted outcome. This process allows the Project Authority to address issues where it is not satisfied with the sufficiency of test procedures to produce results that demonstrate compliance. The Prime Contractor advised the ANAO in October 2007 that the statement 'material lack of compliant test data' is not borne out by the results recorded thus far from the B-TAP process. The contractor advised that of the Baseline Build 1 requirements offered at Provisional Acceptance, none required additional testing to establish acceptable objective quality evidence for the purpose of establishing the requirement that was satisfactorily demonstrated at some point in the test program. The contractor further advised in October 2007 that the B-TAP process has not yet been completed by the Project Authority for the Baseline Build 1 capability.

<sup>&</sup>lt;sup>5</sup> Initial Operational Release of a Navy capability is the milestone at which Chief of Navy is satisfied that the capability can proceed to the Naval Operational Test and Evaluation period. This is based on the advice from Navy's Fleet and Systems Commanders that the operational and materiel state of the Capability and associated deliverables are sufficiently safe, fit-for-service and environmentally compliant. At this milestone any delivery deficiencies with agreed contractual remedies are appropriately mitigated for the Naval Operational Test and Evaluation period. Initial Operational Release also marks the change in management from the DMO to Navy. Despite this change in ownership, DMO's Project Manager and the Prime Contractor retain respective project management and warranty obligations.

against the Contracted schedule. The contractor took substantially longer than the original schedule, which was re-baselined in April 2004 and May 2006. Again, the Contract did not adequately provide for the Project Authority to exercise control over the contractor's inability to meet the schedule. Other than via milestone payments, the only schedule control mechanisms available are claiming liquidated damages or terminating the Contract. DMO's legal advice was that in the circumstances that have prevailed since major delays on the part of the contractor first became apparent, neither option has really been feasible for the Project Authority.

# **Project delays and recent improvements**

13. Overall, the April 2004 and May 2006 schedule re-baselines have deferred the delivery of all FFGs to be upgraded, with the delivery of the last ship to be upgraded delayed by four and a half years. The Department of Defence advised the Joint Committee of Public Accounts and Audit (JCPAA) in February 2007 that:

The effects of the upgrade delays on capability have been mitigated to an extent by the extension of HMAS *Adelaide* to the end of 2007 (originally planned to decommission in September 2006). Furthermore, some operational tasking that might have been undertaken by FFGs has been transferred to other classes of ship. This has remained manageable, causing minimal overall impact on Navy capability and the Surface Combatant Force Element Group (SCFEG) has met all Directed Level of Capability (DLOC) requirements. Moreover, the commissioning of new ANZAC Frigates *Toowoomba* and *Perth* in late 2005 and 2006 respectively has assisted Navy to manage capability requirements.

These aspects have attracted very careful management attention by Navy and, consequently, the FFG upgrade has not had a significant impact on fleet activity, training and personnel leave management. This close management will continue throughout the Upgrade process.

14. The Commander of Navy's Surface Combatant Force Element Group advised the ANAO in September 2007 that:

HMAS *Sydney* was 'Handed back' to Navy in April 2006. The hand back process allowed Navy to employ the ship in a range of activities. Navy used the ship for specialised training periods, progression of Navy continuation training, familiarisation of personnel with upgraded systems and continuation of contractor Sea Trials which enabled an improved understanding of upgraded capabilities. Of note is the availability of the platform to progress dedicated at sea Marine Technician training, which proved most valuable to

the Capability Manager in managing the critical shortfalls in this personnel category.

The performance of the upgraded systems has varied. The Australian Distributed Architecture Combat System (ADACS) has shown gradual improvement, which culminated in a successful Evolved Sea Sparrow (ESSM) firing in August 2007 with Baseline Build 2 software. This has provided Navy with sufficient confidence in the system to continue with Operational Test and Evaluation trials with further ESSM firings at the Pacific Missile Range Facility near Hawaii in October 2007, subject to authorisation of a Safety Case for the evolution. Navy is confident that ADACS is on track to meet its requirements.

Performance of the C-PEARL Electronic Support System and the Underwater Warfare System has been disappointing. Performance of the Electronic Support System during sea trials has not provided Navy with the confidence that the system will meet operational requirements in the short/medium term. Electronic Support System deficiencies are the most significant barrier to Navy using HMAS *Sydney* in an operational environment. While Underwater Warfare System trial results have been disappointing there are some encouraging aspects. Additional Underwater Warfare System trials are planned using a sophisticated underwater range in Canada. Navy expects that the data gathered from these trials will allow ongoing development leading to an operational system in the medium term.

15. The Prime Contractor advised the ANAO in October 2007 that it has been working collaboratively with the FFGSPO to address the operational performance issues noted during the Initial Operational Release process. It further advised that the underwater trials planned for the Lead Ship in Canada are additional trials that are outside the scope of the contract, and that the development of the Underwater Warfare System is complete. The Prime Contractor also advised that the entire upgraded Underwater Warfare System was deemed functionally compliant within the TI-338 for the delivery of HMAS *Melbourne* at Provisional Acceptance [8 October 2007], and accordingly, all underwater system trials on HMAS *Melbourne* achieved a 'Pass'.

# Audit approach

16. The audit follows on from Audit Report No. 45 2004–05, *Management of Selected Defence Systems Program Offices,* May 2005. That report is being considered by the JCPAA, as part of its current inquiry into Defence Financial Management and Equipment Acquisition at the Department of Defence and DMO.

17. The audit scope was a review of the performance of FFGSPO's management of the FFG Capability Upgrade Project. It focused on the delivery and acceptance of HMAS *Sydney* and the arrangements in place for upgrading the remaining three FFGs. The audit also included an examination of the implementation of the SM-1 Missile Replacement Project and the delays in the FFG Upgrade Project.

# Conclusions

18. The FFG Upgrade Project has experienced extensive delays in meeting the contracted capability upgrade requirements specified in the late 1990s. The number of FFGs to be upgraded has been reduced from six to four, and the scheduled acceptance of the fourth and final ship has been delayed by four and a half years to June 2009. Since the last ANAO audit in 2005, the project delays are attributable to a range of Underwater Warfare System and Electronic Support System performance deficiencies. Considerable risk remains to the delivery of contractually compliant capability to Navy, given the maturity of these systems.<sup>6</sup>

19. The FFG Upgrade Prime Contract is less robust than more recent Defence contracts in terms of providing DMO with adequate opportunity to exercise suitable management authority over the project's acceptance test and evaluation programme. Nevertheless, FFGSPO has monitored the Prime Contractor's performance and provided extensive feedback aimed at achieving improved visibility into the project's engineering development, testing procedures and test results. But the overall result has been long-running design review, test programme and requirements completion verification difficulties.<sup>7</sup>

20. The DMO exercised discretion in Provisionally Accepting HMAS *Sydney* in December 2006 in accordance with the contract as amended by the May 2006 Deed of Settlement and Release.<sup>8</sup> Consequently, at the time of its

<sup>&</sup>lt;sup>6</sup> The Prime Contractor advised the ANAO in October 2007 that considerable work has been undertaken throughout July–October 2007 to demonstrate a contractually compliant Electronic Support System and that independent tests are to be conducted in Hawaii during the Lead Ship deployment to provide comprehensive data noting the complexity of the Electronic Support System test environment.

<sup>&</sup>lt;sup>7</sup> The Prime Contractor advised the ANAO in October 2007 that the complexity of the test programme is acknowledged and it was necessary to introduce a contractual change (B-TAP) to address the inadequacies of the original contract. As a consequence the DMO now has an appropriate vehicle to address previously perceived difficulties within the Verification and Validation process.

<sup>&</sup>lt;sup>8</sup> Achieving Provisional Acceptance does not relieve the Prime Contractor of any obligations in regard to rectifying contractual non-conformance prior to the Acceptance of each Upgraded FFG and the Contract Final Acceptance in December 2009.

Provisional Acceptance in December 2006 HMAS *Sydney* had not achieved important Provisional Acceptance milestone precursors,<sup>9</sup> which are now required to be resolved before the ship's Acceptance in November 2008. As at September 2007, HMAS *Sydney* was experiencing continuing delays in obtaining Initial Operational Release by Navy. This is attributed to limitations in the maturity of Underwater Warfare and Electronic Support Systems and supporting documentation required to satisfy Navy's technical regulations.<sup>10</sup>

21. The DMO is not well placed to exert influence over the Prime Contractor performance at this time due to the nature of the original contract, and the extent of funds already advanced. The project's liquidated damages provisions for delayed delivery are capped at less than one per cent of the contract price, and so are unlikely to provide an effective deterrent measure. The May 2006 Deed released both parties from all legal claims including liquidated damages prior to that date. DMO's election not to exercise its preserved right to seek remedies for the Prime Contractor's inability to achieve Provisional Acceptance of HMAS *Sydney* by 27 August 2005, has resulted in no liquidated damages being claimed by DMO as at September 2007.

22. The FFG Upgrade Project's Earned Value Management System (EVMS), which controlled some 70 per cent of payments, has been subjected to 10 revisions of the project's Contract Master Schedule by the Prime Contractor.<sup>11</sup> The May 2006 Deed required a new Integrated Baseline Review to be undertaken by DMO to validate the most recent Contract Master Schedule change. DMO expects the Integrated Baseline Review to be completed in October 2007. The magnitude of the schedule slippage has led to

<sup>&</sup>lt;sup>9</sup> The precursors include satisfactory completion of Combat System Stress Test, training courses for ship's company completed, and Category 5 testing [Sea Acceptance Trials] successfully completed. Also, HMAS *Sydney*'s Combat System Baseline Build 1 was experiencing 16 High, 102 Medium and 218 Low Severity System Integration Problem Reports. The Contract's Provisional Acceptance criteria, detailed in Attachment AG is zero High Severity, 25 Medium and 685 Low Severity Problem Reports. See Tables 4.2 and 4.3 for Problem Report criteria and severity definitions. The number of Medium and Low Severity Problem Reports stated in paragraph 101 of Attachment AG are the maximum unless otherwise agreed with the Project Authority. This clause was exercised in the Provisional Acceptance process. As such, the Contractor complied with the Contract as stipulated at Attachment AG and agreed by the Project Authority.

<sup>&</sup>lt;sup>10</sup> The Prime Contractor advised the ANAO in October 2007 that the discretion exercised by the FFGSPO in accepting Provisional Acceptance of the Lead and First Follow On FFGs was within the specifications of the contract. The Prime Contractor further advised that it would welcome the opportunity to present the objective quality evidence that supports a higher level of maturity of the systems delivered, including the Underwater Warfare System and Electronic Support System, than has been credited in the report.

<sup>&</sup>lt;sup>11</sup> The Prime Contractor's Contract Master Schedule is an important component of the Earned Value Management System. It establishes the FFG Upgrade Project's key dates and hence is required to be completely compatible with and traceable to the Contract's Milestone Schedule, and be meaningful in terms of the Contract's technical requirements and key activities.

DMO experiencing difficulty in determining if earned value payments were accurately tracking work performed on the project. By October 2006, the Prime Contractor had received earned value payments that exceeded actual value earned by \$24 million. DMO progressively recovered these overpayments.

23. There are relatively small milestone payments remaining for the major capability deliveries ahead in the project. The milestone payments for the Acceptance of all four FFGs and the Acceptance of FFG Upgrade Software total \$11 million (February 1998 prices). This is 1.1 per cent of the Prime Contract price. The milestone payment due at Contract Final Acceptance in December 2009 is \$3.36 million (February 1998 prices), which is 0.34 per cent of the Prime Contract price.

24. This audit highlights some of the challenges Defence faces in acquiring advanced capabilities for the Australian Defence Force (ADF). DMO relies on industry to deliver Defence's major capital equipment acquisition programme outcomes. If industry and DMO fail to deliver the specified capability to schedule, then invariably the ADF experiences delays in achieving the anticipated capability. In the FFG Upgrade Project's case, there is a four and a half year delay in the delivery of the final upgraded ship and an over five year delay in the delivery of the upgraded Combat Team Training facility. Project delays also result in DMO, the ADF and DMO's Technical Support Agencies carrying additional costs associated with maintaining and supporting DMO's project teams for longer, and at greater skill levels, than originally anticipated.<sup>12</sup>

25. Another challenge highlighted by this audit is the need for DMO to establish contractual frameworks that encourage and require contractor performance through appropriate contractual performance management and progress payment regimes. In the case of the FFG Upgrade Project, the contract did not provide DMO with sufficient contractual leverage over the contractor, in terms of approval rights over the project's test and evaluation programme, nor did its liquidated damage provisions effectively discourage variations to contracted delivery schedules. The FFG Upgrade Project demonstrates that once major Defence capital equipment contracts are entered into, the prospects for DMO overcoming inadequate provisions are fairly limited. Since the FFG

<sup>&</sup>lt;sup>12</sup> The Prime Contractor advised the ANAO in October 2007 that the reference to the DMO requiring 'greater skill levels than originally anticipated' is a reflection of the fact that the complexity of the contract was not well understood at the outset. This was exacerbated by the necessity to expend additional effort to comply with operational, technical and training regulatory frameworks introduced after contract signature.

Upgrade Prime Contract was signed in June 1999, DMO has taken steps to achieve better contract provisions for test and evaluation and requirements verification.<sup>13</sup>

# Key findings by chapter

## Payments and schedule progress (Chapter 2)

26. The FFG Upgrade Prime contract specifies that the contract price shall be payable progressively by earned value method payments and by milestone payments. The earned value method requires the Prime Contractor to use a DMO certified EVMS, which was achieved in November 2001, that is capable of objectively measuring how much work has been accomplished on the project. By July 2007, the EVMS was reporting the project as actually costing some \$39 million more than the budgeted cost of work scheduled to be completed at that time. This cost overrun does not flow on to Defence because the FFG Upgrade Prime Contract is a variable priced contract, which allows only for price variations based on agreed price variation formula and indices for labour, material and foreign currencies.

27. From the April 2004 Deed to the May 2006 Deed, the Upgrade Project experienced an average schedule extension of 22 months for each ship and this represents an in-year schedule slippage of 85 per cent. Overall, the schedule extensions have delayed the delivery of the last ship to be upgraded by four and a half years. The ANAO has calculated that as a result of schedule extensions the availability of Upgraded FFGs for Navy tasking has been reduced by an average of 20 per cent, assuming the Contract Master Schedule of mid 2006 is maintained. This Contract Master Schedule had not been verified by DMO through an Integrated Baseline Review, as at September 2007.

28. SEA 1390 Phase 4B SM-1 Missile Replacement Project has also experienced schedule slippage. As at September 2007, the slippages ranged from three to 18 months for a number of key project milestones. DMO is not predicting schedule slippage for future Phase 4B milestones.<sup>14</sup>

<sup>&</sup>lt;sup>13</sup> Verification is defined as the process of determining whether or not the products of a given development phase fulfil the requirements established during the previous phase. Verification confirms that the products properly reflect the requirements specified for them.

<sup>&</sup>lt;sup>14</sup> The Prime Contractor advised the ANAO in October 2007 that the success of Phase 4B is predominantly due to the exposure and experience derived by the engaged US Vendors that were also responsible for key elements of the systems delivered in Phase 2.1.

# Upgraded capability development (Chapter 3)

29. The FFG Upgrade contract for Phase 2.1 assigns Total Contract Performance Responsibility to the Prime Contractor, thus making the Prime Contractor solely responsible for all design and construction aspects of the project, from contract signature until each upgraded FFG and all associated project elements are finally accepted by Defence. Consistent with that responsibility, the contract generally limits FFGSPO's engineering role to reviewing, commenting or, in limited instances, agreeing to the Prime Contractor' activities. It is only at Provisional Acceptance, Acceptance and Contract Final Acceptance that the FFGSPO may reject delivery of the contracted supplies.

30. Audit evidence shows FFGSPO monitored the Prime Contractor's performance and provided extensive feedback to the Prime Contractor which generally sought improvements and visibility into the project's engineering development and testing procedures and results. The feedback was aimed at allowing the SPO to gain an adequate level of confidence that the upgrade contract's function and performance requirements would be met. FFGSPO was assisted with advice from Defence resources including Defence Science and Technology Organisation, Navy personnel from HMAS *Sydney*, the Royal Australian Navy's Test, Evaluation and Analysis Authority, and the Royal Australian Navy's Ranges Assessing Unit.

31. Despite the efforts made, FFGSPO was only able to verify that less than half (591) of the 1221 Baseline Build 1 requirements had satisfied the contracted function and performance specifications by August 2007.<sup>15</sup> At that time, FFGSPO referred 285 requirements back to the Prime Contractor with requests for additional information. The Prime Contractor had not offered 217 requirements to FFGSPO for acceptance, given that the contractor had elected to utilise the Prime Contract's provisions for multiple Baseline Builds of software (see Appendix 1).

32. The FFGSPO through Configuration Control Audits and Logistics Documentation Reviews identified that the information needed to operate, maintain and support the upgraded equipment is available from the Prime Contractor. However, FFGSPO records of August 2007 show the Prime Contractor had not delivered all final editions of the Ship Selected Records and

<sup>&</sup>lt;sup>15</sup> Baseline Build 1 includes the upgrade of the Combat System Sensors, the Combat Data System and the Missile Fire Control System.

Systems Manuals, which need to be aligned with Navy's equipment operator and maintainer requirements.

## HMAS Sydney's Provisional Acceptance (Chapter 4)

33. HMAS *Sydney's* Initial Operational Release was rescheduled to occur in May 2007, however, this has not been achieved by October 2007. An FFG Upgrade Board of Review, jointly headed by DMO's Head Maritime Systems Division and Navy's Fleet Commander, was reviewing the situation at the time of this report's completion.

34. The FFGSPO is required by Navy Regulations to produce a Safety Case for the FFG Upgrade, that demonstrates due diligence has been given to the Occupational Health and Safety implications of the introduction into service of new equipment and systems. Navy Systems Command reviewed HMAS *Sydney's* Safety Case revisions of November 2006 and April 2007, and could not endorse them due to concerns regarding software development, safety management, Integrated Logistics Support and Hazard Management. The Prime Contractor advised the ANAO in October 2007 that it has not been advised of the reasons for 'rejection' of the FFGSPO TI-338. Therefore it is not aware of any deficiency related to a non-conformance on its part.

35. FFGSPO is also required to produce a Report of Materiel and Equipment Performance State (TI-338) for each upgraded FFG. Navy Systems Command reviewed HMAS *Sydney's* TI-338 revisions of February 2007 and April 2007, and raised concerns regarding the large number of function and performance requirements not conforming to the Contract.

# Recommendations

36. The ANAO made three recommendations. The first recommendation aims to achieve improved performance in the Information Technology system used by FFGSPO. The second recommendation seeks improvements in the FFG Upgrade Project's software development progress measurements. This recommendation aligns with the Project's need to ultimately measure software system development progress in terms of contractual requirements completion. The final recommendation is for DMO to assist FFGSPO by providing the SPO with additional requirements verification and validation expertise. The aim would be to assist FFGSPO expedite the resolution of the FFG Upgrade Project's increasingly complex requirements verification and associated systems engineering issues.

# Agency response

37. The Department of Defence provided a response to this report on behalf of the DMO and Defence. Defence agreed to the recommendations and provided the following overall comment (see Appendix 4):

Defence and DMO notes that the report provides an in depth assessment of the key events that have occurred over the life of the project, particularly since the 2005 ANAO Report Audit Report No.45 2004–05, *Management of Selected Defence System Program Offices*.

The Guided Missile Frigate (FFG) Capability Upgrade is a highly technical project which involves the development and integration of complex systems (for example; combat system software scope and size exceeds two million source lines of code, notwithstanding the fact that electronic system hardware development and integration is occurring in conjunction with software development). By working collaboratively with the contractor, DMO continues to observe numerous improvements that are enabling the project to progress in an effective manner in efforts to realise delivery of the full upgraded FFG capability. These include increased production efficiencies and detailed risk assessments stemming from lessons learned from HMAS *Sydney*, and improvements in test and engineering review processes. These improvements also contribute to greater schedule certainty for the remainder of the upgrade program between now and delivery of the final FFG in 2009.

Underpinning the DMO's confidence in this project was HMAS *Sydney* successfully conducting the First-of-Class firing of the Evolved Sea Sparrow Missile (ESSM) against an unmanned airborne target on 20 August 2007. The outcome provides additional confidence in the Australian Distributed Architecture Combat System (ADACS) software used to support this First-of-Class firing of the ESSM from the newly installed Vertical Launch System (VLS).

Since 1999 when the Prime Contract was awarded the DMO has implemented numerous procurement reform initiatives. Since the formation of DMO in 2000, the suite of ASDEFCON contracting templates have continually evolved and now provide the DMO with much improved requirements verification safeguards, previously lacking under the previous DEFPUR suite of templates. Further procurement reforms initiated under Kinnaird have strengthened the two pass system, which requires Defence to expend a greater proportion of it project budget in pre-acquisition planning activities, including more rigorous requirements development processes.

Capability delays are also being effectively mitigated to minimise impact on fleet activities, including; extension of HMAS *Adelaide*, transfer of some operational tasking to other classes of ship and commissioning of ANZAC Frigates *Toowoomba* and *Perth*.

# Recommendations

Set out below are the ANAO's recommendations, with report paragraph references and an indication of the Defence and DMO response. The recommendations are discussed at the relevant part of this report.

| Recommendation<br>No.1 | The   | ANAO       | recommends      | that    | Defence's     | Chief   |
|------------------------|---|------------|-----------------|---------|---------------|---------|
|                        | Information Officer Group reviews the performance of        |            |                 |         |               |         |
| Paragraph 1.33         | the E   | Defence Re | estricted Netwo | rk at G | Garden Island | d, with |
|                        | the aim of ensuring satisfactory service delivery to users. |            |                 |         |               |         |

Defence and DMO response: Agreed.

**Recommendation** The ANAO recommends that Defence Materiel No.2 Organisation report regularly software system Paragraph 3.13 development contractual progress in terms of requirements completion.

Defence and DMO response: Agreed.

Recommendation<br/>No.3The ANAO recommends that Defence Materiel<br/>Organisation consider the cost and benefits of engaging<br/>additional resources to assist FFG Upgrade Project's<br/>requirements verification programme.

Defence and DMO response: Agreed.

# Audit Findings and Conclusions

# 1. Introduction

This chapter provides an overview of the Australian Defence Force's Guided Missile Frigate fleet, it outlines the fleet's capability upgrade and sets out the audit's scope and objectives.

# Background

1.1 The Defence Materiel Organisation's (DMO's) management of the \$2.097 billion SEA 1390 Programme aims to ensure the Royal Australian Navy's Guided Missile Frigates (FFGs) remain effective and supportable until their planned withdrawal from service between 2015 and 2021. The FFGs, listed in Table 1.1, constitute the Australian Defence Force's primary maritime surface combat force.

### Table 1.1

| FFG and side<br>number    | Launched          | Commissioned  | Original<br>Life | Upgraded Life                                      |
|---------------------------|-------------------|---------------|------------------|--|
| HMAS <i>Adelaide</i> – 01 | June 1978         | November 1980 | 2008             | To be withdrawn<br>from service in<br>January 2008 |
| HMAS Canberra – 02        | December<br>1978  | March 1981    | 2008             | Withdrawn from<br>service in<br>November 2005      |
| HMAS Sydney – 03          | September<br>1980 | January 1983  | 2010             | 2015   |
| HMAS Darwin -04           | March 1982        | July 1984     | 2012             | 2017   |
| HMAS Melbourne – 05       | May 1989          | February 1992 | 2019             | 2019   |
| HMAS Newcastle - 06       | February<br>1992  | December 1993 | 2021             | 2021   |

### The Royal Australian Navy's FFG Fleet.

Source: Defence Materiel Organisation, FFG System Program Office.

1.2 Phase 2.1 of SEA 1390, known more widely as the FFG Upgrade Project, commenced a two-year \$13.5 million (December 1995 prices) Project Definition Study in 1994. The Request for Tender of Phase 2 was issued in November 1997 and closed in March 1998. The Request for Tender was based on the then Defence Acquisition Organisation's standard contract template known as DEFPUR 101 series. It was developed by the Project Office with assistance from the Defence Acquisition Organisation's contracts organisation, with external legal support. The then Australian Defence Industries (ADI) was

selected as preferred tenderer for Phase 2 in November 1998. Contract clarification discussions commenced immediately and formal negotiations began in March 1999. The FFG Upgrade Prime Contract was signed by ADI Limited in June 1999, and ADI commenced trading as Thales Australia in October 2006.<sup>16</sup> Both ADI and Thales Australia are referred to as the Prime Contractor in this report.

- 1.3 SEA 1390 is divided into four approved phases:
- SEA 1390 Phase 1 Project Definition Study, which provided Defence with upgrade options and documentation needed to initiate the project's implementation phase;
- (b) SEA 1390 Phase 2.1 FFG Upgrade Implementation. This phase commenced in June 1999 at a cost of \$1.266 billion (February 1998 prices). That amount consists of the Prime Contract price of \$944 million and \$322 million for work conducted outside the Prime Contract. As at July 2007, Phase 2.1's overall approved budget has increased by \$191 million as a result of annual labour and materials price indexation and by a further \$194 million as a result of foreign exchange adjustments.<sup>17</sup> Phase 2.1's cost was reduced by \$153 million in November 1998 as a result of a project scope reduction involving the purchase of the FFG's Evolved Sea Sparrow Missiles through another DMO project. This brings Phase 2.1's cost to \$1.497 billion (July 2007 prices). DMO has agreed to a series of schedule changes, which has resulted to Phase 2.1's Prime Contract Final Acceptance originally scheduled for September 2006 being extended to 31 December 2009;
- (C) SEA 1390 Phase 3 Standard Missile-1 (SM-1) Replacement Integration Study; and
- SEA 1390 Phase 4B SM-1 Replacement Project is to replace the FFGs' SM-1 missile system, with the next generation SM-2 surface-to-air Block IIIA 'standard' missile system. This phase commenced in July 2004 at an approved cost of \$553 million (December 2004 prices). Since then its

<sup>&</sup>lt;sup>16</sup> The Prime Contractor advised the ANAO in October 2007 that on contract signature the parties had not agreed to the contract specifications and associated verification methods, and also ADI Limited was sold shortly after the contract was signed.

<sup>&</sup>lt;sup>17</sup> Phase 2.1's approved budget varies in line with the cost of labour, materials and foreign currency. This is a result of the FFG Upgrade Prime Contract being variable priced contract, which allows for variations in the cost of labour and material and variations in foreign exchange rates, in accordance with agreed price variation formula and indices. Variable price contracts are normally used where there is an expectation that contract costs will vary due to factors beyond the reasonable control and responsibility of the supplier. Reference, Department of Defence, *Defence Procurement Policy Manual*, Version 6.0, 2006.

approved cost has increased to \$600 million as a result of annual labour and materials price indexation of \$68 million, a price reduction of \$19 million resulting from foreign exchange adjustments, and a \$2 million real cost decrease. Unlike Phase 2.1, which has a Prime Contractor responsible for all systems integration tasks, Phase 4B's system integration is being managed by DMO's FFG System Program Office (FFGSPO) with DMO's Guided Weapons Acquisition Branch responsible for acquiring the SM-2 missiles.

1.4 Figure 1.1 and Appendix 1 outline the FFG's upgraded combat system elements.

## Figure 1.1

## FFG Upgrade Project, Combat System aspects.



Source: Defence Materiel Organisation, FFG System Program Office.

1.5 In 2003 the Defence Capability Review recommended that the two oldest FFGs should be retired from service and that only four FFGs should be upgraded. The Government agreed to that recommendation and a global settlement resulting in a Deed of Settlement and Release between the DMO and the Prime Contractor was signed on 29 May 2006. This Deed included an

indemnity as a consequence of the scope reduction and prolongation costs associated with hull weld repairs to the first FFG to be upgraded (HMAS *Sydney*). It also changed the Project's Contract Master Schedule and milestones to take into account the need to no longer install two sets of FFG Upgrade equipment.<sup>18</sup> The FFGs' Provisional Acceptance arrangements were also changed through amendments to Acceptance Test processes that reflected the need for a more practical approach to Provisional Acceptance, in response to the Prime Contractor's decision to develop the FFG's upgraded capability using three software Baseline Builds (see Appendix 1). The Deed's net financial impact was a \$54.4 million (2006 prices) net reduction in the Prime Contract price.

# **Project maturity and risks**

1.6 The SEA 1390 Combat System Upgrade falls broadly into the following technical maturity and risk ranges:

- modifications to original FFG equipment, such as the installation of modification kits into the Mark 92 Fire Control System and the AN/SPS 49 Radar. These modifications involve military off-the-shelf modification kits, which have a level of technical maturity that present the project with relatively low risks;
- installation of standard US Navy equipment, such as the Mark 41 Vertical Launch System, AN/UYQ-70 combat system operator consoles, Radar Data Distribution System, and the Link-16 data communications system. These systems present the project with mid-ranging risks; and
- development and integration of new systems such as the Australian Distributed Architecture Combat System (ADACS), the Underwater Warfare System, and the Electronic Support System. These systems have thus far proven to present most risks to the project's success.

1.7 The ADACS development and integration into the remaining combat system elements depends heavily on computing system technology. The risks associated with that task relate to the combat system software's scope and size

<sup>&</sup>lt;sup>18</sup> The ship sets five and six equipment remain as contractual deliverables and it is likely that this equipment will now be used for a variety of applications. These include provision of in-country training for both operators and maintainers at Garden Island and HMAS *Stirling*, which in some cases will replace training previously provided in the USA; risk reduction activities for the FFG SM-1 replacement project for system development and test activities; additional integration and support assets at the FFG Upgrade Warfare Systems Support Centre in Garden Island, Sydney; and major support spares for the four upgraded FFGs.

exceeding two million source lines of code, and to electronic system hardware development occurring in conjunction with software development.

1.8 DMO has implemented a standardised project maturity assessment process, which aims to quantify the relative maturity of a project against a set of benchmarks at 13 milestones that extend from the project's initial entry into the Defence Capability Plan to the project's delivery of fully operational mission and support systems. The maturity assessments cover seven capability definition attributes and seven capability delivery attributes. The attributes are assigned a score between one, signalling low maturity, to 10, indicating extensive knowledge and demonstrated performance.<sup>19</sup> The maturity score provides, at a glance, an indication of where a project is in its lifecycle compared against a set of benchmarks of where it should ideally be. For example: projects at Second Pass Approval generally have a score between 68 and 70 out of 70.

1.9 Figure 1.2 shows the FFG Upgrade Project's Phase 2.1 and Phase 4B's Maturity Scores relative to Benchmark scores for a project progressing with acceptable risks from capability definition (13) to project completion (70).

<sup>&</sup>lt;sup>19</sup> The attributes include cost, schedule, requirements achievement, technical understanding, technical difficulty, commercial performance, and mission and support system delivery.

## Figure 1.2



FFG Upgrade Project Maturity Score, February and April 2007.

Source: ANAO, based on DMO Acquisition Overview Reports.

1.10 FFGSPO in April 2007 assessed Phase 4B as having a maturity score of 42, indicating it had matured to a stage acceptable for entry into capability delivery contracts. By June 2007 FFGSPO had entered FMS arrangements with the United States Department of Defense for the supply of SM-2 missiles and associated support, and had entered Contract Development Agreements with Original Equipment Manufacturers of the remaining Phase 4B elements.

1.11 FFGSPO assessed Phase 2.1 as having a maturity score of 44 in February 2007, which at that time HMAS *Sydney* had been granted Provisional Acceptance.<sup>20</sup> This score is 23 points below the benchmark maturity score of 67, which DMO considers as the maturity score benchmark for acceptance into

<sup>&</sup>lt;sup>20</sup> Provisional Acceptance means the certification by the Project Authority that the Contractor has fulfilled its contractual obligations in respect of any upgraded FFGs or upgraded facilities listed on a Supplies Release Note (SG8), subject to any omissions or defects listed on that SG8, and that those upgraded FFGs or upgraded facilities conform with the requirements of the Contract, and Provisional Acceptance is subject to Acceptance and Final Acceptance. Provisional Acceptance is signified by the Project Authority signing an SG8.

service for all four FFGs in the upgrade programme.<sup>21</sup> Tables 1.2 and 1.3 outline Defence's reported progress with Phase 2.1 and Phase 4B as at May 2007.

#### Table 1.2

Defence Portfolio Budget Statements 2007–08, SEA 1390 Phase 2.1.

#### SEA 1390 Ph 2.1 — Guided Missile Frigates (FFG) Upgrade–Implementation

Prime Contractor: ADI Ltd trading as Thales Australia.

The project is upgrading ship combat systems including sensors, missile launchers and associated platforms systems for the Adelaide-class Guided Missile Frigates.

There are known deficiencies with the underwater warfare system, electronic support system and Australian Distributed Architecture Combat System software. Under the provisions of the contract, work by the prime contractor is to continue to rectify deficiencies before HMAS *Sydney's* acceptance, which is scheduled for late 2008. HMAS *Sydney's* Initial Operational Release is due in mid-2007. HMAS *Melbourne* is planned for provisional acceptance in late 2007. HMAS *Darwin* is to complete the upgrade docking in mid-2007. HMAS *Newcastle* is scheduled to enter the upgrade docking in late 2007.

A major risk to this project is non-adherence to the approved schedule. A renegotiated contract and schedule provide a better, common understanding and milestone measurement of the deliverables as risk mitigation. Risks related to production, system integration and test and trials activities are deeply influenced by the availability of experienced, competent and skilled personnel in a limited and very competitive Australian commercial market. The risk to veracity and completeness of the integrated materiel support products is addressed by monitoring the progress of functional deliverables.

This project contributes to Navy capability.

Source: Portfolio Budget Statements 2007–08, Defence Portfolio, Budget Related Paper No.1.4A and 1.4C, 2 May 2007, pp.276, 277.

<sup>&</sup>lt;sup>21</sup> The Prime Contractor advised the ANAO in October 2007 that it considers there is insufficient justification for this apparent lack of maturity rating, given the completion of the Critical Design Review (see paragraph 3.8) and significant system integration testing such as the recent successful Evolved Sea Sparrow Missile firings (see paragraph 14).

#### Table 1.3

#### Defence Portfolio Budget Statements 2007–08, SEA 1390 Phase 4B.

#### SEA 1390 Ph 4B — Standard Missile-1 (SM-1) Replacement

Prime Contractor: The DMO is the procurement coordinator and is supported by the United States Department of Defense under a FMS case and a range of commercial contractors.

This project is to replace the SM-1 missile with a modern variant of the same missile system (SM-2) and improve the air defence capability of the Guided Missile Frigate fleet, adding to the capability delivered by the FFG Upgrade Project.

A mix of United States commercial and FMS cases will deliver equipment hardware, software development, integration, equipment installation and system testing. Development work required for the guided missile launching system, onboard training and land-based simulation systems and the fire control system will be delivered by commercial contracts which will deliver the preliminary design materials with cost and schedule data for their respective planned procurements that follow. The contract for the guided missile launching system is due for award in late 2007.

The system critical design review of other components is due in late 2007.

The risk to guaranteed interoperability of the systems, equipment and logistic support is mitigated by a combination of FMS acquisition cases and direct contracts with original equipment manufacturers. This combination will cover ship modifications, system hardware alterations and support equipment and will reduce the risk of access and availability of proprietary information and intellectual property necessary for system integration and the related technology. System development schedule risks are mitigated by the engagement of the United States government and experienced system integration agents for the major subsystems and subsequent overall system integration and test and trial.

This project contributes to Navy capability.

Source: Portfolio Budget Statements 2007–08, Defence Portfolio, Budget Related Paper No.1.4A and 1.4C, 2 May 2007, p.277.

## Project expenditure and delivery schedule

#### Phase 2.1

1.12 The Project's Phase 2.1 cumulative expenditure reached \$1.064 billion in June 2007. Of that amount, \$1.005 billion was for Prime Contract payments comprising \$773 million in Earned Value payments, \$229 million for milestone payments, and \$3.3 million in Performance Incentive Fee payments. The total remaining Prime Contract budget was \$208.4 million as at mid June 2007.<sup>22</sup> On that basis 83 per cent of the Prime Contract Budget has been spent. Table 1.4 sets out the Prime Contract and other expenditure outside the Prime Contract.

<sup>&</sup>lt;sup>22</sup> In contract base date terms, this equates to \$138.9 million (February 1998 prices).
#### Table 1.4

| FFG  | Upgrade | Payments, | Prime | Contract | and | other | project | elements, | to |
|------|---------|-----------|-------|----------|-----|-------|---------|-----------|----|
| June | 2007.   |           |       |          |     |       |         |           |    |

| Year    | Prime<br>Contract<br>(\$m) | Spares and<br>Government<br>Furnished Materiel<br>(\$m) | Test<br>and<br>Trials<br>(\$m) | Project<br>Management<br>(\$m) | Configuration<br>Management<br>and Other<br>(\$m) | Total<br>(\$m) |
|---------|----------------------------|---|--------------------------------|--------------------------------|---|----------------|
| 1997/98 | 0.00                       | 0.00  | 0.00                           | 0.19                           | 0.00  | 0.19           |
| 1998/99 | 126.75                     | 0.33  | 0.00                           | 1.52                           | 0.00  | 128.60         |
| 1999/00 | 104.45                     | 0.62  | 0.00                           | 1.78                           | 0.05  | 106.9          |
| 2000/01 | 201.62                     | 7.86  | 0.00                           | 1.75                           | 0.09  | 211.32         |
| 2001/02 | 209.26                     | 5.34  | 0.00                           | 3.10                           | 0.00  | 217.7          |
| 2002/03 | 130.82                     | 10.80   | 0.00                           | 2.54                           | 0.00  | 144.16         |
| 2003/04 | 93.27                      | 4.92  | 0.00                           | 3.44                           | 0.01  | 101.64         |
| 2004/05 | 48.85                      | 3.03  | 0.00                           | 2.19                           | 0.01  | 54.08          |
| 2005/06 | 50.72                      | 2.45  | 0.11                           | 2.87                           | 0.01  | 56.16          |
| 2006/07 | 39.25                      | 0.26  | 0.02                           | 3.23                           | 0.60  | 43.36          |
| Total   | 1 004.99                   | 35.61   | 0.13                           | 22.61                          | 0.77  | 1 064.11       |

Source: Defence Materiel Organisation, FFG System Program Office.

1.13 Phase 2.1's Contingency Budget has been reduced by \$34.15 million, this amount is comprised of:

- \$21.81 million, which was Defence's contribution to the relief sought by the Prime Contractor in 2004. Defence's contribution was for delays associated with the provision of technical specifications and government furnished information and removal of zinc chromate paint from HMAS Sydney;
- \$1.22 million aid to the Prime Contractor in 2004 to compensate for a 35 day delay in preparing the land-based test site facility; and
- \$11.14 million when the Deed of Settlement and Release was signed on 29 May 2006. This amount was part of an adjustment to the Contract Price as a consequence of the overall global settlement pursuant to the Deed and related to delays attributed to welding repairs to HMAS *Sydney's* hull-doubler plates.

1.14 The May 2006 Deed formalised the Government's November 2003 decision to reduce the FFG Upgrade Project from six to four ships. It also settled a number of outstanding commercial and contractual issues, and agreed to a revised Contract Master Schedule with a Contract Final Acceptance

of 31 December 2009.<sup>23</sup> This in effect lengthened the FFG Upgrade Project's delivery schedule for selected products by between 18 and 27 months.

1.15 Navy has supported HMAS *Sydney* through a series of sea trials from mid 2005, in order to progress the Contractor's Category 5 Sea Acceptance Trials (see Appendix 2 for test and trials descriptions). The results of these trials are used by Navy to assess the capability in support of an Initial Operational Release recommendation.<sup>24</sup> The Prime Contractor handed HMAS *Sydney* back to DMO for use by Navy on 28 April 2006, pending contractual Provisional Acceptance which occurred on 15 December 2006. The Project's most recent plans had HMAS *Sydney's* Initial Operational Release scheduled for May 2007. As at October 2007, the Chief of Navy had not granted HMAS *Sydney* Initial Operational Release.

1.16 The second FFG to be upgraded, HMAS *Melbourne*, commenced contractor sea trials in March 2007 and it was Provisionally Accepted on 8 October 2007.

1.17 The third FFG to be upgraded, HMAS *Darwin*, commenced its upgrade in early January 2007, and is expected to commence contractor sea trials in early 2008. HMAS *Newcastle*, the final ship for upgrade is scheduled to commence the docking component of its upgrade in October 2007.

#### Phase 4B

1.18 The *Defence Procurement Review 2003* (the Kinnaird Review), recommended the use of an improved two-pass approval process for new major equipment acquisitions.<sup>25</sup> Pending the full implementation of this two-pass process, Government agreed in March 2004 that the consideration of projects contained within the Defence Capability Plan 2004–14 could constitute first-pass approval for those projects. Phase 4B was included in the November

<sup>&</sup>lt;sup>23</sup> This had implications for the EVMS in that it resulted in an overpayment situation amounting to \$14.9 million (February 1999 prices), which was from May 2006 amortised over 18 months at a rate of \$0.877 million per month.

<sup>&</sup>lt;sup>24</sup> Initial Operational Release of a Navy capability is the milestone at which Chief of Navy is satisfied that the capability can proceed to the Naval Operational Test and Evaluation period. This is based on the advice from Navy's Fleet and Systems Commanders that the operational and materiel state of the Capability and associated deliverables are sufficiently safe, fit-for-service and environmentally compliant. At this milestone any delivery deficiencies with agreed contractual remedies are appropriately mitigated for the Naval Operational Test and Evaluation period. Initial Operational Release also marks the change in management from the DMO to Navy. Despite this change in ownership, DMO's Project Manager and the Prime Contractor retain respective project management and warranty obligations.

<sup>&</sup>lt;sup>25</sup> First and second-pass approvals form the basis of formal Government endorsement to proceed with projects, to an approved scope, timeframe and budget.

2003 Defence Capability Plan and therefore received first-pass approval as part of that process.<sup>26</sup> It received second-pass approval and proceeded to acquisition phase in July 2004 and it is scheduled for completion in August 2010.

1.19 FFGSPO is using two procurement methods to acquire the SM-2 capability namely: FMS arrangements with the United States Department of Defense,<sup>27</sup> and direct commercial sales. FMS arrangements will be used to:

- acquire the SM-2 missiles and support equipment;
- replace the gyro-compass and Inertial Navigation System; and
- procure all software development, testing and integration services required to integrate the SM-2 capability into the FFG Weapons Control System.

1.20 DMO intends to use direct commercial sales contracts to modify the ships' existing equipment, to make platform alterations, and to acquire associated support equipment. For much of this work DMO intends to engage, on a sole source basis, the Original Equipment Manufacturers of the equipment or systems to be modified.

1.21 In June 2007, Phase 4B's cumulative expenditure had reached \$85.45 million, against its approved cost of \$600 million (July 2007 prices).

# **FFG System Program Office**

1.22 The FFGSPO forms part of DMO's Maritime Systems Division. FFGSPO is responsible for ensuring that FFG capability is acquired and sustained in accordance with the FFG Materiel Acquisition Agreement between Defence and DMO and the FFG Materiel Sustainment Agreement between DMO and Navy. FFGSPO is located adjacent to Navy's Surface Combatant Force Element Group headquarters at Garden Island, Sydney.

1.23 FFGSPO's primary responsibility is to make available to Navy the number of FFGs specified within the Materiel Sustainability Agreements between DMO and Navy, and to increase the FFGs' capability in line with approved programmes specified within FFG Materiel Acquisition Agreements

<sup>&</sup>lt;sup>26</sup> Defence Capability Plan 2004–2014, November 2003, p. 144

<sup>&</sup>lt;sup>27</sup> The US FMS program provides a process though which eligible foreign governments and international organisations may purchase defence articles and services from the US Government. Such sales are subject to the provisions of the US Arms Export Control Act and are administered by the US Department of Defense.

between Defence's Capability Development Executive and DMO. In carrying out that responsibility FFGSPO is required to implement management policies and procedures that meet DMO and Navy requirements.

#### **Technical integrity management**

1.24 In June 2002, the then Secretary of Defence and the then Chief of the Defence Force jointly issued an instruction that established the ADF's Technical Regulatory Framework (TRF).<sup>28</sup> In accordance with that instruction, Navy developed a technical regulatory framework to meet its specific requirements.<sup>29</sup> Navy's TRF requires Defence organisations that undertake or accept designs, construction and or maintenance of ADF maritime materiel, to be authorised to perform their tasks through Authorised Engineering Organisation (AEO) certification. Once these organisations achieve AEO certification they are subject to recurrent appraisals to determine the degree of compliance of the AEO engineering systems and processes within Navy's technical regulatory system and to determine the degree of technical risk associated with the continuation of the full AEO status. These requirements were not flowed into the FFG Upgrade Contract by DMO.

1.25 FFGSPO's engineering systems and processes were reviewed by the Director Technical Regulation – Navy in 2003. This resulted in the FFGSPO being awarded Provisional AEO status in November 2003. Subsequent appraisals led to the FFGSPO being awarded full AEO status in August 2005, and this status was reaffirmed in March 2007.<sup>30</sup>

1.26 DMO conducted an internal review of Phase 4B in January 2007. This review identified a series of project management risks, stemming from FFGSPO lacking a range of project management plans required to supplement Phase 4B's Acquisition Strategy. In response to that finding, DMO assigned a project management coach to FFGSPO to assist the SPO to develop the

<sup>&</sup>lt;sup>28</sup> The instruction aims to standardise and integrate, at an overarching policy level, each Service's responsibility to ensure that ADF materiel is fit for service, and poses no hazard to personnel, public safety, or the environment. Defence Instruction (General) 08–15 *Regulation of technical integrity of Australian Defence Force materiel.* 

<sup>&</sup>lt;sup>29</sup> The Navy TRF is documented in Defence Instruction (Navy) 47–3 Regulation of technical integrity of Australian Defence Force maritime materiel and Australian Book of Reference 6492 Navy Technical Regulations Manual.

<sup>&</sup>lt;sup>30</sup> FFGSPO advised the ANAO that when the FFG Upgrade Contract was signed in June 1999 there was no requirement within Navy for Authorised Engineering Organisation status and that this requirement has emerged with a maturing Navy Technical Regulation Framework. Consequently, the FFG Upgrade Contract has limited rights in regard to Navy's Technical Regulation Framework, and therefore DMO relies on appropriately authorised work completed by competent people to approved standards, which is underpinned by Objective Quality Evidence.

necessary suite of Phase 4B project management plans. By June 2007, FFGSPO had developed a project management plan framework, a Risk Management Plan, a Quality Management Plan, a Schedule Management Plan and a Communication Management Plan.

1.27 However, as at June 2007 Phase 4B still lacked a Project Certification Plan, an Integrated Logistics Support Plan, and many systems engineering plans. Timely application of approved plans is now necessary to reduce project management risks to acceptable levels, given that FFGSPO is acting as Phase 4B's systems integrator, and that this phase was entering its implementation stage.

#### Quality management

1.28 An integral part of the AEO certification is the application of a Quality Management System (QMS) that is certified, by a third party Quality Management Certification organisation, as complying with ISO 9001:2000 *Quality System – Requirements.*<sup>31</sup> FFGSPO's QMS underwent a third party certification audit in December 2003. This resulted in a recommendation for certification to ISO 9001:2000, subject to the rectification of non-conformances related to data management, configuration management and the FFGSPO personnel's understanding of the SPO's QMS. These issues were resolved and FFGSPO was awarded certification to ISO 9001:2000 in April 2004. FFGSPO underwent a QMS recertification audit in January 2007, and this audit resulted in no corrective action requests and a continuation of FFGSPO's QMS certification.

#### FFG Upgraded design approval and acceptance

1.29 Navy's Technical Regulations require the Design Authorities to certify that their designs meet specified requirements and are fit for service, safe and environmentally compliant. This assurance needs to be in the form of Designers Certificates for specific equipment, and a Report of Materiel and Equipment Performance State (TI-338) populated with assurances that certify that products have been delivered in accordance with the terms and conditions of the contract and its approved amendments as at the delivery date. The TI-338 is to document all deficiencies that Contractors or DMO are responsible to rectify. The TI-338 is also one of the formal documents used to facilitate Initial

<sup>&</sup>lt;sup>31</sup> FFGSPO's third party QMS certification organisation is Det Norske Veritas (DNV) Certification Pty Ltd.

Operational Release, and eventually, Operational Release. Another document used to facilitate Initial Operational Release is each vessel's Safety Case.

#### FFGSPO personnel and Information Technology issues

1.30 FFGSPO had 81 employees in January 2007; 65 were full-time Australian Public Service (APS) personnel and the remaining 16 were Australian Defence Force (ADF) personnel. In January 2007, the SPO had 26 APS vacancies and six ADF vacancies. The APS turnover rate over the previous year was 19 per cent and the ADF personnel turnover rate was 60 per cent.<sup>32</sup> In 2006–07, DMO engaged 17 external Professional Service Providers to assist FFGSPO with technical assessments. The Prime Contractor advised the ANAO in October 2007 that FFGSPO personnel resource issues have caused a considerable lag in FFGSPO's review, comment and acceptance of contractor supplies.

1.31 FFGSPO reports a higher than anticipated demand for personnel caused by project delays and complications arising from the Prime Contractor's approach to delivery, and by the staged establishment of new Navy technical regulations. The SPO advised the ANAO that it experiences difficulties in recruiting suitably qualified and experienced staff with expertise in maritime combat systems, software engineering, and tests and trials. The difficulties are compounded by several factors including:

- FFGSPO's geographical location at Garden Island, Sydney;
- Sydney's high cost of living; and
- the levels of APS remuneration that can be offered to the specialist personnel it needs to attract and retain.

1.32 FFGSPO also reports frequent problems with its Information Technology that result in connectivity interruptions, poor response times, and a failure to support some important business operations. Defence advised the ANAO that these problems are well understood by CIOG, which is actively addressing local area network performance issues at Garden Island through its BALANCE program and related initiatives.

<sup>&</sup>lt;sup>32</sup> The turnover rates are based on the standard formula of dividing the total number of personnel that left the organisation during the last 12 month period by the total number of personnel at the beginning of that period.

# **Recommendation No.1**

1.33 The ANAO recommends that Defence's Chief Information Officer Group reviews the performance of the Defence Restricted Network at Garden Island, with the aim of ensuring satisfactory service delivery to users.

#### **Defence and DMO response**

1.34 Agreed. CIOG is already addressing local area network performance issues, such as those experienced at Garden Island, through the Base And Local Area Network Critical Enhancements program and related initiatives. The recently completed Network Architecture Review indicated that the majority of network performance issues were caused by a combination of old desktop hardware and poor application design. Refresh activities already in place will continue to address the former. Application performance is a longer term issue that requires careful planning and analysis. CIOG will address this issue on an application by application basis once other factors have been clearly separated.

# Audit approach

1.35 The audit scope covered DMO's management of the FFG Upgrade Project and focused on the delivery and Provisional Acceptance of the first of the upgraded FFGs, HMAS *Sydney*.

1.36 The audit follows on from Audit Report No. 45 2004–05, *Management of Selected Defence Systems Program Offices*. This report was considered by the Joint Committee of Public Accounts and Audit in its current inquiry into Defence Financial Management and Equipment Acquisition at the Department of Defence and DMO. Relevant ANAO accountability findings for the 2005 audit are provided in Table 1.5

1.37 The audit fieldwork was conducted at FFGSPO between February and September 2007. The fieldwork involved interviewing FFGSPO personnel and examining project records. A discussion paper was provided to DMO and Defence for comment in August 2007. This was followed by a proposed report issued pursuant to section 19 of the *Auditor-General Act 1997*, which was provided to Defence, DMO and the Prime Contractor in September 2007.

1.38 The audit was conducted in accordance with the ANAO auditing standards at a cost to the ANAO of \$380 000.

#### Table 1.5

#### Previous ANAO Audit Report – financial accountability issues.

The ANAO reported in 2005 that the FFGSPO's records management system was inadequate for the size and complexity of the FFG programme. In 2005 Defence agreed to the ANAO recommendation that Defence establish a timetable for all groups to migrate to the Defence Records Management System (DRMS). The FFGSPO engaged Defence's Records Management Solutions Directorate in August 2005 to conduct a scoping study with the aim of implementing the IT-based DRMS. FFGSPO implemented its DRMS by October 2006, and this involved a rationalisation of electronic records and personnel training and support.

The ANAO reported in 2005 that the FFGSPO's records for 1999 to mid-2003, did not provide a basis for orderly, efficient and accountable measurement of the use of Defence resources. Since then FFGSPO has assembled many additional FFG Upgrade Project payment records, and reconciled these records with payment records held in Defence's centralised financial management systems. The SPO has also updated its financial management spreadsheets and from March 2006 separated all monthly payments related to the FFG upgrade (capital expenditure) from those payments related to FFG maintenance (operating expenses).

DMO's Maritime Systems Division engaged an accounting firm to assist the SPO with technical advice and with redeveloping the SPO's financial management policy and work instructions. This resulted in the production of two handbooks covering the financial management aspects of capital equipment acquisition and sustainment as applied to the FFG fleet. Indications are that this led to cost effective improvements in the SPO financial management practice.

Source: ANAO.

#### **Report structure**

1.39 The remainder of the report is organised into three chapters. Chapters 2 and 3 discuss the FFG Upgrade Project's payments and schedule, and the FFG Upgrade Combat System development. Chapter 4 discusses HMAS *Sydney's* Provisional Acceptance.

# 2. Payment and Schedule Progress

This chapter discusses the project's payment and schedule progress measurement system, progress payments and the project's schedule delays.

# Background

2.1 Equipment acquisition projects involving significant engineering development tasks require the use of an integrated set of progress measurement techniques covering project costs, schedule and systems engineering requirements achievement. This is important for the FFG Upgrade Project, as Defence estimates indicate that some \$1.68 billion or 80 per cent of the FFG Upgrade investment in Phase 2.1 and Phase 4 will be spent prior to the contractual Acceptance of the first upgraded FFG in November 2008.

2.2 The FFG project uses the following progress assessment techniques, which successively focus more on systems development progress and less on the progress payment mechanism:

- Earned Value Management (EVM);
- milestone assessments;
- software development metrics; and
- engineering design reviews, configuration audits and system verification reviews.

2.3 This chapter focuses on EVM and milestone assessments, and the next chapter focuses on design reviews, software development metrics, configuration audits and requirements verification reviews.

## **Earned Value Management**

2.4 A key project management responsibility is to ensure that the Contractor's cost and schedule progress data are sufficient, and reliable enough to accurately track and review results being obtained.<sup>33</sup> In carrying out that responsibility, FFGSPO relies on the Prime Contractor's Earned Value

<sup>&</sup>lt;sup>33</sup> To be meaningful, this data must:

<sup>·</sup> portray budgets allocated over time to achieve specific contract tasks;

<sup>·</sup> indicate work progress;

<sup>·</sup> relate properly to costs, schedule and technical accomplishment;

<sup>·</sup> remain valid, timely and auditable; and

<sup>·</sup> provide summary information at a practical level.

Management System (EVMS) as the predominant mechanism for measuring and reporting Phase 2.1's cost and schedule progress.

2.5 The FFG Upgrade Contract required the Prime Contractor to establish and maintain an EVMS, which complies with Australian Defence Standard DEF (AUST) 5655, *Australian Cost/Schedule Control Systems Criteria; Standard*, within 15 months after contract signature. The first compliance check included an Integrated Baseline Review of the Prime Contractor's evolving EVMS six months from contract signature. Table 2.1 describes the essential elements of an Integrated Baseline Review.

#### Table 2.1

#### Integrated Baseline Reviews.

An Integrated Baseline Review (IBR) is a technical and schedule review, focusing on the assignment, definition, scheduling and resourcing of work (including budgets), thus establishing early visibility into the acceptability of the Contractor's contract planning. Where the contract provides for payment by earned value, the IBR also reviews the methods and metrics used to measure contract performance. Where a Contractor is using an already validated EVM system, the IBR is used as a streamlined approach to assessing the acceptability of the Performance Measurement Baseline on new contracts. The objectives of the IBR are to:

- (a) ensure that the complete contract scope of work is covered in the Contract Work Breakdown Structure;
- (b) assess whether the technical scope can be accomplished within cost and schedule baseline constraints and that resources have been appropriately distributed to the contract tasks;
- (c) assess that there is a logical sequence of effort that supports the contract schedule;
- (d) identify areas of risk in resource allocations and in the technical performance of the contract and understand the cost and schedule implications of that risk;
- (e) assess the validity and accuracy of the Contractor's baseline by examination of at least one Cost Performance Report or Cost Schedule Status Report; and
- (f) develop Project Office understanding of the Performance Measurement Baseline resulting in a better appreciation of the Contractor's performance management process and the methodologies used to measure performance.

Source: Department of Defence Circular Memorandum No. 9/99, Integrated Baseline Review, 22 February 1999.

2.6 The Contract also specified that the first EVM payment claim was not to be made until the Project Authority approved the project's Performance Measurement Baseline based on the Integrated Baseline Review. By August 2000, these requirements had been largely achieved and the Prime Contractor received a \$1 million milestone payment for the FFGSPO's acceptance of the Contractor's Contract Master Schedule, and a further \$1 million milestone payment for the completion of its Integrated Baseline Review.

#### **Contract Master Schedule**

2.7 As indicated by the \$1 million milestone payment attached to FFGSPO's acceptance of the Contractor's Contract Master Schedule, this master schedule is an important component of the EVMS. It establishes the FFG Upgrade Project's key dates and hence is required to be completely compatible with and traceable to the Contract's Milestone Schedule, and be meaningful in terms of the Contract's technical requirements and key activities. However, the Prime Contractor's FFG Upgrade Contract Master Scheduling process has not proven reliable.

2.8 In mid February 2007, the Prime Contractor provided FFGSPO with the 10th revision of its Contract Master Schedule. In response, FFGSPO advised the Prime Contractor that its earned value claim that followed the development of the revised Contract Master Schedule could not be considered verifiable until an Integrated Baseline Review was completed. The last FFG Upgrade Contract Master Schedule to be verified as reliable through an Integrated Baseline Review was the Contract Master Schedule of November 2001. It was not until a Deed of Settlement and Release in May 2006 that a repeated Integrated Baseline Review became a specific contract requirement.

2.9 It remains a project responsibility to organise and conduct Integrated Baseline Reviews reviews. These reviews require a level of expertise not normally held by FFGSPO. Consequently, FFGSPO engaged a private firm to assist with the Integrated Baseline Review, which it planned to complete in October 2007. The ANAO was advised in October 2007 that further consideration will be given to improving support corporately to the reliability of Earned Value Management Systems used by DMO System Program Offices.

#### Earned value reporting

2.10 The Prime Contractor provides the FFGSPO with monthly Cost Performance Reports that summarise contractor performance against the contracted schedule, progressive costs, and the estimated cost to complete the contract. Figure 2.1 shows, in cumulative dollar terms, how far the project's cost and schedule have varied from the project's EVM plan.

#### Figure 2.1

FFG Upgrade Project Phase 2.1, cumulative monthly project cost and schedule variance to July 2007.





2.11 The Cost Variance line in Figure 2.1 tracks the difference between the actual cost of FFG Upgrade work completed and the budgeted cost of that work. By July 2007, the project was running \$39 million over its budgeted cost. The Prime Contract is a variable price contract so the Prime Contractor's actual costs do not feature in the progress payments.<sup>34</sup> However, for risk management purposes, the FFGSPO needs to be aware of the Prime Contractor's actual cost performance so that they may assess the reliability of the Contractor's cost estimates.

2.12 The Schedule Variance line in Figure 2.1 tracks the difference between the value of work scheduled to be completed, and the value of work actually completed. The large schedule recoveries in June 2002 and November 2004 resulted from major replans, which respectively added 24 months and 31 months to the project's overall delivery schedule. The smaller schedule recoveries from September 2002 result from several variations to the Prime

<sup>&</sup>lt;sup>34</sup> Variable price contracts allow for elements of the contract to be varied during the period of the contract according to certain specified cost factors. For example; variations in labour, material and exchange rates.

Contractor's Contract Master Schedule and its underlying workpackage schedule estimates.

2.13 Schedule slippages caused by combat system software development delays and delays in developing test procedures, have persisted into 2007. By June 2007 some \$14 million of combat system software development remained incomplete, and FFGSPO was awaiting revised EVM data, which it expected would provide a more accurate indication of the schedule slippage in EVM terms. However, Figure 2.1 shows that since the approval of the Deed of Settlement and Release of May 2006, and a revised strategy implemented, the upgrade project's Cost Variance has reached a plateau and its Schedule Variance is stable or improving.

# Phase 2.1 Milestone achievement

2.14 The Prime Contract contains 111 milestones with a total price of \$285.1 million (February 1998 prices). The milestone payment amounts were not necessarily linked to the actual or budgeted cost of work performed at the time of the nominated milestone. The initial FFG Upgrade Prime Contract aimed to achieve milestone payments totalling 30 per cent of the contract price. The contract amendment in June 2006 increased the ratio of milestone payment amounts to earned value payments for the remainder of the contract. This places greater weight on milestone payments rather than earned value for the remainder of the contract. This increases the incentive for the contractor to deliver measurable value to the Commonwealth. This was in line with an ANAO recommendation,<sup>35</sup> which sought increased emphasis on successful completion of mandated system reviews, tests and evaluations.

2.15 As at June 2007, the Prime Contractor had completed 57 milestones and received milestone payments totalling \$242.8 million. Of that amount \$209.9 million was in base date (February 1998) prices, \$24.2 million was for price escalation and \$8.7 million was for Goods and Services Tax applied to foreign currency transactions and mobilisation payments.

## HMAS Sydney's Provisional Acceptance Milestone Payment

2.16 Included among the milestone payments was a \$9 million (February 1998 prices) payment for Milestone 40–Provisional Acceptance of HMAS *Sydney.* This milestone payment was escalated to \$14.654 million (February

<sup>&</sup>lt;sup>35</sup> ANAO Report No.45 2004–05, *Management of Selected Defence System Program Offices*, May 2005, p. 85.

2007 prices) by a payment for labour, material and foreign exchange rates variations of \$4.322 million, and a GST payment of \$1.332 million.

2.17 Provisional Acceptance Milestone 40's original price was \$10 million (February 1998 prices). FFGSPO withheld \$1 million (10 per cent) from that milestone and transferred the \$1 million to Milestone 50 – Acceptance of Lead Ship. The reason for FFGSPO withholding the final \$1 million payment was that the Prime Contractor had not fully satisfied the milestone's precursors which are:

- satisfactory completion of System Stress Test. The Baseline Build 1 stress test failed;
- successful completion of HMAS *Sydney's* Category 5 Sea Acceptance Trials. This was not achieved as only 10 of 43 Combat System sea acceptance procedures had passed, and only nine of the 14 Platform sea acceptance procedures had passed (Appendix 2 briefly describes the Category 5 test concepts); and
- training courses for ship's company completed. The training received by Navy personnel was compromised by schedule changes that delayed the development of the Combat System operation and maintenance training facilities and by delays in the issue of Ship Selected Records and Systems Manuals.

2.18 These are material Provisional Acceptance precursor achievement deficiencies, despite the considerable effort being undertaken by DMO, Navy and the contractor to resolve these issues. DMO's rationale for approving HMAS *Sydney's* Provisional Acceptance include a need to avoid claims for Act of Prevention that may have arisen from HMAS *Sydney's* scheduled dry-dock maintenance limiting the Prime Contractor's ability to complete at sea regression testing or retesting. DMO agreed to a contract change in June 2006 that Provisional Acceptance would be assessed on the basis that deficiencies which have been rectified but which rectification is not able to be evidenced by regression testing or retesting are:

- to be noted in the TI-338;
- not to contribute to the Problem Report count for the purposes of Provisional Acceptance; and
- to be subject to subsequent shipboard verification testing at a time to be agreed by the parties.

2.19 The DMO exercised discretion in Provisionally Accepting HMAS *Sydney* in December 2006 in accordance with the contract as amended by the May 2006 Deed of Settlement and Release.<sup>36</sup> Consequently, at the time of its Provisional Acceptance in December 2006 HMAS *Sydney* had not achieved important Provisional Acceptance Milestone precursors,<sup>37</sup> which are now required to be resolved by the ship's Acceptance in November 2008. As at September 2007, HMAS *Sydney* was experiencing continuing delays in obtaining Initial Operational Release by Navy. This is attributed to limitations in the maturity of Underwater Warfare and Electronic Support Systems and supporting documentation required to satisfy Navy's revised technical regulations introduced after the Prime Contract was signed in June 1999.<sup>38</sup>

#### **Progress payments**

2.20 Phase 2.1's cumulative expenditure reached \$1.064 billion in June 2007. Of that amount, \$1.005 billion was for Prime Contract payments (see Table 2.2). The total remaining Prime Contract budget was \$208.4 million as at mid June 2007.<sup>39</sup> On that basis, 83 per cent of the Prime Contract Budget had been spent.

<sup>&</sup>lt;sup>36</sup> Achieving Provisional Acceptance does not relieve the Prime Contractor of any obligations in regard to rectifying contractual non-conformance prior to the Acceptance of each Upgraded FFG and Contract Final Acceptance in December 2009.

<sup>&</sup>lt;sup>37</sup> The precursors include satisfactory completion of Combat System Stress Test, completion of HMAS *Sydney's* Sea Acceptance trials and competed training courses for ship's company.

<sup>&</sup>lt;sup>38</sup> HMAS Sydney's combat system Baseline Build 1 was experiencing 16 high, 102 medium and 218 low severity System Integration Problem Reports The Prime Contract's Provisional Acceptance criteria, detailed in Attachment AG, is zero High, 25 Medium and 685 Low Severity Problem Reports. See Tables 4.2 and 4.3 for Problem Report criteria and severity definitions.

<sup>&</sup>lt;sup>39</sup> In contract base date terms, this equates to \$138.9 million (February 1998 prices).

#### Table 2.2

| Phase 2.1's P | rime ( | Contractor | payment | types | and | amounts, | June | 1999 1 | to |
|---------------|--------|------------|---------|-------|-----|----------|------|--------|----|
| June 2007.    |        |            |         |       |     |          |      |        |    |

| Payments <sup>1</sup>            | 1998/<br>2000 <sup>2</sup><br>(\$ m) | 2000/<br>2001<br>(\$ m) | 2001/<br>2002<br>(\$ m) | 2002/<br>2003<br>(\$ m) | 2003/<br>2004<br>(\$ m) | 2004/<br>2005<br>(\$ m) | 2005/<br>2006<br>(\$ m) | 2006/<br>2007<br>(\$ m) | Total<br>(\$ m) |
|----------------------------------|--------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------------|
| Earned Value                     | 88.2                                 | 197.8                   | 195.1                   | 119.0                   | 66.6                    | 47.6                    | 31.7                    | 13.3                    | 759.3           |
| Mobilisation<br>Milestone        | 126.7                                | 0                       | 0                       | 0                       | 0                       | 0                       | 0                       | 0                       | 126.7           |
| Progress<br>Milestones           | 16.0                                 | 2.9                     | 13.6                    | 11.8                    | 1.8                     | 1.2                     | 7.9                     | 26.0                    | 81.2            |
| Delay<br>Milestones              | 0                                    | 0                       | 0                       | 0                       | 23.1                    | 0                       | 11.1                    | 0                       | 34.2            |
| Performance<br>Incentive<br>Fees | 0.2                                  | 0.9                     | 0.5                     | 003                     | 1.7                     | 0                       | 0                       | 0.02                    | 3.3             |
| Total                            | 231.1                                | 201.6                   | 209.2                   | 130.8                   | 93.2                    | 48.8                    | 50.7                    | 39.32                   | 1 004.7         |

Note 1. Payment amounts include escalation, currency variations and exclude Goods and Services Tax.

Note 2. The only payment that occurred in 1998–99 was the \$126.7 million Mobilisation payment. All other payments in this column occurred in 1999–2000.

Source: Defence Materiel Organisation, FFG System Program Office.

2.21 The milestone payments due for payment at the Acceptance of all four FFGs and the Acceptance of FFG Upgrade Software total \$11 million (February 1998 prices). This is 1.1 per cent of the Prime Contract price. The milestone payment due at Contract Final Acceptance in December 2009 is \$3.36 million (February 1998 prices), which is 0.34 per cent of the Prime Contract price.

2.22 Phase 4B's approved budget was \$600 million (July 2007 prices), and as at May 2007 \$85.45 million or 14 per cent of the budget had been spent (see Table 2.3).

| Contract type          | 2005 – 06<br>( \$ million) | 2006 – 07<br>(\$ million) | Total<br>(\$ million) |
|------------------------|----------------------------|---------------------------|-----------------------|
| Foreign Military Sales | 36.25                      | 44.26                     | 80.51                 |
| Commercial             | 1.65                       | 3.04                      | 4.69                  |
| Other                  | 0.05                       | 0.21                      | 0.26                  |
| Total                  | 37.94                      | 47.50                     | 85.45                 |

#### Table 2.3

#### Phase 4B's contract types and amount spent to May 2007.

Source: Defence Materiel Organisation, FFG System Program Office.

## **Delivery schedules**

2.23 Since the Prime Contract for Phase 2.1 was signed in June 1999 the parties have negotiated several major changes to its Delivery Schedule. The most significant changes are shown in Table 2.4, and these changes have in effect delayed the delivery of some project elements by some four years.

2.24 The project has been the subject of a number of schedule negotiations and reviews, the most extensive being those leading up to a 24 month extension to the project's duration agreed to in April 2004. This agreement provided for a new Provisional Acceptance of 1 July 2005 for the lead ship HMAS *Sydney* and the fourth FFG being Provisionally Accepted on 20 February 2007.

2.25 The FFG Upgrade contract was amended by a Deed of Settlement and Release in May 2006 to reflect the retirement of the two oldest FFGs leaving only four FFGs to be upgraded. The amendment also included changes to the FFGs' delivery schedule to account for delays to the programme caused by test and trials issues and by repairs to HMAS *Sydney's* hull-doubler plate welds.

#### Table 2.4

| Ship                                    | 1 June 1999                                  | Apri  | il 2004                                      | June 2006             |                           |             |  |
|---|--|---|--|-----------------------|---------------------------|-------------|--|
|   | Delivery <sup>1</sup>                        | Delivery <sup>2</sup>   | Provisional<br>Acceptance                    | Delivery <sup>2</sup> | Provisional<br>Acceptance | Acceptance  |  |
| HMAS<br>Sydney                          | 17 May 2003                                  | 17 June<br>2005   | 1 July 2005                                  | 1 Dec<br>2006         | 15 Dec 2006               | 18 Nov 2008 |  |
| HMAS<br><i>Melbourne</i>                | 16 Jan 2004                                  | 16 Feb<br>2006  | 2 March 2006                                 | 29 Sept<br>2007       | 12 Oct 2007               | 18 Nov 2008 |  |
| HMAS<br>Darwin                          | 11 July 2004                                 | 10 Aug<br>2006  | 24 Aug 2006                                  | 12 Aug<br>2008        | 26 Aug 2008               | 18 Nov 2008 |  |
| HMAS<br>Newcastle                       | 5 Jan 2005                                   | 6 Feb 2007  | 20 Feb 2007                                  | 20 May<br>2009        | 3 June 2009               | 3 Dec 2009  |  |
| 5 <sup>th</sup> FFG                     | 28 June 2005                                 | 27 July<br>2007   | 10 Aug 2007                                  | Deleted               | Deleted                   | Deleted     |  |
| 6 <sup>th</sup> FFG                     | 5 Dec 2005                                   | 8 Jan 2008  | 22 Jan 2008                                  | Deleted               | Deleted                   | Deleted     |  |
| Team<br>Trainer                         | 5 April 2002                                 | 4 March<br>2005   | 18 March<br>2005                             | 1 Feb<br>2007         | 19 Nov 2007               | 31 Dec 2009 |  |
| Warfare<br>Systems<br>Support<br>Centre | 15 April 2004<br>(Provisional<br>Acceptance) | 4 May 2007  | 18 May 2007                                  | 4 Nov<br>2008         | 18 Nov 2008               | 31 Dec 2009 |  |
| Upgraded<br>Software                    | 15 April 2004<br>(Acceptance)                | Not<br>Applicable<br>(Delivery<br>Date for<br>Acceptance<br>May 07) | Not Applicable<br>(Acceptance:<br>18 May 07) | Not<br>Applicable     | Not<br>Applicable         | 18 Nov 08   |  |

#### Phase 2.1 Delivery Schedule, as at June 2007.

 Notes:
 1. Delivery Date coincides with Provisional Acceptance Date as specified in Milestone Schedule.

 2. Delivery Date is two weeks before Provisional Acceptance.

Source: ANAO analysis of Defence Materiel Organisation, FFG System Program Office records.

2.26 Figure 2.2 shows the delays in the handover and Acceptance of the upgraded FFG capability compared with the original estimates. The lead FFG, HMAS *Sydney* was handed to the Prime Contractor to commence the upgrade in September 2003, 14 months behind the original hand over date of July 2002. It was Provisionally Accepted in December 2006, 43 months behind the original Provisional Acceptance date of May 2003. Notably, the schedule as of June 2006, had the lead FFG achieving Provisional Acceptance four months after the original contract had the final FFG being Accepted.

#### Figure 2.2







2.27 FFGSPO advised the ANAO that Phase 4B's original Materiel Acquisition Agreement and Acquisition Strategy require updating to reflect changes in the delivery of the SM-2 products as well as delays in the completion of FFG Upgrade Baseline Build 2 system integration and software development. These delays impacted on Phase 4B as the US Government, as the provider of FMS SM-2 related software, required a stable baseline from which SM-2 software development could commence. Additionally, many US Government technical data export control issues and Intellectual Property arrangements required resolution before suitable interface technical data could be provided to the various programme participants. As of September 2007, Phase 4B's schedule slippage ranged from three to 18 months, as compared with the original estimates. The Prime Contractor advised the ANAO in October 2007 that the recognised delays in completing Baseline Build 2 do not seem to have been considered a risk in completion of Phase 4B.

2.28 FFGSPO had FMS arrangements in place for the supply of SM-2 missiles and associated support in August 2005, and for the replacement of the gyro-compass and Inertial Navigation System in March 2005. During mid-to-late 2005 and extending into 2006, FFGSPO negotiated Contract Development Agreement contracts with the Original Equipment Manufacturers for initial

designs, and contract development covering engineering services and modifications to the following equipment and systems:

- On-Board Training System/Land-Based Simulation System;
- Guided Missile Launching System; and
- Continuous Wave Illumination units.

2.29 By June 2007, FMS arrangements costing some \$19.89 million were also in place to procure initial development work on the FFG's Weapons Control System software upgrade. At the same time, the Contract Development Agreement arrangements enabled FFGSPO to negotiate Procurement Contracts with the Original Equipment Manufacturers for the modification of the above equipment and systems.

# Liquidated damages

2.30 The FFG Upgrade contract contains liquidated damages provisions, as outlined below:

- \$50 000 per day for each day the Prime Contractor fails to achieve the Provisional Acceptance of each FFG, this amount was increased from \$35 000 per day by a contract amendment in June 2006;
- \$10 000 per day for each day the Prime Contractor fails to achieve Provisional Acceptance of the Operator Trainer and Weapon System Support Centre;<sup>40</sup> and
- 15 per cent of the shortfall in value of local content or 15 per cent of the Strategic Industry Development Activities the Prime Contractor fails to achieve during the execution of the contract.

2.31 The total amount of liquidated damages is capped at \$2.5 million per FFG, \$0.75 million for the Operator Trainer and Weapon System Support Centre, and \$10 million overall. The value of liquidated damages represent less than one per cent of the contract price, and so it is unlikely to effectively discourage late deliveries. Nevertheless, FFGSPO sought to preserve Defence's right to seek remedies against the Prime Contractor for its failure to achieve Provisional Acceptance of HMAS *Sydney* by 27 August 2005.

<sup>&</sup>lt;sup>40</sup> The Prime Contractor advised the ANAO in October 2007 that the Operator Trainers have been Provisionally Accepted.

2.32 The Deed of Settlement and Release of 29 May 2006, released both parties from all claims prior to that date. That Deed, combined with DMO's election not to exercise its preserved right to seek remedies for the Prime Contractor's failure to achieve Provisional Acceptance of HMAS *Sydney* by 27 August 2005, has resulted in no liquidated damages being claimed as at September 2007. The Prime Contractor was granted Provisional Acceptance of HMAS *Sydney* on 15 December 2006, in accordance with the dates specified in the revised delivery schedule of June 2006.

2.33 The ANAO was advised by DMO that the omission of liquidated damages via the May 2006 Deed was one of the factors taken into account in determining the overall contract price reduction and the global settlement of claims. The liquidated damages factors taken into account included:

- the overall cap on liquidated damages was less than one per cent of the contract price, and so was inadequate either to protect the Commonwealth from the consequences of delay, or to provide incentives for schedule achievement;
- the liquidated damages entitlement was unlikely to be accessible to the Commonwealth without major disputation. The costs of resolving such disputes and the consequential impact on performance of the contract would, in all likelihood, have negated the liquidated damage's monetary value; and
- the unanimous view of DMO senior executives and their external advisors involved in the negotiations leading to the May 2006 Deed was that trading-off the removal of the Commonwealth's right to liquidated damages in return for the contractor's agreement to other amendments in the Deed provided a net benefit to the Commonwealth.

# 3. Upgraded Capability Development

This chapter discusses the FFG Upgrade Project's design reviews, software development metrics, configuration audits and requirements verification reviews.

# Background

3.1 The FFG Upgrade contract assigns Total Contract Performance Responsibility to the Prime Contractor. This holds the Prime Contractor solely responsible for the project's design, construction, inspection and acceptance testing, from contract signature until each upgraded FFG and all associated project elements receive Contract Final Acceptance by DMO. Consistent with that responsibility, the contract generally limits the FFGSPO's engineering role to reviewing, commenting or, in limited instances, agreeing to the Prime Contractor's activities. It is only at Provisional Acceptance, Acceptance and Contract Final Acceptance that the FFGSPO may reject delivery of supplies.

3.2 FFGSPO does not have the authority to approve or reject the content of the Prime Contractor's acceptance test plans, procedures and reports. The FFGSPO may review and comment on them, and raise Problem Identification Reports and Non-Conformance Reports. However, the Prime Contractor is under limited obligation to accept or take action on the issues raised.

3.3 Nevertheless records show FFGSPO monitored the Prime Contractor's performance and provided the Contractor with extensive feedback. That feedback in general sought an adequate level of assurance that the upgrade contract's function and performance requirements would be met. FFGSPO's feedback was supplemented by input from Defence resources including Defence Science and Technology Organisation, DMO, Navy including personnel from HMAS *Sydney* and the Royal Australian Navy's Test, Evaluation and Analysis Authority.

3.4 However, this feedback was not consistently taken up as evidenced by HMAS *Sydney's* TI-338 at Provisional Acceptance, which reports significant deficiencies in the execution of the project's requirements verification.<sup>41</sup> A large portion of those deficiencies appear to result from decisions and circumstances established during the early years of the contract, that adversely affected the establishment of an ordered systems engineering approach, particularly in

<sup>&</sup>lt;sup>41</sup> Verification is defined as the process of determining whether or not the products of a given development phase fulfil the requirements established during the previous phase. Verification confirms that the products properly reflect the requirements specified for them.

regard to requirements verification through adequate acceptance test plans, procedures and reports. The Prime Contractor advised the ANAO in October 2007 that the original FFG Upgrade Contract was signed without an agreed Function and Performance Specification and requirements Verification Cross-Reference Matrix.<sup>42</sup> The contractor further advised that this was not ideal, but it happened, and the changes negotiated and agreed by both parties in mid 2006 were introduced to address the associated resulting problems.

3.5 Other Defence projects audited by the ANAO in recent years have Prime Contracts containing similar Total Contract Performance Responsibility provisions. However, these contracts differ in that they safeguard Defence's interests by allowing DMO SPOs to exercise a measure of control over the requirements verification process through approval powers over Prime Contractor's requirements Verification Cross-Reference Matrix and test and evaluation programmes. This aligns with DMO's responsibility to ensure products offered for acceptance have been adequately tested and evaluated in terms of verifying the achievement of contractual requirements.

3.6 The FFG Upgrade contract was developed from Defence Purchasing contracting template 101 (DEFPUR 101) which was replaced by the Australian Defence Strategic Contracting template AUSDEFCON (Strategic Materiel) Handbook in March 2002. AUSDEFCON contains the 'Clear Accountability in Design' concept not found in DEFPUR 101, which provides Defence with much improved safeguards over the requirements verification process (see Table 3.1).

<sup>&</sup>lt;sup>42</sup> The FFG Upgrade Contract is based on the Function and Performance Specification concept, whereby the Contract Specification defines the operations the upgraded systems are to perform and how well the functions are to be performed. A Verification Cross-Reference Matrix specifies the method by which each function and performance requirement may be verified as satisfactorily completed.

#### Table 3.1

#### Clear Accountability in Design.

Clear Accountability in Design (CAID) is an element of the overall ASDEFCON (Strategic Materiel) acquisition strategy. This strategy seeks to balance cost, schedule, and performance risks while keeping Defence project team resource needs to a minimum. The CAID approach is based on two key elements:

- (a) Defence controls the contracted requirements at the highest practicable levels, that is, at the Function and Performance Specification and Mission and Support System Specifications levels. Defence also manages the risks associated with ensuring requirements completion through exercising approval rights over the Prime Contractor's requirements Verification Cross-Reference Matrix and test and evaluation programmes; and
- (b) the Prime Contractor controls lower level requirements and the design in order to implement cost, schedule, performance, and risk-based business decisions, unless Defence has a specific need to control them.

Source: Defence Materiel Organisation, ASDEFCON (Strategic Materiel) Handbook, Volume 2, Draft Statement of Work, March 2002, Section 10.4.

# **Design Reviews**

3.7 DMO project team representatives attend Prime Contractors' Design Reviews with the aim of gaining adequate assurance that the system under review can meet the contracted function and performance requirements within cost, schedule, risk, and other constraints. The FFG Upgrade Project's Design Review Reports show action items were raised before, during and after those reviews. The list of actions included those designated as 'closeout' items, critical to the achievement of a related contract and project milestone.

3.8 Many actions had been closed by the time the various Design Review Reports were released, progressively between January 2000 and June 2007. However, some design reviews remained open for years longer than first envisaged, and this placed unforseen long-term workloads on FFGSPO's engineering review and audit personnel. For example FFGSPO signed the Progress Certificate for \$3 million (February 1998 prices) Milestone 12– completion of all Critical Design Reviews, in late May 2007, some six years after the milestone's initially planned completion date of April 2001, and five months after the first upgraded FFG was Provisionally Accepted by DMO. <sup>43</sup>

<sup>&</sup>lt;sup>43</sup> The Prime Contractor advised the ANAO that it is not correct to imply that the design remained incomplete until 2007; on the contrary, the Project Authority requested that the reviews be deferred due to Project Authority resource limitations in the support multiple software build activities and multiple ship activities as allowed for under the contract. The Prime Contractor further advised that the delayed approval of Milestone 12 was therefore the result of actions by the Project Authority and not of omissions by the Contractor.

#### Software development metrics

3.9 The Prime Contractor and the FFGSPO aim to reduce software development risk by the use of computing system development metrics. These metrics show significant slippage in software development achievements against the contract schedule for the Combat System's Baseline Build 1. For example the Test Readiness Review for Baseline Build 1 was originally scheduled for completion in November 2001, but after several schedule revisions it was not completed until December 2003. This two-year delay partly resulted from delays in achieving the predecessor milestones, namely the Software Specification Review, Software Preliminary Design Review and Software Critical Design Review.

3.10 Figure 3.1 combines selected data from the development progress and problem resolution graphs attached to the Prime Contractor's June 2007 Monthly Progress Report to FFGSPO.

#### Figure 3.1

Combat System Baseline Build 1 software development progress metrics and ADACS Open Problem Reports, as at June 2007.



Source: Adapted from Defence Materiel Organisation, FFG System Program Office records.

3.11 Figure 3.1 shows the impact on percentage completion made by difficulties encountered by the original Combat System Design Authority. These difficulties lead to a re-working of the specification of the Command & Control System (ADACS). This accounted for much of the early project delays,

which were addressed by a 24 month extension to the delivery schedule agreed to in April 2004. The figure also shows that the estimated percentage completion of Coding, Unit and Integration Testing activities remained mostly above the 90 per cent level from January 2004, and at the same time Open Problem Reports remained for the most part above 300. These metrics make a lesser contribution to software maturity assessments than metrics that focus on the number of function and performance requirements found to be fully 'processed', that is, fully designed, coded, tested or implemented. These latter metrics align with the need to ultimately assess and report software system development progress in terms of contractual requirements completion.

3.12 The ANAO notes that most of the software metrics the Prime Contractor reports to the FFGSPO do not contain direct measures of software development progress, in terms of function and performance requirements completion. Instead, the Prime Contractor's monthly progress reports provide 'percentage complete' statistics, which are ambiguous because percentage completed may refer to time consumed; effort expended; stage reached; software units processed; or indeed requirements verified as satisfactorily complete. This indicates there is scope for improvements in the software development progress measures specified in the FFG Upgrade contract.

# **Recommendation No.2**

3.13 The ANAO recommends that Defence Materiel Organisation report regularly software system development progress in terms of contractual requirements completion.

#### **Defence and DMO response**

3.14 Agreed. This recommendation aligns with the FFG Project's need to ultimately measure software system development progress in terms of contractual requirements completion. However, it will be addressed within the limits of the current prime contract.

## Upgraded Systems' function and performance tests

3.15 The Prime Contractor's System Engineering Management Plan sets out the sequence of engineering reviews, and functional and performance tests, which generally align with the sequence outlined in Appendix 2. However, the Contract does not mandate the sequence of reviews and tests.

The FFG Upgrade test programme was not conducted sequentially 3.16 from Category 1 Factory Acceptance Tests through to Category 5 Sea Acceptance Trials as normally occurs. For example Category 5 Sea Acceptance Trials were conducted even though not all Category 3 System Integration Tests and Category 4 Harbour Acceptance Trials were satisfactorily completed. FFGSPO objected to this process, but the contract does not allow FFGSPO to direct the contractor without undermining the contractor's Total Contract Performance Responsibility. The Prime Contractor advised the ANAO in October 2007 that the concept of a sequence that always follows the Category 1 to Category 5 with no variation is erroneous, and rarely happens in practice. Sequence variations occur in complex programmes with many component parts, because sometimes from a scheduling perspective it is not logical or practical to wait for all Category 4 tests to complete before commencing a single Category 5 test. For example, it is normal for the ship to go to sea to conduct machinery trials (Category 5 trials) before all Combat system Category 4 trials have completed. The Prime Contractor further advised that this consequential approach has enabled it to ensure delivery was progressed at all times.

3.17 Table 3.2 provides the results of HMAS *Sydney's* Combat System test and trials programme at the time of the *Sydney's* Provisional Acceptance in December 2006.

#### Table 3.2

HMAS *Sydney's* Combat System test programme results, at Provisional Acceptance in December 2006.

| ltem                             | Category 3<br>Tests –<br>System<br>Integration<br>Tests | Category 4<br>Tests –<br>Harbour<br>Acceptance<br>Trials | Category 5<br>Tests – Sea<br>Acceptance<br>Trials | Total |
|----------------------------------|---|--|---|-------|
| Total Test Procedures            | 23  | 305  | 43  | 371   |
| Test Procedures Passed           | 0   | 234  | 10  | 244   |
| Test Procedures Not<br>Commenced | 0   | 15   | 1   | 16    |
| Test Procedures<br>Ongoing       | 0   | 12   | 22  | 34    |
| Test Procedures Failed           | 23  | 44   | 10  | 77    |

Source: Defence Materiel Organisation, FFG System Program Office.

3.18 The large percentage of test procedure failures indicated complications in the Prime Contractor's systems engineering processes that produce the evidence needed to verify the completion of contracted function and performance requirements. That situation resulted in disagreements between FFGSPO and the Prime Contractor regarding availability of the prerequisite evidence and test procedure readiness, which normally justify progress to the next stage of a test and trials programme. At the time of audit fieldwork these disagreements were being managed through a test programme incorporating an improved requirements verification process as well as close co-operation between FFGSPO and the Prime Contractor.

3.19 FFGSPO and the Prime Contractor have used Integrated Product Teams during the system design and development, and the development of integrated logistics support to address the perception of a less than ideal test programme. FFGSPO has also used the Integrated Product Teams' outcomes as part of its efforts to satisfy Navy's requirements for delivery of specified FFG Upgrade capability and to provide assurances of FFG safety and fitness for service.

# **Configuration audits**

3.20 Configuration audits are an important element of the systems engineering configuration management process. Navy's technical regulations view configuration management as the control process of systems engineering. Configuration management is the discipline of applying technical and administrative direction and surveillance over the functional and physical characteristics of configuration items. Configuration items may be hardware or software or a combination of both.

3.21 Each FFG's configuration is required by Navy's technical regulations to be accurately defined in product specifications and technical documentation. Functional Configuration Audits are the formal examination of a configuration item's functional characteristics, prior to acceptance, to verify that the item has achieved the requirements specified in its functional configuration documentation. The FFG Upgrade contract requires the Prime Contractor to conduct Functional Configuration Audits prior to Physical Configuration Audits and after Sea Acceptance Trials.

3.22 The Functional Configuration Audit conducted for HMAS *Sydney* in October 2006 revealed deficiencies and errors in the requirements verification records that linked the functional requirements with their associated test

procedures and test reports. These deficiencies complicated the overall tests and trials programme, and raised questions regarding the validity of HMAS *Sydney's* Sea Acceptance Trials leading up to HMAS *Sydney's* Provisional Acceptance in December 2006. The Prime Contractor advised the ANAO in October 2007 that the System Verification Review leading up to HMAS *Sydney's* Provisional Acceptance and the associated TI-338, was to address the impact on capability of defects and deficiencies noted during the trials program. This is in accordance with the contract.

3.23 The FFG Upgrade contract requires the Prime Contractor to conduct Physical Configuration Audits (also known as configuration inspections) to verify that each configuration item is consistent with its technical documentation. The audits are also needed to enable project teams and technical regulators to gain assurance that equipment Integrated Logistics Support is properly aligned in terms of operation and maintenance documents, spares, and repair and manufacture data. This is necessary for the safe and effective in-service operation and maintenance of the complex systems aboard navy vessels.

3.24 The Physical Configuration Audit conducted for HMAS *Sydney* in October 2006 revealed the existence of 111 discrepancies within a sample of 90 of the 15 270 configuration items that constitute the FFG Upgrade. Following that audit, the Prime Contractor and FFGSPO commenced a configuration data accuracy rectification activity to address the discrepancies. By August 2007, FFGSPO audited 107 of HMAS *Sydney's* configuration items. This audit resulted in 123 discrepancy reports and seven discrepancy reports remained unresolved. At the same time FFGSPO audited 73 of HMAS *Melbourne's* configuration items. This audit resulted in 64 discrepancy reports and all of these remained unresolved.

3.25 The Physical and Functional Configuration Audit findings indicate the Prime Contractor did not consistently apply the necessary configuration management processes or management tools. Consequently, FFGSPO was unable to gain sufficient evidence to verify that the contract's functional and physical configuration management requirements were satisfactorily completed.

3.26 FFGSPO and Navy have endeavoured to manage the configuration management and logistics support risks by defining in HMAS *Sydney's* Handback status document, the equipment *Sydney's* crew was able to operate and maintain in accordance with specified preliminary and final equipment

operation and maintenance publications. The Hand-back of HMAS *Sydney* from the Prime Contractor to DMO occurred in May 2006, and this provided DMO and Navy with an opportunity to assess the accuracy of the logistic support products in a controlled operational environment.

3.27 The final release of the logistics support documents are required to be supported by Certificates from the Prime Contractor, which state the manuals comply with the contracted Defence standard for the production of technical manuals. The Defence standard states, amongst other things, manuals shall not be considered validated until the information reflects the configuration of the system, sub-systems or equipment and includes all engineering changes.<sup>44</sup> Given the configuration audit findings, the provision of all technical manuals that adhere to the standard could not be achieved as at June 2007. Systems most affected by this issue include the Underwater Warfare System, Combat System and Electronic Support System.

# **Requirements completion verification**

3.28 The completion of function and performance requirements may be verified using a combination of formal tests and evaluations, demonstrations, inspections, reviews and analysis. Regardless of the method used, systems engineering standards typically require contractors to produce a Requirements Verification Cross-Reference Matrix. That matrix specifies the method by which each function and performance requirement may be verified as satisfactorily completed, and is typically managed with the aid of databases containing the contracted requirements and their respective test and evaluation procedures and test results, and the configuration status of each configuration item under test.

3.29 As early as mid 2003 FFGSPO was aware that the FFG Upgrade Project's test and evaluation programme was not sufficiently mature to effectively contribute to assuring that the upgraded FFGs would meet the contracted function and performance requirements. The SPO was unable to gain assurance that the Prime Contractor had developed a Verification Cross-Reference Matrix that comprehensively linked the requirements in the contract to the production and acceptance test and evaluation procedures necessary to

<sup>&</sup>lt;sup>44</sup> The objective of technical manual validations is to ensure that the Contractor has provided accurate and adequate technical manuals for the support of the systems or equipment, in accordance with approved maintenance plans and user skill levels, as specified in the statements of requirements. DEF(AUST) 5629A Production of Military Technical Manuals January 1991, Section 4 Chapter 1, paragraphs 102 and 110.

verify that the contracted requirements had been satisfactorily achieved. At that time the Prime Contractor's:

- Requirements Verification Cross-Reference Matrix did not meet the contract's requirements in terms of specifying the test procedures or engineering documents that detail how each system specification had been satisfied; and
- test procedures written against sub-system specifications were neither sufficiently rigorous nor complete to the extent that the Prime Contractor and FFGSPO had failed to agree on the Pass or Fail criteria for requirements verification within the test procedures.

The Prime Contractor advised the ANAO in October 2007 that the test verification matrix did not exist in an agreed form until 2005, and that there was a failure to agree, even in 2005, on the Acceptance (Pass or Fail) criteria associated with each requirement. This agreement had to be a joint process, as it marks the events at which the FFGSPO accepts that requirements will have been met. There was much debate during test procedure production in relation to issues such as 'test sample size' and 'false or firm track establishment during sea trials'. The Prime Contractor further advised that these issues should have been sorted pre-contract, however, as they were not agreed, then the project had to proceed in the most pragmatic way possible.

3.30 System Verification Reviews,<sup>45</sup> Functional Configuration Audits and Physical Configuration Audits conducted in October 2006 demonstrated to FFGSPO that despite improvements since 2003, the Prime Contractor's requirements verification process had not provided all data needed by FFGSPO to verify the completion of all contracted requirement's for Combat System Baseline Build 1. This situation resulted in the need for FFGSPO to identify what evidence was lacking with regard verifying the completion of each of the 1 221 Combat System Baseline Build 1 contracted function and performance requirements.

3.31 The Prime Contractor advised the ANAO in October 2007 that there is no evidence to support a claim that there is a 'failure' in the requirements verification and validation process. Rather, the current results reflect the magnitude of review work required of the presented data to be completed by

<sup>&</sup>lt;sup>45</sup> The FFG Upgrade contract includes a need for the Prime Contractor to conduct a System Verification Review near the completion of the system production and integration stage. This review is a key element of the FFG Upgrade Project's Test and Evaluation program. It aims to ensure that the upgraded systems are technically mature and that there is high-level of confidence that the systems comply with the contracted Function and Performance specifications.

the FFGSPO. The Prime Contractor further advised that it is continuing to assist the FFGSPO with access to necessary objective quality evidence to complete the requirements verifications task.

## Test and acceptance process improvements

3.32 As at September 2007 the key process used by both parties to verify requirements completion was the revised Test and Acceptance Process (known by project personnel as the B-TAP process). This process was agreed to by both parties as part of the negotiations in 2006 to reduce the numbers of FFGs to be upgraded from six to four. It was designed to assist the Prime Contractor and FFGSPO personnel to assess and agree that the Prime Contractor had achieved functional requirements completion. Its primary aim was to resolve the extent to which Defence would accept the Prime Contractor' test results as sufficient to verify completion of the functional requirements, and the extent to which retests were required to resolve problems identified at the Hand-back of HMAS *Sydney* to DMO. Secondary aims were to:

- assist the Prime Contractor to schedule a Test Programme for the remainder of the FFG Upgrade Project;
- enable the development of a more streamlined process for requirement completion tests, reviews and verifications for the FFGs following HMAS *Sydney*, and
- ensure that adequate testing is conducted to produce evidence supporting the verification of requirements.

3.33 The FFG Upgrade contract was amended in June 2006 to incorporate this improved process, and the process was still underway in September 2007.

# 4. HMAS *Sydney's* Provisional Acceptance

This chapter discusses the Provisional Acceptance of the first of the FFGs to be upgraded.

# Background

4.1 The FFG Upgrade contract defines Provisional Acceptance as the certification by the Project Authority (FFGSPO Director) that the Prime Contractor has fulfilled its contractual obligations in respect of any upgraded FFGs or upgraded facilities listed on a Supplies Release Note.<sup>46</sup>

4.2 DMO Provisionally Accepted HMAS *Sydney* in December 2006. At that time, FFGSPO had documented within HMAS *Sydney's* Report of the Materiel and Equipment Performance State (TI-338), wide-ranging and extensive deficiencies regarding the achievement of function and performance requirements specified in the FFG Upgrade contract.<sup>47</sup> These deficiencies were also documented in 283 contractual Non-Conformance Reports. DMO advised the ANAO that a large majority of these were classified as low severity and within the tolerance permitted for low severity Problem Reports under the Prime Contract. DMO had an obligation to assess the basis of the offer for Provisional Acceptance, then consider the impacts of non-conformances, exercising discretion as required. The advice of the Navy capability customer was pivotal in making this assessment. By far the majority of those deficiencies were listed for the Prime Contractor to resolve prior to HMAS *Sydney's* Acceptance scheduled for November 2008.

# **Requirements completion at Provisional Acceptance**

4.3 By the time of HMAS *Sydney's* Provisional Acceptance in December 2006, the task of verifying the completion of requirements specified in the FFG Upgrade contract was less than half complete, as indicated by the following results:

<sup>&</sup>lt;sup>46</sup> The Prime Contractor uses Supplies Release Notes (SG8s) to certify that the upgraded FFGs or facilities have been inspected or otherwise quality controlled and, unless otherwise stated, conform with the order, drawings and specifications, in all respects, and with the conditions and requirements of the Contract, subject to any omissions or defects listed on that SG8.

<sup>&</sup>lt;sup>47</sup> Report of the Materiel and Equipment Performance State (TI-338) of HMAS Sydney FFG-03 FFG Upgrade (FFGUP) Project SEA 1390 (CAPO 605178NQ).

- Combat System Requirements. Of the 1221 performance requirements allocated to combat system Base Build 1, 28 per cent were agreed, 16 per cent were under review and 56 per cent had not been reviewed;
- Platform System Requirements. Of the 220 performance requirements specified for the Platform, 24 per cent were agreed, 10 per cent were under review and 62 per cent had not been reviewed;
- Functional Configuration Audits. These audits remained substantially incomplete and the parties agreed that they would be conducted as a staged review of requirements offered and agreed through the revised Test and Acceptance Process (B-TAP); and
- Physical Configuration Audits. Of the FFG Upgrade's 15 275 configuration item changes, 0.6 per cent (90) had been audited and these audits raised 111 discrepancy reports.

The Prime Contractor advised the ANAO in October 2007 that since the audit the process of verifying completion of requirements is covered by B-TAP, and that this process continues to produce improved statistics without the need for additional trials. The Prime Contractor further advised that the objective quality evidence exists, the capability is present (as expressed in the System Verification Review) and the trace to that objective quality evidence is being established through its collaborative work with the Project Authority.

4.4 DMO advised the ANAO that the Functional and Physical Configuration Audit discrepancies were determined by the FFGSPO to be systemic and plans were established with the Prime Contractor to address them. DMO also advised that satisfactory resolution of the systemic issues was achieved in September 2007, through configuration item identification measures and collection of necessary configuration evidence.

4.5 Figure 4.1 shows that by August 2007, the Prime Contractor offered for FFGSPO's acceptance 1004 of the 1221 function and performance requirements allocated to Combat System Baseline Build 1.

#### Figure 4.1



Combat System Baseline Build 1 requirements offered and accepted as complete, as at 17 August 2007.

Source: Defence Materiel Organisation, FFG System Program Office.

4.6 The FFGSPO was only able to verify that 591 requirements satisfied the contracted function and performance specifications, and the SPO referred 285 requirements back to the Prime Contractor due to a lack of verification data. At the same time the Prime Contractor had not offered 217 requirements to FFGSPO for acceptance. In October 2007 the Prime Contractor advised the ANAO that it would be a mistake to deduce that the above 285 requirements have not been delivered. Rather, the predominant reason for their existence is that the first pass review of the information made available to the FFGSPO appeared not to contain the required verification data. The Prime Contractor further advised that this does not mean the verification data, in objective quality evidence form, does not exist; but in fact, the 285 requirements were underwritten by the contractors' Design Authority as being present in the delivered system data at the time of the Systems Verification Review.

#### **System Integration Problem Reports**

4.7 FFGSPO relies on the Prime Contractor's System Integration Problem Reports to assist the SPO to assess the progress being achieved toward the required level of Combat System integration and overall performance. 4.8 Table 4.1 shows the number of System Integration Problem Reports documented in HMAS *Sydney's* TI-338 that were provided to the Prime Contractor through Non-Conformance Reports.

#### Table 4.1

# HMAS *Sydney's* System Integration Problem Reports, at Provisional Acceptance in December 2006.

| System Integration Problem Reports incorporated into Non-Conformance Reports                    |     |     |    |     |  |  |  |  |
|---|-----|-----|----|-----|--|--|--|--|
| High Severity         Medium Severity         Low Severity         Not Classified         Total |     |     |    |     |  |  |  |  |
| 16  | 102 | 218 | 48 | 384 |  |  |  |  |

Source: Defence Materiel Organisation, FFG System Program Office.

4.9 Figure 4.2 indicates as at 17 August 2007 the numbers of open (unresolved) High Severity and Medium Severity System Integration Problem Reports remained significantly higher than the acceptance criteria for Provisional and Final Acceptance shown in Table 4.2.

#### Figure 4.2

# Combat System Baseline Build 1 System Integration Problem Reports, actual and trend statistics, as at 17 August 2007.



Source: Defence Materiel Organisation, FFG System Program Office.

ANAO Audit Report No.11 2007–08 Management of the FFG Capability Upgrade
#### Table 4.2

# Problem Report acceptance criteria, at each FFG's Provisional Acceptance and Acceptance.

| Supplies               | Provisional<br>Acceptance<br>or<br>Acceptance | Provisional<br>Acceptance |                 | sional Acceptance  |                 |
|------------------------|---|---------------------------|-----------------|--------------------|-----------------|
|                        | High<br>Severity                              | Medium<br>Severity        | Low<br>Severity | Medium<br>Severity | Low<br>Severity |
| Lead FFG (HMAS Sydney) | 0   | 25                        | 685             | 2                  | 10              |
| First Follow-on FFG    | 0   | 25                        | 685             | 2                  | 10              |
| Second Follow-on FFG   | 0   | 15                        | 380             | 2                  | 10              |
| Third Follow-on FFG    | 0   | 15                        | 380             | 2                  | 10              |

Note: The number of Medium and Low Severity Problem Reports stated above are maximums unless otherwise agreed with the Project Authority.

Source: ANAO, adapted from FFG Upgrade Contract, Attachment AG.

4.10 Table 4.3 defines the problem severity classifications.

#### Table 4.3

#### Problem Report severity definitions.

| Problem<br>Severity | Definition  |
|---------------------|---|
| High                | <ul> <li>a. Jeopardises personnel or equipment safety or information security; or</li> <li>b. Adversely affects, or has the potential to adversely affect, accomplishment<br/>of an operational or mission essential capability and no known workaround<br/>solution has been tested and implemented; or</li> <li>c. Significantly increases, or has the potential to significantly increase, life<br/>cycle cost; or</li> <li>d. Impairs, or has the potential to impair, support of the system below specified<br/>values and no known workaround solution has been tested and</li> </ul> |
|                     | implemented.  |
|                     | <ul> <li>Adversely affects, or has the potential to adversely affect, accomplishment<br/>of an operational or mission essential capability but an agreed workaround<br/>solution has been tested and implemented; or</li> </ul>   |
| Medium              | b. Impairs, or has the potential to impair, one or more mission functions; or   |
|                     | <ul> <li>Impairs, or has the potential to impair, support of the system below specified<br/>values, but an agreed work-around solution has been tested and<br/>implemented.</li> </ul>  |
|                     | a. Results in user/operator inconvenience or annoyance; or  |
| Low                 | <ul> <li>Results in inconvenience or annoyance for development or support<br/>personnel; or</li> </ul>  |
|                     | c. Any other effect excluding minor discrepancies or omissions.   |

Source: FFG Upgrade Contract Attachment AG.

4.11 During the 2006 negotiations to reduce the scope of the FFG Upgrade Contract from six to four FFGs, the Prime Contractor and DMO sought, amongst other things, to resolve issues arising from the project's large number of unresolved Problem Reports, which were significantly greater than the maximum number specified by FFG Upgrade Contract. The Prime Contractor was concerned that it would be unable to satisfy the contract in that regard, when it intended to offer HMAS *Sydney* to DMO for Provisional Acceptance and Acceptance.

4.12 In mid 2006 the Prime Contractor proposed an amendment to the Provisional Acceptance and Acceptance criteria covering the numbers of High, Medium and Low Severity Problem Reports set out in Attachment AG of the Contract. DMO did not agree to changes in the numbers, and the contract retained FFGSPO Project Authorities' right to exercise discretion regarding the Problem Report acceptability criteria, after having regard to:

- the substance of the Problem Reports, their individual and combined effect; and
- whether the Contractor has satisfied the Project Authority that the defects or omissions will be corrected to meet the criteria for Acceptance by the date scheduled for Acceptance.

The Prime Contractor advised the ANAO in October 2007 that it complied with the Contract's Attachment AG and will continue to do so, providing adequate justification and explanation of impact on capability and safety aspects are also provided. The Prime Contractor further advised that this occurs at System Verification Reviews and subsequent Problem Report Screening Conferences.

4.13 However, the Deed of Settlement and Release of May 2006 did amend System Stress and Acceptance Test precursor requirements. This amendment allows the Prime Contractor to proceed with successive tests, with the prior agreement of the FFGSPO Project Authority, without the need for any or all High or Medium Severity Problem Reports to be cleared. When providing that agreement, the FFGSPO Project Authority is required by the contract to take into account risk assessments provided by the Prime Contractor.

4.14 In December 2006 HMAS *Sydney* received Provisional Acceptance even though the number of High and Medium Severity Problem Reports significantly exceeded the numbers agreed to in the Contract's Attachment AG. DMO advised the ANAO that the decision to grant Provisional Acceptance was made in conjunction with the Chief of Navy and the Fleet Commander having regard to strategic considerations and the overall interests of Defence. This occurred after consultations with the Navy capability customers, which aimed to maintain focus on achieving the required capability for operational deployments, with the highest level of confidence in the safety and fitness for service of those systems, with well-understood risk mitigation measures and plans to remedy known deficiencies.

4.15 DMO further advised that the knock-on effects of FFG non-availability, capability shortfalls and risk mitigations were considered by the Head of Maritime Systems in DMO and the Fleet Commander in the FFG Upgrade Board of Review, and the Chief of Navy Senior Advisory Committee. The FFG Project Authority advised the ANAO that he was guided by advice obtained from that process when assessing the impacts of problems and defects at Provisional Acceptance.

4.16 Consequently, HMAS *Sydney* was presented for Provisional Acceptance with 16 unresolved High Severity Problem Reports and 102 unresolved Medium Severity Problem Reports. The Problem Report data shown in Figure 4.2 indicate the Prime Contractor faces a major backlog of effort to reduce the number of Problem Reports to below the limits specified for Acceptance. The Prime Contractor advised the ANAO in October 2007 that it is maintaining steady progress in resolving the problem counts toward the required level at Acceptance in 2008.

# Integrated logistics support

4.17 The Prime Contractor is responsible for delivering a selection of Integrated Logistics Support items needed to assist DMO to develop and integrate an effective FFG in-service support programme. These items include:

- Technical information such as drawings, equipment operation and planned maintenance documentation, publications and reports, needed for the safe and effective operation and maintenance of the upgraded FFGs. These take the form of Ship Selected Records and System Manuals;
- Organisational Level Maintenance training courses and facilities; and
- Operator training courses and facilities.

## Ship Selected Records and System Manuals

4.18 The Prime Contractor was contracted to deliver the Final Ship Selected Records to the FFGSPO for review and comment one month after Provisional Acceptance of each Upgraded FFG. Some eight months after the Provisional Acceptance of HMAS *Sydney*, only 84 per cent of the Ship Selected Records delivered by the Prime Contractor were considered to be final editions by DMO, and 50 per cent of the records had been verified as acceptable for publication by the relevant Level 2 Engineer. The Prime Contractor was also contracted to deliver Final Systems Manuals to DMO for acceptance two months after Provisional Acceptance of the first upgraded FFG. As at August 2007, only 38 per cent of the system manuals delivered by the Prime Contractor were considered by the Prime Contractor and DMO to be of final edition standard and ready for verification processing by DMO. Systems most affected by this issue include the under water systems, Mark 92 Fire Control System.

4.19 The Prime Contractor advised the ANAO in October 2007 that it was not aware of any significant issues with HMAS *Sydney's* Ship Selected Records at Provisional Acceptance, and that the audit findings would be significantly different if September and October 2007 data were considered. The Prime Contractor further advised that all Ship Selected Records were provided to the Project Authority for HMAS *Sydney* as per the contract, however, the Project Authority was unable to review these within the contracted period of 20 days. The Prime Contractor considers that the lack of available Project Authority resources to review the large volume of data caused, and causes, the Contractor significant concerns, with consequential effects on contract requirements. Similarly, the Prime Contractor advised the ANAO that all Systems Manuals have now been delivered in final format, and that the majority of Equipment Manuals have been updated from initial format and delivered to the Project Authority.

## Equipment spares provisions

4.20 At the time of the audit fieldwork, FFGSPO had ordered Organisational-Level spares for all systems with the exception of Electronic Surveillance and Underwater Warfare Systems. FFGSPO was withholding the purchase of spares for these two systems until the documentation from the Prime Contractor matched their configurations. FFGSPO aims to procure the spares for all upgraded systems by 2008.

#### Equipment operator and maintainer training

4.21 The Prime Contractor is required to provide upgraded equipment Operator and Maintainer training for the First-of-Class and First Follow-on Ships (HMA Ships *Sydney* and *Melbourne*) undergoing upgrade. As at May 2007 this training had been delivered for Combat System Baseline Build 1. The Prime Contractor is also required to provide additional Operator and Maintainer training for HMAS *Sydney* and HMAS *Melbourne* personnel related to Combat System Baseline Build 2 and Baseline Build 3 configurations, once these builds are installed in these ships. The Prime Contractor advised the ANAO in October 2007 that initial training was conducted by the contractor in the absence of the Command Team Trainer, and that further training could have been carried out in the same way.

4.22 Navy is responsible for all follow-on and additional training utilising Command Team Trainer and Weapon System Support Centre equipment and facilities to be developed by the Prime Contractor. At the time of the audit these facilities were not sufficiently developed to fulfil all Navy personnel equipment Operator and Maintainer training requirements as they were not scheduled for Provisional Acceptance until November 2007 and November 2008 respectively.<sup>48</sup>

4.23 Consequently, Navy was unable to provide crews of the upgraded FFG with adequate Command Team Training, nor with adequate equipment Operator and Maintainer training. This presents risks for Navy in terms of HMAS *Darwin's* crew training, as that training is Navy's responsibility. As at mid 2007 these training risks were increasing as project schedule slippages necessitated repeat training for HMAS *Sydney* and HMAS *Melbourne* crews in line with crew changeovers. Navy's training risks also flow on to DMO, as fully trained Navy personnel are required for Category 5 Sea Acceptance Trials, and successful completion of these trials is one of the milestone precursors of each upgraded FFG's Provisional Acceptance.

4.24 As no upgraded FFGs have been accepted into Naval service, DMO remains responsible for delivering FFG Upgrade Training. Consequently, FFGSPO has contracted the Prime Contractor to deliver training courses to the

<sup>&</sup>lt;sup>48</sup> This represents a delay in the original scheduled delivering these facilities of 58 months and 55 months respectively. The June 1999 delivery schedule had the Team Trainer delivered in April 2002, and the Warfare Systems Support Centre in April 2004. Contract amendments in 2004, 2006, and 2007 set back the Team Trainer's Provisional Acceptance from March 2005 to November 2007, and its final Acceptance to December 2009. Contract amendments in 2004 and 2006 also set back the Weapon System Support Centres' Provisional Acceptance from May 2007 to November 2008, and its Acceptance to 31 December 2009.

crews of HMAS *Darwin, Melbourne* and *Sydney*, at a cost of \$1.6 million. DMO advised the ANAO that under the Prime Contract's Statement of Work, the contractor is entitled to assume that Defence personnel assisting in Category 1 to 5 tests and trials have been appropriately trained in the operation and maintenance of the upgraded systems. However, Defence was not able to organise this training as the documentation necessary to develop the training material was not in Defence's possession. Accordingly, the Prime Contractor was contracted to provide training to ensure the Commonwealth could meet its obligations, with respect to assisting in the conduct of tests and trials.

# Hazard Risk Assessments

4.25 The defects and deficiencies documented in HMAS *Sydney's* TI-338 were subjected to Hazard Risk Assessments by subject matter experts in FFGSPO, the assessments are verified by FFGSPO's Heads of Departments, and signed-off by the FFG Upgrade Project Manager.<sup>49</sup>

4.26 The FFGSPO's Hazard Risk Assessment process assesses each hazard in terms of likelihood and severity from the perspectives of:

- personnel safety;
- mission capability;
- fitness for service; and
- environmental impact.

4.27 FFGSPO applies a Hazard Risk Index table to the resulting likelihood and severity assessments to yield an index number between one and 20. An index value of one signifies catastrophic severity and frequent occurrence likelihood; and an index value of 20 signifies minor severity and improbable likelihood.

4.28 Figure 4.3 provides FFGSPO's overall Hazard Risk Assessment of the 802 hazards associated with the 257 open non-conformance reports listed in HMAS *Sydney's* April 2007 TI-338. The figure shows FFGSPO rated the vast majority of hazards as having a Hazard Risk Index (HRI) of greater than nine (the lower the HRI, the greater the risk), which is interpreted in Navy regulations as tolerable with periodic review, or acceptable with periodic review.

<sup>&</sup>lt;sup>49</sup> The TI-338 at Provisional Acceptance is signed off by both the FFGSPO Project Authority and the Prime Contractor's Project Director.

### Figure 4.3



HMAS Sydney's Hazards by Category, as at June 2007.

Source: Defence Materiel Organisation, FFG System Program Office.

4.29 All 12 of the hazards with higher severity and impact were rated by FFGSPO as having a hazard risk of eight, which the regulations state are tolerable with continuous review. As the statistics suggest, each hazard potentially affects one or more categories in Figure 4.3.<sup>50</sup>

# HMAS Sydney's progress to Initial Operational Release

4.30 HMAS *Sydney's* Initial Operational Release did not occur in May 2007 as scheduled, and an FFG Upgrade Board of Review, jointly headed by DMO's Head Maritime Systems Division and Navy's Fleet Commander was reviewing the situation, at the time of this report's completion.

## HMAS Sydney's Safety Case

4.31 The FFGSPO is required by Navy Regulations to produce a Safety Case for the FFG Upgrade. Safety Cases are required to demonstrate how hazards are identified, managed and monitored through the life of the capability. Safety cases are a component of the Navy Regulatory System and are required

<sup>&</sup>lt;sup>50</sup> As the defects and deficiencies listed in HMAS Sydney's TI-338 are under corrective action by the Prime Contractor and continuous review by FFGSPO, the numbers presented in the Table are likely to change over time.

to demonstrate due diligence has been applied to the Occupational Health and Safety implications of the introduction into service of new equipment and systems.<sup>51</sup>

4.32 FFGSPO has developed an evolving Safety Case for HMAS *Sydney*, which focuses on the deficiencies documented in HMAS *Sydney's* TI-338. The eight regulatory areas reviewed HMAS *Sydney's* Safety Case twice, the Safety Case release of November 2006 and of April 2007. Neither was endorsed by several of the regulators. The regulators' reasons for not endorsing the Safety Case included issues such as:

- the Software Development Programme not adhering to the contracted Software Development and Documentation Standards and System Safety Programme Requirements;<sup>52</sup>
- the Integrated Logistics Support safety assessments do not detail risk treatments for technical data deficiencies, such as deficient maintenance and operator manuals, against individual upgraded systems. The lack of detail prevented the formation of a satisfactory opinion about the risk that exists against the whole of the Integrated Logistics Support; and
- the Safety Case required significant further development such as detailing the controls put in place to manage residual risks, and the periodic review process that ensured the residual risks controls remained effective.

The Prime Contractor advised the ANAO in October 2007 that it has not been made aware of these issues, and that it does not believe there is any objective evidence supporting this perception. The ANAO considers that this is a matter for Defence and DMO to resolve when appropriate with the Prime Contractor.

4.33 The Chief Naval Engineer in May 2007 did not endorse HMAS *Sydney's* Safety Case, and he recommended that a number of operational restrictions be placed on the ship. The Prime Contractor advised the ANAO in October 2007 that it has not received feedback on this issue.

<sup>&</sup>lt;sup>51</sup> ABR 6303, Safety Management System – Navy Risk Management, Part 2 Chapter 5.

<sup>&</sup>lt;sup>52</sup> The FFG Upgrade Project's tailored version of MIL-STD-498, *Software Development and Documentation*; and MIL-STD-882C, *System Safety Program Requirements.* 

## HMAS Sydney's TI-338

4.34 Navy Systems Command reviewed HMAS *Sydney's* TI-338 versions of February 2007 and of April 2007. The Chief Naval Engineer in February 2007 raised the following concerns regarding the TI-338's use as a primary vehicle to support HMAS *Sydney* proceeding to Initial Operational Release:

- the number of requirements listed as non-conforming, requirements that had not been offered by the contractor, and requirements not reviewed by the FFGSPO resulted in the HMAS *Sydney's* overall compliance status remaining uncertain. The Prime Contractor advised the ANAO in October 2007 that the compliance status is only uncertain because B-TAP has not yet completed;
- significant numbers of unresolved issues existed concerning ADACS Baseline Build 1 Combat Management System software technical integrity. These issues included five 'High Severity' Software System Integration Problem Reports not being rectified in Baseline Build 1. The Prime Contractor advised the ANAO in October 2007 that the impact on capability and safety was clearly articulated at the System Verification Review; and
- serious concerns existed regarding the integrity of gathered Test and Trial Objective Quality Evidence.

4.35 In May 2007 the Chief Naval Engineer found that whilst many issues called into question the fitness for service of the platform for continuing NOTE [Naval Operational Test and Evaluation] activities, of greater concern was the degree of doubt surrounding the safety of the systems for the NOTE period. Consequently the Chief Naval Engineer could not endorse HMAS *Sydney's* TI-338 for Initial Operational Release. The Prime Contractor advised the ANAO in October 2007 that it has never been made aware of the details of Chief Naval Engineer's rejection.

4.36 Based on the difficulties in gaining the required endorsement of HMAS *Sydney's* Safety Case and TI-338, it appears likely DMO and Navy will experience continuing delays in HMAS *Sydney* achieving Initial Operational Release, and transitioning to Naval Operational Test and Evaluation. This would result in significant flow-on affects to the remainder of Navy's FFG fleet.

4.37 DMO advised the ANAO that the deficiencies with HMAS *Sydney's* Underwater Warfare System, Electronic Support System and Australian

Distributed Architecture Combat System software are presenting significant challenges for DMO and Navy. However, DMO, Navy and the contractor have developed, or are in the process of developing, strategies to address these issues. DMO further advised it should be recognised that the upgrade of the FFGs is a complex project and involves systems of a developmental nature. On this basis, there are clearly risks associated with the Initial Operational Release of HMAS *Sydney*, but these risks are being actively managed by DMO, Navy and the contractor.

4.38 DMO advised the ANAO that it is acknowledged there is the potential for significant flow-on effect to the remainder of Navy's FFG Fleet. This was recognised and strategies developed and agreed with Navy for HMAS *Sydney* to undertake a 'First of Class' role in addressing known and perceived deficiencies with the above mentioned systems in an operational context, with Early Operational Assessment trials. Underwater trials are now programmed for October 2007 in Canada. Additionally, it was agreed with Navy that the implementation of Baseline Build 2 functionality, Evolved Sea Sparrow Missile (ESSM) capability be brought forward and a parallel trials programme implemented with HMAS *Melbourne.* This has required a contract change but has resulted in ESSM firings on the East Australia Exercise area in August 2007. Initial results from these firings indicate the shipboard system performance was to design.

4.39 The TI-338 process contains multiple certificates giving effect to Provisional Acceptance, notwithstanding the existence of class defects, contractor non-compliances and other obligations to be met prior to final Acceptance. DMO advised that it is misleading to infer that existence of any non-compliance is by definition a barrier to employing the capability. If that were applied in practice, the capability customer, Navy, would never receive a usable product. DMO further advised that the TI-338 captures known deficiencies, and allows Navy to operate the capability within safe limits as an informed customer.

# Increasing urgency to resolve systems development and verification issues

4.40 The May 2006 Deed of Settlement and Release provided for the Handover to the Prime Contractor of the third FFG to be upgraded (HMAS *Darwin*) after HMAS *Sydney's* Provisional Acceptance. Consequently, as at September 2007 two of the Navy's remaining five FFGs were undergoing the FFG Upgrade and one was undergoing early operational assessment under Navy's control. At the same time, the Prime Contractor was working to resolve HMAS *Sydney's* Underwater Warfare and Electronic Support Systems' deficiencies.

4.41 Even though FFGSPO has made considerable progress in verifying the FFGs were being upgraded in accordance with the contracted requirements, there still remains increasingly complex systems development work ahead through 2008. DMO advised the ANAO that the approach taken in the context of both the global settlement of claims in May 2006 and the grant of Provisional Acceptance of HMAS *Sydney* in December 2006 was to put aside questions of fault and responsibility, and for DMO to work collaboratively with the Prime Contractor towards developing solutions which in the opinion of senior Defence, DMO and FFGSPO officers, as well as external commercial advisers, were considered to be ultimately in the Commonwealth's strategic and commercial benefit.

4.42 There appears considerable justification for DMO to increase the expertise available to FFGSPO and its Technical Support Agencies, so that FFGSPO can continue working collaboratively with the Prime Contractor using expertise aligned with the project's increasing complex requirements verification and systems engineering issues.

# **Recommendation No.3**

4.43 The ANAO recommends that Defence Materiel Organisation consider the cost and benefits of engaging additional resources to assist FFG Upgrade Project's requirements verification programme.

## **Defence and DMO response**

4.44 Additional resources will be provided to assist FFGSPO to expedite the resolution of the FFG Upgrade Project's increasingly complex requirements verification and associated systems engineering issues.

~ ~\_\_\_\_

Ian McPhee Auditor-General

Canberra ACT 31 October 2007

ANAO Audit Report No.11 2007–08 Management of the FFG Capability Upgrade Appendices

ANAO Audit Report No.11 2007–08 Management of the FFG Capability Upgrade

# Appendix 1: FFG Upgrade Combat System

 The Contract allows the Prime Contractor to develop the combat system software and/or the software for any support facility in more than one software build. This has enabled to FFG Upgrade Prime Contractor to divide the FFG Upgrade into the following three Baseline Builds of software development.

### Table A 1

#### **Combat System Software Builds**

| Software<br>Build   | Build Target  | Systems  | Subsystems   |
|---|---|--|--|
| Baseline<br>Build 1 -<br>1 221<br>requirements            | New and<br>retained<br>equipment that<br>provide at least<br>the pre-upgrade<br>FFG capabilities          | Combat System<br>Sensors,<br>Combat Data<br>System and<br>Missile Fire<br>Control System | Long Range Radars and Navigation<br>Radars, Guided Missile Fire Control<br>System, SM-1 Area Air Defence Missile<br>System, Close-In Weapon System,<br>Infrared and Acoustic Decoy System,<br>Underwater Warfare System, Electronic<br>Support System, Radar Integrated<br>Automatic Detection & Tracking System |
| Baseline<br>Build 2 – an<br>additional 56<br>requirements |   | Missile<br>Systems, and<br>Electro-Optic<br>Tracking<br>System                           | Vertical Launch System, Evolved Sea<br>Sparrow Missile System, SM-2 Block IIIA<br>Area Air Defence Missile System  |
|   | New weapons<br>capabilities and<br>completion of<br>non-Command<br>and Control<br>Systems                 |  | Electro-Optic Tracking System  |
|   |   | Combat Data<br>System  | Human Machine Interface supporting<br>SM-2 and the Electro-Optic Tracking<br>System  |
|   |   | On Board<br>Training<br>System   | Shipboard Data Link Simulation and Stimulation   |
|   | Completion of<br>required data-<br>link and other<br>Command and<br>Control<br>Subsystem<br>functionality | Combat System  | Surface (Maritime) Command and<br>Control Tactical Data Information Link   |
| Baseline<br>Build 3 – an<br>additional 64<br>requirements |   |  | Digital Air Control of non-Command and<br>Control Fighter Aircraft   |
|   |   |  | Beacon Video Processors for<br>Identification  |
|   |   |  | Integration of Electro-Optic Tracking<br>System into the Command and Control<br>System   |
|   |   |  | Human Machine Interface supporting the above systems   |

Source: Defence Materiel Organisation, FFG System Program Office.

2. The Combat System is integrated using newly developed computer hardware and software. Figure A1 provides an indication of the scope of the integration task.

## Figure A 1

FFG Upgrade Combat System simplified block diagram.



Source: Based on Defence Materiel Organisation, FFG System Program Office records.

# Appendix 2: Engineering Reviews and Test and Trials Activities

## Table A 1

## Engineering reviews and tests conducted at development facilities.

| Activity Name                       | Activity Description   |
|-------------------------------------|--|
| System<br>Requirements<br>Review    | This review is conducted to ensure that all system and performance<br>requirements derived from the Function and Performance Specification are<br>defined and consistent with cost, schedule, risk, and other system constraints.<br>The review ensures consistency between the system requirements and the<br>preferred system solution and available technologies.   |
| System<br>Function<br>Review        | This review is conducted to ensure that the system under review can proceed<br>into preliminary design, and that all system requirements and functional<br>performance requirements derived from the Function and Performance<br>Specification are defined and are consistent with cost, schedule, risk, and<br>other system constraints.  |
| Software<br>Specification<br>Review | As system design decisions are made, typically some functions are allocated<br>to hardware items, while others are allocated to software. A separate<br>specification is developed for software items to describe the functions,<br>performance, interfaces and other information that will guide the design and<br>development of software items.   |
| Preliminary<br>Design Review        | This review is conducted to ensure that the system under review can proceed<br>into detailed design, and can meet the stated performance requirements within<br>cost, schedule, risk, and other system constraints. Generally, this review<br>assesses the system preliminary design as captured in performance<br>specifications for each configuration item in the system (allocated baseline),<br>and ensures that each function in the functional baseline has been allocated to<br>one or more system configuration items. Configuration items may consist of<br>hardware and software elements.  |
| Critical Design<br>Review           | This review is conducted to ensure that the system under review can proceed<br>into system fabrication, demonstration, and test; and can meet the stated<br>performance requirements within cost, schedule, risk, and other system<br>constraints. Generally this review assesses the system final design as<br>captured in product specifications for each configuration item in the system<br>(product baseline), and ensures that each product in the product baseline has<br>been captured in the detailed design documentation. Product specifications for<br>hardware enable the fabrication of configuration items, and may include<br>production drawings. Product specifications for software (e.g., Software Design<br>Documents) enable coding of a Computer Software Configuration Item.<br>Configuration items may consist of hardware and software elements, and<br>include items such as weapons, crew systems, engines, trainers/training. |

| Test<br>Readiness<br>Review  | A review conducted for each configuration item to determine whether the test procedures are complete and to assure that the contractor is prepared for formal configuration item testing. Test procedures are evaluated for compliance with test plans and descriptions, and for adequacy in accomplishing test requirements. At the Test Readiness Review, the contracting agency also reviews the results of informal testing and any updates to the operation and support documents. A successful Test Readiness Review is predicated on the contracting agency's determination that the test procedures and informal test results form a satisfactory basis for proceeding into formal system configuration item testing.            |
|--|--|
| Category 0<br>Tests -<br>Design and<br>Engineering<br>Development<br>Tests.                                      | These tests apply to individual equipment items, hardware and software. They are required during the detailed engineering design stage of development and aim to verify compliance with technical performance specifications. They are to be completed prior to commencement of Category 1 testing for that particular item. Design and Engineering Tests are not required for equipment that is in service onboard service combatants with the RAN or a foreign Navy with standards acceptable to the Project Authority.  |
| Category 1<br>Tests -<br>Factory<br>Acceptance<br>Tests  | The purpose of Category 1 tests is to verify that all system and interface requirements have been met. System Test Procedures and System Test Reports are required to be recorded in the Prime Contractor's test database. The Prime Contractor is responsible for Category 1 tests, however this responsibility may be allocated to sub-contractors that developed the respective systems.  |
| Initial Stress<br>Test   | Initial Stress Tests involve subjecting items under test to extreme operational loads in order to measure their tolerance to software failures. These loads are designed to exceed the maximum rate of inputs and likely to occur in real operational and tactical situations.   |
| Category 2<br>Tests -<br>Environmental<br>Qualification<br>Tests.  | These tests demonstrate that individual equipment types/items are able to operate in adverse environmental conditions as stipulated in the Contract. Environmental testing is not required for equipment that is in service onboard service combatants with the RAN or a foreign Navy with standards acceptable to the Project Authority. Category 2 testing, as applicable to the relevant equipment, will be conducted after Category 1 testing for equipment not already qualified and must be completed prior to release of equipment for Category 3, 4 or 5 testing.  |
| Category 3<br>Tests -<br>System<br>Development<br>Integration<br>Tests at<br>System<br>Integration<br>Laboratory | These intra-system tests are conducted to demonstrate that the system resulting from the integrated equipment items under development will meet operational and functional requirements of the Contract Specification. Details of the System Development Tests are contained within the Statement of Work and the Contract Specification. Category 3 integration testing, as applicable to the relevant equipment items, will be completed before the commencement of the applicable Category 4 Stage 5 testing for the lead ship. Similarly, Category 3 tests will be completed before the commencement of installation acceptance (Category 4) testing at the Land Based Test Site, as applicable to the relevant equipment or system. |

Source: ANAO, based on general systems engineering documents, ABR 6205 – Naval Test, Evaluation and Acceptance Manual, and FFG Upgrade Test and Evaluation Management Plan.

## Table A 2

## Engineering reviews and test activities conducted onboard each ship.

| Activity   | Description   |
|--|---|
| Test Readiness<br>Review   | A review conducted for each configuration item to determine whether the test<br>procedures are complete and to assure that the contractor is prepared for<br>formal computing system configuration item testing. Test procedures are<br>evaluated for compliance with test plans and descriptions, and for adequacy<br>in accomplishing test requirements. At the Test Readiness Review, the<br>contracting agency also reviews the results of informal testing and any<br>updates to the operation and support documents. A successful Test<br>Readiness Review is predicated on the contracting agency's determination<br>that the test procedures and informal test results form a satisfactory basis for<br>proceeding into formal system configuration item testing. |
| System Stress<br>Test  | System Stress Tests are also designed to place the system under high-loads<br>in order to reveal if the system can operate continuously at maximum<br>specified values.   |
| Category 4<br>Tests -<br>Shipyard<br>Installation and<br>Contractor<br>Acceptance<br>Tests | These tests consist of shipyard and contractor Harbour Acceptance Trials (HATs) that evaluate the performance of equipment and systems once the systems have been installed into the ship. The Contractor shall conduct the testing of shipboard equipment and systems in six stages with each stage adding to the results of the previous stages. The stages will confirm the satisfactory operation of all systems on the Upgraded FFG and ensure the retained or new systems or machinery are ready for Provisional Acceptance.  |
| Category 5<br>Tests -<br>Sea Acceptance<br>Trials  | These consist of Contractor's Delivery Tests, and are to be conducted once<br>Fleet Headquarters and Ships Staff have completed necessary post<br>production work and Sea Safety Checks, providing approval for the ship to<br>proceed to sea. The contractor conducts the trials to prove the performance<br>of the upgraded systems and provides personnel to monitor and adjust the<br>supplies and test equipment during the trials. The Category 5 sea<br>acceptance testing occurs immediately prior to Provisional Acceptance.   |
| Configuration<br>Audits  | Functional Configuration Audits comprise formal audits to validate that the development of a configuration item has been completed satisfactorily and that the configuration item has achieved the performance and functional characteristics specified in the functional or allocated configuration identification. In addition, the completed operation and support documents shall be reviewed.<br>Physical Configuration Audits comprise technical examinations of a designated configuration item to verify that the configuration item 'As Built' conforms to the technical documentation which defines the configuration item.   |
| System<br>Verification<br>Review   | The Functional Configuration Audits and Physical Configuration Audits<br>combined with a consolidating Systems Requirements Review re-examine<br>and verify the customer's needs, and the relationship of these needs to the<br>system and subsystems technical performance descriptions. They determine<br>if the system produced is capable of meeting the technical performance<br>requirements established in the specifications.   |

| Activity                  | Description   |
|---------------------------|---|
| Provisional<br>Acceptance | The certification by the Project Authority that the Contractor has fulfilled its contractual obligations in respect of any upgraded systems or upgraded facilities listed on a Supplies Release Note (SG8), subject to any omissions or defects listed on that SG8, and that those upgraded systems or upgraded facilities conform with the requirements of the Contract, and Provisional Acceptance is subject to Acceptance and Final Acceptance. |

Source: ANAO, based on general systems engineering documents, ABR 6205 – Naval Test, Evaluation and Acceptance Manual, and FFG Upgrade Test and Evaluation Management Plan.

#### Table A 3

#### Navy acceptance test and trials.

| Activity   | Description  |
|--|--|
| Category 6 -<br>Operational<br>Test and<br>Evaluation      | Category 6 testing is Operational Test and Evaluation (OT&E). OT&E is<br>conducted in an 'as-realistic' operational environment as possible, when the<br>capability is maintained and operated by sailors, subjected to routine wear-<br>and-tear, and employed in typical combat conditions against a simulated<br>enemy who fights back. It is designed to test a capability's effectiveness and<br>sustainability against Critical Operational Issues in order to inform<br>recommendations to be made to Chief of Navy on Operational Release (OR)<br>and subsequent Operational Employment of the capability. |
| Category 7 -<br>Follow-on<br>Operational<br>Analysis Tests | Category 7 tests comprise any operational sea trial devised to assess the extent to which a ship and its systems can operate at levels beyond the originally contracted or currently approved performance envelope. Category 7 tests can be initiated by Navy at any time during the post-acceptance life of the ship in response to scenario planning or new operational environments or requirements.  |

Source: ABR 6205 – Naval Test, Evaluation and Acceptance Manual.

# Appendix 3: Glossary

- Acceptance 'Acceptance' means the certification by the Project Authority that the Contractor has fulfilled its contractual obligations in respect of any item or items of the Supplies or for an upgraded FFG or upgraded facility or Upgraded Software listed on an SG1, subject to any omissions or defects listed on that SG1, and that those Supplies or upgraded FFG or upgraded facility or Upgraded Software conform with the requirements of the Contract, and Acceptance is subject to Final Acceptance.
  - Source: FFG Upgrade Contract.
- Acquisition Involves purchasing, leasing or other ways by which the DMO procures a materiel capability or system for use by the Australian Defence Force. Source: Defence Capability Development Manual 2006.
- Acquisition Phase This is the third of the five-phase Defence capability life cycle. The Acquisition Phase is the process of procuring an appropriate materiel system to meet the identified requirements while achieving the best value for money over the life of the system. Source: Defence Capability Development Manual 2006.
- Capability The power to achieve a desired operational effect in a nominated environment within a specified time and to sustain that effect for a designated period. Capability is generated by Fundamental Inputs to Capability comprising organisation, personnel, collective training, major systems, supplies, facilities, support, command and management. Source: Defence Capability Development Manual 2006.
- Defence Materiel A prescribed agency, the DMO's purpose is to equip and sustain Organisation Australia's Defence Force. It is accountable directly to the Minister for Defence on matters under the Financial Management and Accountability Act 1997, while remaining accountable to the Secretary of Defence and Chief Defence Force for administration under the Public Service and Defence Acts. Source: Defence Capability Development Manual 2006.
- Disposal Phase The last of the five-phase Defence Capability Life Cycle, and occurs once the materiel system reaches the end of its life. Source: Defence Capability Development Manual 2006.
- Earned Value Earned Value is a set of Best Practice Project Management Principles that integrate Cost, Schedule and Technical Performance. It establishes objective measures of the actual work achieved compared to the plan for that work, and is mandated in Defence Materiel Organisation policy, with the level of application decided depending upon contract value, risk and duration. Source: <a href="http://www.defence.gov.au/dmo/esd/evm/index.cfm">http://www.defence.gov.au/dmo/esd/evm/index.cfm</a>, available July 2007.
- Equipment All materiel items except consumables. May be qualified by referring to items as major or minor capital equipment. Source: Defence Capability Development Manual 2006.

Final Acceptance 'Final Acceptance' means the certification by the Project Authority that the Contractor has fulfilled all its contractual obligations in respect of achieving Acceptance of the Upgraded FFGs, Acceptance of the Upgraded Software and Acceptance of those Supplies required to be supplied prior to Final Acceptance, subject to any omissions or defects listed on an SG1, and that the FFGs, facilities, Upgraded Software and all of the Supplies conform with the requirements of the Contract. Final Acceptance is signified by the Project Authority signing an SG1 (Attachment H Part 2). For the purpose of Final Acceptance, the contractual obligations surviving under clause 18.7 will not be unreasonably used in delaying the signing of the SG1.

Source: FFG Upgrade Contract.

- First Pass Approval The process that gives Government the opportunity to narrow the alternatives being examined by Defence to meet an agreed capability gap. First Pass Approval allocates funds from the Capital Investment Programme to enable the options endorsed by Government to be investigated in further detail, with an emphasis on detailed cost and risk analysis. Source: Defence Capability Development Manual 2006.
- Initial Operational Capability The point in time at which the first subset of a capability system that can be operationally employed is realised. IOC is a capability state endorsed by Government at Second Pass and reported as having been reached by the capability manager. Source: Defence Capability Development Manual 2006.
- Initial Operational Initial Operational Release of the capability is the milestone at which Chief of Navy (CN) on the advice and recommendation of the Fleet and Navy Systems Commanders, is satisfied that the operational and materiel state of the Capability and associated deliverables are sufficiently safe, fit-for-service and environmentally compliant to proceed to the Naval Operational Test and Evaluation (NOTE) period. It is also the milestone, where any delivery deficiencies with agreed contractual remedies are manageable within the NOTE period and are appropriately mitigated at this stage of the programme. IOR also marks the change in ownership from the DMO to Navy. Despite this change in ownership, the Project Manager and Contractor retain respective project management and warranty obligations. Source: Defence Materiel Organisation advice to the ANAO, September 2007.

- Initial Operational Navy's Initial Operational Release process requires Chief of Navy to Release process authorise the employment of the capability to enter the Naval Operational Test and Evaluation period. This authorisation is based on the formal advice provided by the Fleet and Systems Commanders during their review of the Initial Operational Release report created by the Director of the Royal Australian Navy's Test, Evaluation and Analysis Authority The Operational Release (DRANTEAA). Initial report makes assessments and recommendations regarding the operational and materiel state of the capability based on the advice of the eight Naval Regulatory Authorities in their consideration of the TI-338 and Safety Case. On completion of the Navy Regulator's analysis and endorsements, facilitated by Systems Command's Director Naval Certification, DRANTEAA collates these results in addition to the results of Contractor Sea Trials, Ship's Staff observations, and the Capability Risk Statement produced by Director Naval Certification and produces an Initial Operational Capability Report. Source: Defence Materiel Organisation advice to the ANAO, September 2007.
- In-Service Date The point in time that symbolically marks the beginning of the transition of a capability system, in part or full, from the Acquisition Phase to the In-Service Phase. In-Service Date coincides as closely as is practicable with Initial Release. Source: Defence Capability Development Manual 2006.
- Life Cycle The whole life of a particular item/system/process, from identification of a capability need. Source: Defence Capability Development Manual 2006.
- Life of Type The estimated time, for planning purposes, for which an item will be a current service requirement. Source: Defence Capability Development Manual 2006.
- Liquidated An amount agreed between the parties to a contract as a genuine preestimate of damages to be recoverable from the party in the event of specified breaches of contract. Source: Defence Procurement Policy Manual Version 6.0, 2006
- Major CapitalEquipment projects of \$20 million or more, or of less than \$20 million butEquipmentwith individual items of \$1 million or more, or equipment projects of less<br/>than \$20 with strategic significance. Source: Defence Capability Development<br/>Manual 2006.
- Materiel All items of military equipment and related spares, repair parts and support equipment, (excluding real property, installations and utilities), necessary to equip, operate, maintain and support military activities without distinction as to its application for administrative or combat purposes. Source: Defence Capability Development Manual 2006.
- Materiel AcquisitionAn agreement between Capability Development Executive and DefenceAgreementMateriel Organisation, which states in Agreement concise terms what<br/>services and products the Defence Materiel Organisation (as supplier)<br/>will deliver to Capability Development Executive, for how much and<br/>when. Source: Defence Capability Development Manual 2006.
- Military Capability The combination of force structure and preparedness that enables the nation to exercise military power. Source: Defence Capability Development Manual 2006.

- Objective Evidence Objective Evidence is information that can be proved true, based on facts obtained through observation, measurement, test or other means. Source: Defence Procurement Policy Manual Version 6.0, 2006
- Off-the-Shelf A product that is available for purchase, and will have been delivered to another military or Government body or commercial enterprise in a similar form to that being purchased at the time of the approval being sought (First or Second Pass). An option put forward at First Pass that was not considered off-the-shelf at that time, but which meets the criteria at Second Pass, may be considered as an off-the-shelf option at Second Pass. Source: Defence Capability Development Manual 2006.
- Operational Release Will occur when the Chief of Navy (CN), on the advice and recommendation of the Fleet and Navy Systems Commanders, is satisfied that the equipment is in all respects suitable for operational service. CN must also be satisfied that sufficient information on the capability is held to allow for its safe and effective employment in service. OR relieves the project authority from any further financial responsibilities although DMO retains responsibility for through-life support.
- Project The activity of managing projects undertaken by and/or contracted Management Management out by Defence, to achieve stated objects through the application of planned strategies and processes within predefined constraints, including project scope, costs, time, quality and stakeholder satisfaction. Source: Defence Capability Development Manual 2006.
- Project Describes the plan that provides a summary of the project phase Management Plan Management Plan including what, how and when activities are to be done, who is responsible, the budget and risk associated with these activities. The Project Management Plan is a summary level document supported by detailed subordinate planning documents. Source: Defence Capability Development Manual 2006.
- Provisional Acceptance' means the certification by the Project Authority Acceptance 'Provisional Acceptance' means the certification by the Project Authority that the Contractor has fulfilled its contractual obligations in respect of any upgraded FFGs or upgraded facilities listed on a Supplies Release Note (SG8) (Attachment H Part 4), subject to any omissions or defects listed on that SG8, and that those upgraded FFGs or upgraded facilities conform with the requirements of the Contract, and Provisional Acceptance is subject to Acceptance and Final Acceptance. Provisional Acceptance is signified by the Project Authority signing an SG8. Source: FFG Upgrade Contract.
- Quality Assurance Quality Assurance is all those planned and systematic actions necessary to provide confidence that goods and services will satisfy the contracted requirements for quality. Source: Defence Procurement Policy Manual Version 6.0, 2006.

Second PartySecond Party Certification is that conducted by Defence under its<br/>programme of Defence Register of Accredited Suppliers. Source: Defence<br/>Procurement Policy Manual Version 6.0, 2006

Second Pass The final milestone in the Requirements Phase, at which point Approval Government Approval will endorse a specific capability solution and approve funding for the Acquisition Phase. The project cannot proceed to the Acquisition Phase until this approval is obtained from Government. Source: Defence Capability Development Manual 2006.

- Statement of Work A Statement of Work forms part of a contract, and is a statement of the requirement to be delivered under the contract. Source: Defence Procurement Policy Manual Version 6.0, 2006
- System An integrated composite of people, products and processes that provide a capability to satisfy a stated need or objective. A system is a combination or assembly of hardware, software, principles, doctrines, methods, ideas, procedures and personnel, or a combination of these, arranged or ordered towards a common objective. Source: Defence Capability Development Manual 2006.
- Systems An interdisciplinary approach that encompasses the entire technical Engineering effort, and evolves into and verifies an integrated and life cycle balanced set of system people, products, and process solutions that satisfy customer needs. Source: Defence Capability Development Manual 2006.
- Technical SupportAre those agencies that are responsible for ensuring the design,<br/>construction and maintenance of ADF ships and submarines are<br/>conducted to approved standards by capable engineering organisations<br/>comprising competent authorised individuals whose work is certified<br/>correct. Source: Royal Australian Navy ABR 6492 Navy Technical Regulations<br/>Manual, Volume 1, Section 1 Chapter 2, part 2.11.
- Test and Evaluation A process to obtain information to support the objective assessment of a capability system with known confidence, and to confirm whether or not a risk is contained within acceptable boundaries across all facets of a system's life cycle. Source: Defence Capability Development Manual 2006.
- Third PartyThird Party Certification is that conducted by an independent JointCertificationAccreditation System of Australian and New Zealand (JAS-ANZ)<br/>accredited certification body. Source: Defence Procurement Policy Manual<br/>Version 6.0, 2006
- Through Life Costs All the costs incurred once a capability, system or equipment has been introduced into service, including all the costs associated with ownership and disposal. Source: Defence Capability Development Manual 2006.
- Variable price Variable price contracts allow for elements of the contract to be varied during the period of the contract according to variation in certain specified cost factors. For example: variations in labour, material and exchange rates. Source: Defence Procurement Policy Manual Version 6.0, 2006.
- Whole-of-Life Costs Also known as life-cycle costs. The total costs of owning (or leasing), operating and maintaining an item over a specified period of time. Source: Defence Procurement Policy Manual Version 6.0, 2006.

# Appendix 4: Defence and DMO Response

DEFENCE AND DMO COMBINED RESPONSE TO THE ANAO REPORT ON THE MANAGEMENT OF THE FFG CAPABILITY UPGRADE PROJECT

Defence and DMO notes that the report provides an in depth assessment of the key events that have occurred over the life of the project, particularly since the 2005 ANAO Report on 'Management of Selected SPOs (FFG)' – Audit Report No.45 of 04/05.

The Guided Missile Frigate (FFG) Capability Upgrade is a highly technical project which involves the development and integration of complex systems (for example; combat system software scope and size exceeds two million source lines of code, notwithstanding the fact that electronic system hardware development and integration is occurring in conjunction with software development). By working collaboratively with the contractor, DMO continues to observe numerous improvements that are enabling the project to progress in an effective manner in efforts to realise delivery of the full upgraded FFG capability. These include increased production efficiencies and detailed risk assessments stemming from lessons learned from HMAS *Sydney*, and improvements in test and engineering review processes. These improvements also contribute to greater schedule certainty for the remainder of the upgrade program between now and delivery of the final FFG in 2009.

Underpinning the DMO's confidence in this project was HMAS *Sydney* successfully conducting the First-of-Class firing of the Evolved Sea Sparrow Missile (ESSM) against an unmanned airborne target on 20 Aug 07. The outcome provides additional confidence in the Australian Distributed Architecture Combat System (ADACS) software used to support this First-of-Class firing of the ESSM from the newly installed Vertical Launch System (VLS).

Since 1999 when the Prime Contract was awarded the DMO has implemented numerous procurement reform initiatives. Since the formation of DMO in 2000, the suite of ASDEFCON contracting templates have continually evolved and now provide the DMO with much improved requirements verification safeguards, previously lacking under the previous DEFPUR suite of templates. Further procurement reforms initiated under Kinnaird have strengthened the two pass system, which requires Defence to expend a greater proportion of it

project budget in pre-acquisition planning activities, including more rigorous requirements development processes.

Capability delays are also being effectively mitigated to minimise impact on fleet activities, including; extension of HMAS *Adelaide*, transfer of some operational tasking to other classes of ship and commissioning of ANZAC Frigates *Toowoomba* and *Perth*.

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