The Auditor-General
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Performance Audit

Multi-Role Helicopter Program

Department of Defence

Defence Materiel Organisation

Australian National Audit Office

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Australian National Audit Office

Canberra ACT
25 June 2014

Dear Mr President
Dear Madam Speaker

The Australian National Audit Office has undertaken an independent performance audit in the Department of Defence and the Defence Materiel Organisation titled *Multi-Role Helicopter Program.* The audit was conducted in accordance with the authority contained in the *Auditor-General Act 1997*. I present the report of this audit to the Parliament.

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

Yours sincerely

Ian 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

ADF	Australian Defence Force
AEO	Authorised Engineering Organisation
AIC	Australian Industry Commitments
AIOS	Acceptance Into Operational Service
AMO	Approved Maintenance Organisation
AMTC	Australian Military Type Certificate
CCP	Contract Change Proposal
CDD	Capability Definition Document
CDG	Capability Development Group
CFU	Carried Forward Unserviceability
DCP	Defence Capability Plan
DGA	Direction générale de l'armement (France's Defence Procurement Agency)
DMO	Defence Materiel Organisation
FPS	Function and Performance Specifications
FRRD	Fast Roping and Rappelling Device
MOTS	Military-Off-The-Shelf
MRH	Multi-Role Helicopter
NAHEMA	NATO Helicopter Management Agency
NATO	North Atlantic Treaty Organisation

NH90	NATO Helicopter for the 1990s
NH90 NFH	NH90 NATO Frigate Helicopter variant
NH90 TTH	NH90 Troop Transport Helicopter variant
NHI	NATO Helicopter Industries
OCD	Operational Concept Document
ODRP	Offer Development and Refinement Process
PRE ERC	pre-Expenditure Review Committee budget approval
PM&C	(Department of the) Prime Minister and Cabinet
RAN	Royal Australian Navy
RFP	Request for Proposal
SDGS	Self Defence Gun System
SOI	Statement of Operating Intent
SPO	Systems Program Office

Summary

Summary

Introduction

1. At a budgeted cost of $4.013 billion, the Multi-Role Helicopter (MRH90) Program is to acquire 47 helicopters and their support system for the Australian Defence Force (ADF). The program involves the acquisition of a single helicopter type to meet multiple capability requirements, and it is being implemented as part of Defence's AIR 9000 Program. The capability requirements include: troop lift helicopter operations from Royal Australian Navy (RAN) ships; utility helicopter operations to enable the Australian Army to respond swiftly and effectively to any credible armed lodgement on Australian territory; and more likely types of operations in Australia's immediate neighbourhood. In pursuing the acquisition, the then Australian Government recognised that ADF helicopters would be instrumental in the planned expansion of the ADF's amphibious deployment and sustainment capability.[1]

2. The multi-role helicopter acquisition was also a key component of Defence's 2002 *ADF Helicopter Strategic Master Plan*.[2] The overall aim of the Master Plan was to achieve acquisition and sustainment cost efficiencies by reducing the number of helicopter types in ADF service, and by increasing Australian industry capability to assemble and sustain the ADF's helicopter fleet within *Defence Capability Plan* price and schedule limits.[3] A core feature of the Master Plan was to form a partnership with a Prime Contractor to implement the AIR 9000 Program through a Strategic Partner Program Agreement. This Strategic Agreement was to complement long-term sole-source helicopter acquisition and sustainment contracts, through the sharing of goals, risks and communication strategies, and by providing for cost visibility and audit access.

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1 The $3.073 billion Joint Project 2048 Phase 4A/4B Amphibious Ships Program is responsible for the construction of two 27 000 tonne Canberra-class Landing Helicopter Docks (LHDs). These are to be named HMAS *Canberra* and HMAS *Adelaide*, and are scheduled to enter service in 2014 and 2015 respectively. Each LHD is designed to hangar up to 12 helicopters, and the integration of the MRH90 capability with the LHDs will be a significant aspect of the MRH90 Acceptance into Operational Service.

2 The *ADF Helicopter Strategic Master Plan* is discussed in Appendix 2.

3 The *Defence Capability Plan* lists major projects that Defence plans to present to government for approval over the next four years.

3. The AIR 9000 Program consists of eight phases. This audit considers the following four phases:

- Phase 1 produced the *ADF Helicopter Strategic Master Plan*;
- Phase 2 is to acquire a squadron of 12 MRH90 aircraft to provide the ADF with extra mobility for forces on operations, particularly amphibious operations. This phase received government Second Pass approval[4] in August 2004; and
- Phase 4 and Phase 6 are to acquire 28 MRH90 aircraft to replace Army's S-70A-9 Black Hawk aircraft, and six MRH90 aircraft to replace the retired RAN Sea King aircraft.[5] These phases received simultaneous Second Pass approval in April 2006.

4. In May 2013, Defence agreed to an offer of an additional MRH90 aircraft, the 47th, as part of a negotiated settlement and release of commercial, technical and schedule issues with the MRH90 Prime Contractor. Figure S.1 shows an MRH90 aircraft in a standard configuration.

4 The Second Pass approval process involves government endorsing a specific capability solution and approving funding for its acquisition.

5 The other phases of AIR 9000 are as follows: Phase 3 was to upgrade the RAN's S-70B-2 Seahawk aircraft, but this phase was replaced by Phase 8; Phase 5A is the engine upgrade for the CH-47D Chinook aircraft; Phase 5C is replacing the CH-47D Chinook with CH-47F Chinook aircraft; Phase 5D is the accelerated acquisition of two replacement CH-47D Chinook aircraft; Phase 7 is the new Helicopter Aircrew Training System (HATS); and Phase 8 is acquiring 24 MH-60R Seahawk aircraft to replace the RAN's S-70B-2 Seahawk aircraft.

Figure S.1: Multi-Role Helicopter (MRH90)

Source: Department of Defence.

5. During the audit, the MRH90 Program was dealing with a range of challenges related to immaturity in the MRH90 system design and the support system. The challenges include:

- resolving MRH90 cabin and role equipment design issues so that operational test and evaluation validates the MRH90 aircraft's ability to satisfy Operational Capability Milestones set by Army and Navy;
- the continuing need to conduct a wide range of verification and validation activities on problematic or deficient aircraft systems;
- increasing the reliability, maintainability and flying rate of effort of the MRH90 aircraft;
- embedding revised sustainment arrangements directed toward improving the value for money of these arrangements;
- establishing a revised Australian industry activities plan, including performance metrics;
- funding and managing the extended concurrent operation of the Army S-70A-9 Black Hawk and MRH90 aircraft fleets; and
- managing a Navy capability gap following the retirement of the RAN Sea King aircraft in December 2011.

Source selection and contractual arrangements

6. In May 2003, the Department of Defence (Defence) released a Request for Proposal (RFP) for AIR 9000 Phase 2 to three prospective suppliers. In response to the RFP, AgustaWestland offered the EH101 Merlin, Australian Aerospace Limited offered the NH90 (to be developed for Australia as the MRH90) and Sikorsky Aircraft Australia Limited offered the S-70M Black Hawk.[6] Following evaluation of the bids, the AgustaWestland EH101 offer was set aside and Defence pursued an Offer Development and Refinement Process (ODRP) for a combined Phases 2 and 4 with the two remaining bidders. This led to a Defence recommendation to the Minister for Defence in June 2004 that the S-70M Black Hawk be selected as the preferred aircraft for Phases 2 and 4.

7. In accordance with direction provided by the Minister for Defence and government, Defence developed alternate draft submissions, initially to ask ministers to choose between the two aircraft options—the MRH90 and S-70M Black Hawk—and later recommending acquisition of the MRH90 for Phase 2 only. In August 2004, government formally approved the acquisition of 12 MRH90 aircraft for Phase 2 on the basis that strategic and other government considerations outweighed the cost advantage of the Sikorsky proposal.

8. In June 2005, following protracted contract negotiations, Defence signed an acquisition contract with Australian Aerospace for the supply of 12 MRH90 aircraft and for an interim support system. The interim support system did not include important MRH90 aircraft support elements such as an electronic warfare self protection support cell, a ground mission management system, a software support centre, an instrumented aircraft with telemetry, and Full Flight and Mission Simulators. These support elements are critical for providing training and the ability to operate off ships. They were removed from the MRH90 acquisition contract to ensure AIR 9000 Phase 2 remained within its approved budget, and were added to the contract through later amendments, and at additional cost.[7] In July 2005, Defence signed an MRH90 sustainment contract and a Strategic Partner Program Agreement with Australian Aerospace.

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6 The Sikorsky S-70M Black Hawk is the direct commercial sale version of the Sikorsky UH-60M produced for the US Army, and shares the UH-60M design characteristics.

7 The final MRH90 aircraft support system includes an electronic warfare self protection support cell, a ground mission management system, a software support centre, an instrumented aircraft with telemetry, two Full Flight and Mission Simulators, and facilities infrastructure at Townsville, Oakey, Holsworthy and Nowra.

9. In November 2005, the Defence Capability Investment Committee (DCIC) agreed to seek a combined First and Second Pass approval for both Phase 4 and 6.[8] Defence developed two acquisition business cases: one for an MRH90 option and another for an S-70M Black Hawk option. An April 2006 Defence submission recommended the acquisition of the MRH90 to replace the Army S-70A-9 Black Hawk and Navy Sea King aircraft, on the basis that it was a better capability, and that the rationalisation of the utility helicopter fleet would generate lower through-life costs. Following formal government approval of the MRH90 option, the original acquisition contract with Australian Aerospace[9] was amended in June 2006 to include the additional 34 MRH90 aircraft and their support system. This brought to 46 the number of MRH90 aircraft to be acquired, with a 47th aircraft added in May 2013.

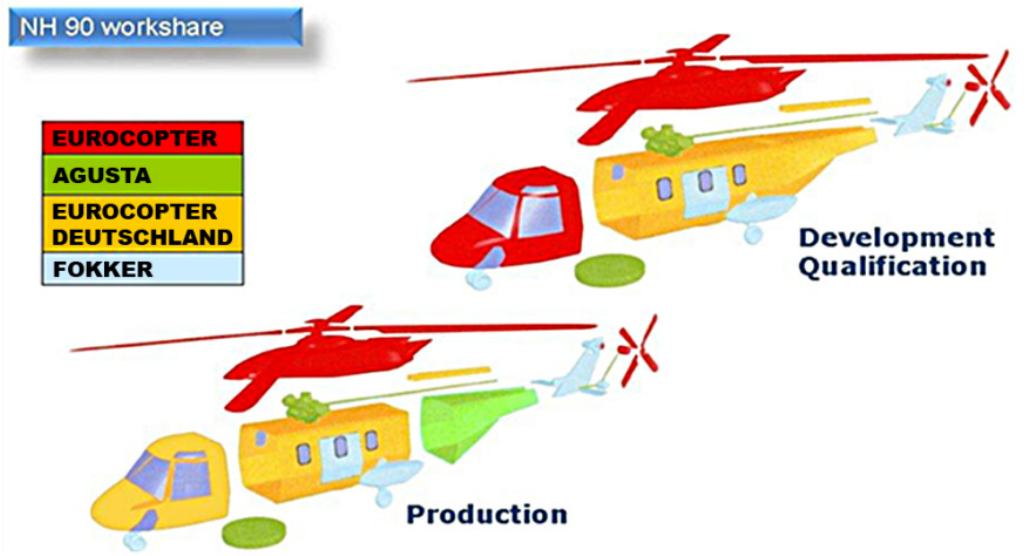
10. The 47 Australian MRH90 aircraft are a variant of the NATO Helicopter Industries (NHI) NH90 Troop Transport Helicopter (TTH). NHI was established in 1992 to develop and produce the NH90, and is a partnership between Eurocopter (France), Eurocopter Deutschland (Germany), AgustaWestland (Italy) and Stork Fokker Aerospace (Netherlands). NHI is the MRH90 aircraft's Original Equipment Manufacturer, and Australian Aerospace, a Eurocopter[10] subsidiary, is the Prime Contractor for the MRH90 Program, for both the acquisition and sustainment of the ADF's MRH90 fleet. The MRH90 aircraft are assembled in Brisbane by Australian Aerospace, utilising assemblies supplied by Eurocopter. Figure S.2 shows the workshare arrangement used to develop and produce the NH90.

8 The DCIC consists of the: Chief of the Defence Force (Chair); Secretary for Defence; Vice Chief of the Defence Force; Chief of Navy; Chief of Army; Chief of Air Force; Chief Executive Officer Defence Materiel Organistion; Chief Defence Scientist; Chief Financial Officer; First Assistant Secretary Capability Investment and Resources; and Deputy Secretary Strategy and Plans.

9 Discussed at paragraph 8.

10 On 2 January 2014, Eurocopter was renamed Airbus Helicopters. For the purpose of this audit, the company is called Eurocopter, as it was so named for the majority of the period covered by the audit.

Figure S.2: NH90 development and production workshare



Source: Department of Defence.

Capability management arrangements

11. The Chief of Army is the lead Capability Manager for all of the ADF's MRH90 fleet. The Chief of Navy has capability management responsibilities for the six MRH90 aircraft assigned to Navy. These officers are responsible for overseeing and coordinating all elements necessary to achieve the MRH90 aircraft's full level of operational capability by the date agreed to by government.

12. The Defence Materiel Organisation (DMO) MRH90 Program Office is located in Canberra and is responsible for the acquisition of the MRH90 aircraft and their transition into service. The DMO's MRH90 Logistics Management Unit is located in Brisbane, and at the time of the audit was merging with the Armed Reconnaissance Helicopter (ARH) Logistics Management Unit to form the Reconnaissance and Mobility Systems Program Office (RAMSPO).[11]

11 A fleet of 22 ARH (Tiger) aircraft has also been acquired from Australian Aerospace through AIR 87 Phase 2. The ARH acquisition project was the subject of an ANAO performance audit in 2005–06. See ANAO Audit Report No.36, 2005–06, *Management of the Tiger Armed Reconnaissance Helicopter Project — Air 87*, May 2006.

13. Australian Aerospace is the Authorised Engineering Organisation (AEO) for sustainment of the MRH90 aircraft, and has overall Systems Program Office (SPO) responsibility for a range of services normally undertaken by a DMO SPO. Australian Aerospace is the Approved Maintenance Organisation (AMO) for MRH90 Operational Maintenance at the Army Aviation Training Centre in Oakey, Queensland, and for MRH90 Retrofit and Deeper Maintenance at its MRH90 assembly facility in Brisbane. Two other maintenance organisations have been formally accredited by the Director General Technical Airworthiness (DGTA) as AMOs for the MRH90 aircraft: Army's 5th Aviation Regiment in Townsville; and Navy's 808 Squadron in Nowra.

14. Army and Navy operational units provide overall MRH90 fleet management in terms of flying operations and safety management, fleet-usage coordination and management of aircraft serviceability. At the time of the audit, 27 MRH90 aircraft had been accepted by DMO. The Army's 5th Aviation Regiment was assigned seven MRH90 aircraft, Navy's 808 Squadron was assigned six MRH90 aircraft, and the Army Aviation Training Centre was assigned eight MRH90 aircraft. Five MRH90 aircraft were undergoing Retrofit and one was in Deeper Maintenance servicing at Australian Aerospace's facility in Brisbane.

Audit objective and scope

15. The audit objective was to assess the Department of Defence's progress in delivering Multi-Role Helicopters (MRH90 aircraft) to the ADF through AIR 9000 Phases 2, 4 and 6, within approved cost, schedule and performance parameters.

16. The timeline covered by this audit extended from the MRH90 Program's requirements definition phase in 2002, to progress achieved by April 2014.

17. The audit approach closely followed the systems engineering processes that Defence uses to manage the capability lifecycle of projects. The ANAO did not intend, nor was it in a position, to conduct a detailed analysis of the full range of engineering issues being managed within the MRH90 Program. Rather, the audit focused on the MRH90 Program's progress thus far in establishing the management structures and processes used to deliver the aircraft within approved cost, schedule and performance parameters.

18. The high-level criteria developed to assist in evaluating Defence's performance were as follows:

- the requirements definition phase of the MRH90 Program, acquisition strategies and plans, and capability development policy and processes should be in accordance with internal Defence systems engineering procedures;
- the criteria used in the tender evaluation and selection process should reflect the approved capability identified through the requirements definition phase;
- the acquisition phase of the MRH90 Program, and test and evaluation leading to system acceptance, should meet the required technical, operational and safety regulatory requirements;
- the process involved in certifying the safety and fitness for service of the aircraft should meet the required technical, operational and safety regulatory requirements; and
- MRH90 sustainment arrangements should enable the aircraft to achieve agreed operational readiness requirements within approved budgets.

19. The audit report, which responds to the audit objective, refers to submissions received, and formal decisions made by government in August 2004 and April 2006. These submissions and decisions were central to the course of the MRH90 aircraft acquisition, and to an understanding of issues involved in the tender processes undertaken and their consequences. I have concluded that the inclusion of this information is not contrary to the public interest.[12] The audit report does not extend to commenting on the deliberations of government beyond matters reflected in formal decisions.

Overall conclusion

20. At a budgeted cost of some $4.013 billion, the AIR 9000 Phases 2, 4 and 6 Multi-Role Helicopter (MRH90) Program is to acquire 47 helicopters and their support system for the Australian Defence Force (ADF). Under the program, a single helicopter type has been selected to meet multiple ADF

12 Section 37 of the *Auditor-General Act 1997* outlines the circumstances in which particular information is not to be included in public reports, including if the Auditor-General is of the opinion that disclosure of the information would be contrary to the public interest.

capability requirements, including Australian Army Airmobile Operations, battlefield support and support to Special Operations; and the Royal Australian Navy (RAN) requirement for Maritime Support Helicopters (MSH) that operate from RAN ships. The helicopters are a central element of the planned expansion of the ADF's amphibious deployment and sustainment capability.

21. In December 2002, the then Prime Minister announced the acceleration of the purchase of additional troop lift helicopters (AIR 9000 Phase 2) to enable a squadron of helicopters to be based in Sydney. The two main contenders for AIR 9000 Phase 2 offered significantly different designs—Australian Aerospace offered the Mark I version of the NH90 Troop Transport Helicopter design, primarily based on the United States (US) civilian helicopter design standard with European amendments[13]; and Sikorsky offered the Mark III version of the US Army battlefield utility helicopter, the S-70M Black Hawk designed to US Military Standards. These designs have indelible impacts on military role suitability, and for that reason both the MRH90 and S-70M design features are mentioned throughout this report.

22. In 2004 and 2006, the then Australian Government selected an Australian variant of the NH90 (known as the MRH90) to meet the ADF's multi-role helicopter requirements. Government formally approved the acquisition of 12 MRH90 aircraft through AIR 9000 Phase 2 in August 2004 on the basis that strategic and other government considerations outweighed the cost advantage of the Sikorsky proposal; and government approved the acquisition of another 34 MRH90 aircraft through Phases 4 and 6 in April 2006. Australian Aerospace, a Eurocopter subsidiary, is the Prime Contractor for the MRH90 Program, for both the acquisition and sustainment of the ADF's MRH90 fleet. The MRH90 aircraft are assembled by Australian Aerospace in Brisbane from complete assemblies supplied by Eurocopter.

23. Following MRH90 aircraft flight trials from HMAS *Choules* in April and May 2012, the Navy reported impressive handling over the deck and that the aircraft showed considerable potential for embarked operations. However, the MRH90 aircraft also remain subject to a range of design rework in order to operate in high-threat environments. In April 2014, Defence informed the ANAO that the MRH90 aircraft has shown that it has the potential to offer

13 See paragraph 3.82.

greater capability in some areas than the Black Hawk and the Sea King, and Defence continues to adjust operational tactics, techniques and procedures to account for the differences between the platforms.

24. By March 2014, over $2.4 billion had been spent acquiring and sustaining the MRH90 aircraft, with 27 delivered. However, the MRH90 Program was running some four years behind schedule, with the first Operational Capability milestones for both the Army and the Navy yet to be achieved. Considerable work remains to implement and verify some design changes, and to adjust operational tactics, techniques and procedures, in order to develop an adequate multi-role helicopter capability for Army and Navy operations.

25. The difficulties experienced by the MRH90 Program are primarily a consequence of program development deficiencies and acquisition decisions during the period 2002 to 2006. That period included requirements definition, the source selection process and the establishment of acquisition and sustainment contracts. The history of the MRH90 Program shows that when these crucial stages of program development are not appropriately performed, then there are likely to be serious and potentially long-term consequences for capability delivery and Commonwealth expenditure.

26. Defence's helicopter capability requirements definition was inadequate, did not properly inform the source selection process, and led to gaps in contract requirements. Defence also did not effectively assess the maturity of the MRH90 and S-70M Black Hawk aircraft designs, and the potential implications of immaturity, during the source selection process and to inform the development of contracts. Further, the acquisition and sustainment contracts established by Defence did not contain adequate protections for the Commonwealth.

27. The decision by the then Australian Government in 2004 to approve the acquisition of the MRH90 aircraft, instead of the initial Defence recommendation that the S-70M Black Hawk aircraft be acquired for Phases 2 and 4, has had significant implications as a consequence of: unforseen immaturity in the MRH90 system design and the support system; the continuing need to modify some design elements to meet multi-role capability requirements; and the high cost of sustaining the aircraft.

28. Defence has applied a range of strategies directed toward addressing aircraft deficiencies and achieving better contractual outcomes for the

acquisition and sustainment of the aircraft. These strategies commenced in 2007 after Australian Aerospace delivered the initial aircraft, and were ongoing in 2014. They have included the Defence Materiel Organisation (DMO) suspending acceptance of aircraft, the listing of the MRH90 Program as a Project of Concern, and negotiation of revisions to the acquisition and sustainment contracts. Ongoing management attention across the areas of Defence with acquisition, sustainment and capability management responsibilities remains necessary for the MRH90 Program to provide an acceptable and affordable MRH90 aircraft capability for Army and Navy operations in a reasonable timeframe.

29. The following discussion of the audit findings is structured around the key elements of the acquisition: the source selection process, including requirements definition; acquisition progress and remediation; and cost, schedule and capability. The audit also highlights a number of key lessons from the MRH90 Program, which have also been observed in previous reviews of Defence and in previous ANAO audits.

Source selection process, including requirements definition

30. Under the 2002 *ADF Helicopter Strategic Master Plan*, Defence's strategy was to rationalise the number of helicopter types in service with the ADF through the acquisition of a multi-role helicopter capability. Defence planned to acquire the capability via a Military-Off-The-Shelf (MOTS) procurement to reduce the risk of cost escalation and schedule slippage. A MOTS helicopter procurement may confidently be undertaken when tests and evaluations are complete; full-rate production is well underway; and mature sustainment supply chains are in place to support the aircraft. However, when Australia planned to acquire troop lift helicopters in the early 2000s, the solutions offered by the main contenders had not yet achieved these milestones.

31. The MRH90 Program source selection process commenced with a Phase 2 Request for Proposal (RFP) process in 2003. There followed an Offer Development and Refinement Process (ODRP) for a combined Phases 2 and 4. Government ultimately decided to separate these phases to make an initial Phase 2 purchase in 2004, and Defence subsequently conducted a combined Phases 4 and 6 procurement process in 2006.

32. During the Phase 2 RFP process in 2003, Defence noted uncertainty about development and certification risks for the two main contenders (the MRH90 and the S-70M Black Hawk aircraft), and had low–medium confidence in cost estimates, as both aircraft remained under development at the time and

were not yet MOTS aircraft. However, this assessment did not lead Defence to undertake a thorough analysis of the maturity of the two aircraft options, and associated cost and schedule risks. Defence could have undertaken more thorough analysis of the available options during the remainder of the source selection process[14], in order to better inform government decision making on the selection of a preferred aircraft.

33. By way of background, Air 9000 Phase 2 was a pilot project in Defence for a new approach to achieve more rigorous capability requirements definition. However, there were a range of shortcomings in the defined helicopter capability requirements for Phases 2, 4 and 6. These shortcomings have had significant implications, in that the assessment of Australian Aerospace and Sikorsky's Phase 2, and combined Phases 2 and 4 proposals, was made against an incomplete set of requirements. While Defence provided candid advice to its Minister on its preferred option and the possible separation of Phases 2 and 4, in the absence of comprehensive helicopter capability requirements definition, Defence was on the back foot. Defence was not positioned to readily identify areas in need of developmental work for the respective aircraft, and to confidently inform ministers on the respective strengths and weaknesses of the proposals.

34. In June and July 2004, Defence recommended the S-70M Black Hawk option following the Phases 2 and 4 ODRP on the basis of its cost advantage, robust construction, ballistic protection and crashworthiness.[15] Defence also found that the MRH90 aircraft would meet the capability requirement. Defence considered that the MRH90 was a more marinised aircraft, and that the Australian Aerospace offer had Australian industry capability advantages.

35. It is a matter for the government of the day to make decisions on major Defence capability proposals after considering the detailed submissions brought forward by Defence and its Minister, and being persuaded that the acquisition represents value for money for the expenditure of public funds. Following Defence's initial recommendation that the Black Hawk option be

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14 In a similar vein, in DMO's *2012–13 Major Projects Report* (p.185), it was noted that:
The MRH Project was viewed as a Military Off-The-Shelf (MOTS) acquisition. Lessons associated with MOTS procurements include: that it is essential that the maturity of any offered product be clearly assessed and understood; and that elements of a chosen off-the-shelf solution may meet the user requirement.

15 Defence noted that the Black Hawk recommendation had the support of the: Secretary for Defence, Chief of the Defence Force, Chief Capability Development Group, Chief Executive Officer Defence Materiel Organisation, Chief of Army and Chief of Air Force.

selected for Phases 2 and 4, the Minister for Defence requested that Defence develop a revised submission that asked ministers to choose between the two aircraft options; and government subsequently directed that Defence bring forward a submission recommending acquisition of the MRH90 for Phase 2 only. Developing cost estimates for Phase 2 only was complicated by the fact that Defence had only low–medium confidence in cost estimates provided as part of the initial RFP process, and because the ODRP process focused on combined Phases 2 and 4 estimates. Defence's submission also included estimated support costs, but only with low confidence.

36. On 30 August 2004, government formally approved the acquisition of 12 MRH90 aircraft, together with associated training and support equipment and facilities, under a $1 billion project that was subject to satisfactory conclusion of negotiations. Government agreed that the MRH90 be selected as the preferred helicopter for AIR 9000 Phase 2 based on its generally better troop-lift capacity and superiority in the amphibious role. The following day, caretaker arrangements took effect in advance of the Federal Election held on 9 October 2004, and the Government announced the acquisition.

37. The selection of 12 MRH90 aircraft for Phase 2 was followed by formal government approval of 34 MRH90 aircraft for Phases 4 and 6 in April 2006. Defence had envisaged that the helicopter chosen for Phase 2 would also be the preferred helicopter for Phases 4 and 6, in order to generate efficiencies in fleet management and through-life support under its fleet rationalisation strategy. In the event, the choice of aircraft has had significant implications for Defence capability and costs, due to unforseen immaturity in the MRH90 system design and the support system, the continuing need to modify some design elements to meet multi-role capability requirements, and the high cost of sustaining the aircraft.

38. As mentioned in paragraph 2, the *ADF Helicopter Strategic Master Plan* involved a partnership with a Prime Contractor to implement the AIR 9000 Program through a Strategic Agreement. This agreement was to complement long-term sole-source helicopter acquisition and sustainment contracts, through the sharing of goals, risks and communication strategies, and by providing for cost visibility and audit access. However, the initial MRH90 acquisition and sustainment contracts did not establish a strong foundation for a successful strategic partnership, nor did they adequately protect the Commonwealth's interests. The abovementioned shortcomings in requirements definition meant that many key capability requirements were not

included in the acquisition contract and, as a consequence, Defence has not had contractual remedies for related shortfalls in the capability to be provided by the MRH90 aircraft. Further, the initial MRH90 sustainment contract resulted in support costs that significantly exceeded expectations. The contract's provisions were largely ineffective, as they were based on the incorrect premise that the number of fully developed (mature) MRH90 aircraft delivered through the acquisition contract would increase in a timely manner and trigger the sustainment contract's performance management regime. When this did not occur, DMO was obliged to take remedial action by negotiating contractual changes with Australian Aerospace.

Acquisition progress and remediation

39. Since the establishment of the acquisition and sustainment contracts covering Phases 2, 4 and 6, Defence has had to respond to a broad range of MRH90 Program challenges. Australian Aerospace has delivered MRH90 aircraft later than scheduled, and the aircraft have been delivered with much reduced levels of operational capability, which did not satisfy the set of requirements that had been contracted. Defence has approved many temporary and permanent design waivers for the aircraft with respect to the original requirements.[16] Further, due to the immaturity of the design, DMO has agreed to accept the MRH90 aircraft with three Product Baseline upgrades which are expected to bring the aircraft to their contracted standard; and three software builds which make evolutionary software improvements.[17] The first 13 aircraft delivered have had to undergo an extensive Retrofit Program to Product Baseline 3. As a consequence of these factors, DMO has undertaken a design compliance assessment workload that has far exceeded that needed for MOTS acquisitions.[18]

40. Elements of the MRH90 cabin and role equipment have been the subject of significant ongoing design issues. At the time of the audit, the MRH90 self defence gun system, cabin seating and cargo hook were being redesigned to overcome significant operational deficiencies. Further, operational test and

16 A waiver is the discharge of a contractual obligation by agreement. The MRH90 aircraft waivers predominately relate to technical specifications and standards (see paragraphs 80, 3.87, 4.9, 4.10). In June 2014, Defence informed the ANAO that waivers of this kind are not unusual in aviation projects.

17 Australian Aerospace informed the ANAO that evolutionary software upgrades are to be expected as part of normal software sustainment activities.

18 In March 2014, the ANAO was informed by the MRH90 Program Office that it had used an estimated 92 400 man-hours making compliance assessments, with an estimated 26 300 remaining.

evaluation had not validated the ability of the MRH90 aircraft to satisfy any of the 11 Operational Capability milestones set by the Army and Navy.

41. The reliability and maintainability of the aircraft accepted by DMO have also been low, which has resulted in the Army revising its MRH90 Acceptance into Operational Service plan six times. Overall, Defence has had to cope with ongoing commercial and technological management issues which are yet to be fully resolved, with sustained improvements in MRH90 capability and value for money yet to be demonstrated.

42. DMO suspended acceptance of the MRH90 aircraft in November 2010 and February 2012 as a result of persistent technical issues. The project also underwent diagnostic reviews (known as Gate Reviews) in February and September 2011.[19] These reviews positioned Defence to work with Australian Aerospace to implement a remediation plan to improve the availability of the helicopters by addressing engineering and reliability issues. In November 2011, Defence contemplated options to terminate or truncate the MRH90 acquisition contract and pursue alternative options. In the same month, the then Minister for Defence announced that the MRH90 Program had been listed as a Project of Concern, which is a process that aims to focus the highest levels of government, Defence and industry on remediating problem projects.

43. These reviews and actions assisted DMO in the negotiation of major revisions to the acquisition and sustainment contracts through Deeds of Agreement 1 and 2, signed in October 2011 and May 2013 respectively. Deed 1 addressed a range of technical, legal and commercial issues that had arisen between Defence and Australian Aerospace in respect to the acquisition and sustainment contracts. Deed 2 addressed aircraft reliability and support, and sought to improve the value for money of sustainment arrangements. As part of the Deed 2 negotiations, Defence settled a Liquidated Damages and common law damages claim, by re-baselining the acquisition contract in return for a range of improvements, including new aircraft cabin seats, the 47th MRH90 aircraft, a Repair By the Hour Sustainment Scheme, final spares and support equipment, a warranty that sufficient major spares had been procured

19 Gate Reviews involve an assessment by a DMO-appointed body (known as a 'Gate Review Assurance Board') of a project's readiness to proceed to the next stage of its lifecycle: that is, through a project 'gate'. Generally, the assessments are held before the project reaches a major milestone. DMO intends that the board should comprise senior DMO management and external members. ANAO Audit Report No.52, 2011–12, *Gate Reviews for Defence Capital Acquisition Projects,* June 2012, p.13.

to support the mature rate of effort, configuration changes and obsolescence resolution.

Cost, schedule and capability

44. As at May 2014, the DMO considered that there was sufficient budget remaining for the project to complete against the agreed scope.[20] The current out-turned overall acquisition contract price for the first 46 MRH90 aircraft and their support system is $2.9909 billion (2014–15 PRE ERC[21] price basis). On that basis, the average Unit Procurement Cost (also known as the weapon system cost) for each of the 46 MRH90 aircraft is $65.020 million (2014–15 PRE ERC price basis)[22], or $63.636 million if the 47th aircraft is included (2014–15 PRE ERC price basis).

45. Assuming that MRH90 aircraft support (sustainment) costs may increase by three per cent per year due to price inflation, then the potential contracted services cost of sustaining the 47 MRH90 helicopters, in their current configuration, until their Planned Withdrawal Date of 2040, may be in the order of $8.730 billion (in out-turned price terms). On that basis, the total contracted cost of acquiring and sustaining the 47 MRH90 aircraft until 2040 will be some $11.7 billion.

46. With the acquisition of MRH90 aircraft, the Army S-70A-9 Black Hawk fleet withdrawal from service was to commence in January 2011 and be completed by December 2013. In April 2014, Defence informed the ANAO that the S-70A-9 Black Hawk fleet's withdrawal from service commenced in January 2014 and is scheduled to be completed by June 2018. Defence also informed the ANAO that the budgeted cost of this S-70A-9 Black Hawk fleet service life extension is $311 million. The Chief of Army has noted the significant financial implications for the Army that arise from operating both the Black Hawk and MRH90 fleets:

> Extended concurrent operation of both Black Hawk and MRH90 fleets, due to immaturity and delays with MRH90 are creating significant problems for

20 Having reviewed the current, financial, contractual obligations of the DMO for this project, current known risks and estimated future expenditure. The agreed scope included the discharge by agreement of a range of acquisition contract obligations (see paragraphs 4.9, 4.10).

21 Pre-Expenditure Review Committee budget approval.

22 This cost includes: the aircraft and the cost of all fixed systems (that is, the baseline aircraft configuration, including airframe, engine and avionics); and the cost of the initial suite of support items, such as technical data and publications, technical training and training equipment, maintenance support equipment and spares.

funding of Army aviation. The inability to fund both platforms through transition is likely to require compromises to levels of capability.[23]

47. The MRH90 aircraft received Australian Military Type Certification (AMTC)[24] in April 2013, 53 months later than originally scheduled. In April 2014, the Chief of Army redefined the first Operational Capability milestone for the Army MRH90 aircraft to a limited capability subset involving a low-threat environment and no combat capability. This redefined milestone is scheduled to be achieved in July 2014, 39 months later than the original Operational Capability plan, with a second Operational Capability milestone covering Army's first Airmobile capability (a high-threat combat capability) now scheduled for September 2014, 41 months later than the original Operational Capability plan. The first Operational Capability milestone for the Navy MRH90 aircraft is currently delayed by 45 months, with an Operational Capability recommendation to be made by the RAN Test, Evaluation and Acceptance Authority to the Chief of Navy following receipt of acceptable role equipment qualification reports. Under the original MRH90 Final Operational Capability (FOC)[25] milestone, the first 46 MRH90 aircraft were scheduled to be in service by July 2014. FOC is now scheduled for April 2019, which is a delay of 57 months from the original estimate.

48. As previously indicated, the MRH90 aircraft design has proven to be more developmental than expected during the source selection in 2004 and 2006. A large number of aircraft design issues have impacted the achievement of capability milestones, including the self defence gun mount, the cargo hook release mechanism and the fast rope rappelling device. At the time of the audit, the MRH90 self defence gun system, cabin seating and cargo hook were being redesigned to overcome significant operational deficiencies. Further, low MRH90 aircraft reliability, maintainability and flying rate of effort have impacted aircrew training and the achievement of capability milestones. A capability gap has developed for Navy, as the RAN Sea King helicopters were retired in December 2011.

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23 MRH90 Materiel Sustainment Agreement – Army Module E to CA48, 2013–14, July 2013.

24 AMTC is issued by the Defence Aviation Authority and provides formal recognition that the aircraft design, as documented, and under defined management and operating regimes, is safe to operate in its intended roles. The operating roles are then evaluated as part of the Operational Test and Evaluation Program. AMTC is a condition for commencement of collective training, and may also be a prerequisite for individual training.

25 FOC is the point in time at which the final subset of a Capability System that can be operationally employed is realised. FOC is a capability state endorsed at project approval at Second Pass, and reported as having been reached by the Capability Manager.

49. Defence advised its Minister when negotiating the acquisition contract in May 2006 that an overarching Australian Industry Commitment target of 37 per cent translated to a $1.1 billion investment in Australian industry activities for the combined Phases 2, 4 and 6. ANAO examination of Defence's acquisition contract expenditure on these phases indicated that expenditure on Australian industry activities was trending significantly below the target of 37 per cent.

Lessons learned

50. This audit again highlights the importance of Defence capability development, which the *Review of the Defence Accountability Framework* observed is a process which 'has a profound effect on Defence as a whole, and is where much policy and organisational risk concentrates.'[26] The ANAO's analysis in the Major Projects Reports over the last five years, along with the findings of a range of ANAO performance audits of individual Defence major projects and related topics, indicate that the underlying causes of schedule delay in the acquisition phase can very often relate to weaknesses or deficiencies in the requirements phase of the capability development lifecycle.[27]

51. The ANAO has not made recommendations in this report, as Defence already has relevant management processes suitable for defining capability requirements, formulating cost-effective major capital equipment acquisition strategies, and delivering program outputs. The key issue for Defence is to consistently apply these processes to the standards required. The ANAO notes that the MRH90 Program proceeded into its acquisition and sustainment phases with inadequately defined capability requirements, and inadequate program cost investigations and analysis. While it was a government decision to acquire the MRH90 aircraft and not the option initially proposed by Defence, the department did conclude that the MRH90 aircraft was a valid option.

52. One of the major causes of schedule delay in the acquisition phase of Defence major projects is inadequate specification of capability requirements. The procedures to verify and validate compliance with requirements also need

26 Department of Defence, *Review of the Defence Accountability Framework* (the Black Review), January 2011, p.92.

27 See ANAO Audit Report No.6, 2013–14, *Capability Development Reform,* October 2013, p.23.

to be adequately defined and agreed.[28] In the case of the MRH90 Program, even though battlefield helicopter requirements were well known to Defence, these were not translated into adequate functional and performance specifications, and followed-through as part of tender evaluations and program approval submissions to government.

53. Successive Defence reviews have highlighted that risk can be decreased through MOTS solutions.[29] The ANAO has also observed that schedule delay in the acquisition phase of Defence projects has resulted where the capability solution approved by government was not adequately investigated in terms of its technical maturity, including the threshold issue of whether an option is truly off-the-shelf or developmental in some respect.[30] The MRH90 Program risk mitigation strategy was based on the acquisition of a MOTS solution, which is a sound and well-proven strategy. However, this strategy was not applied at the time the then Government pursued an accelerated AIR 9000 Phase 2 acquisition decision. The two options under consideration remained in the development phase of the production lifecycle, and were not yet MOTS aircraft. This led to the MOTS strategy being written out of the AIR 9000 Phases 2, 4 and 6 specifications, but with no compensating or more appropriate risk mitigation strategies. Following the commitment to procure the MRH90 aircraft, Defence has had to manage a range of systems development issues, many of which have not been resolved, or have been resolved at additional cost.

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28 See, for example, ANAO Audit Report No.57, 2010–11, *Acceptance into Service of Navy Capability,* p.21, which found that:

> … significant deficiencies which adversely affect the projects subject to this audit included:
>
> … the process of gaining agreement on requirements and on the procedures for verifying and validating that equipment fully meets contractual requirements was not adopted as standard practice by DMO and Navy.

29 The reviews referred to are: (i) Department of Defence, *Report on Defence Governance, Acquisition and Support* (prepared by KPMG), April 2000; (ii) *Defence Procurement Review* (Malcolm Kinnaird AO, chairman), August 2003—'the Kinnaird Review'; (iii) Department of Defence, *Going to the Next Level: the Report of the Defence Procurement and Sustainment Review* (David Mortimer AO, chairman), September 2008—'the Mortimer Review'; (iv) Department of Defence, *2008 Audit of the Defence Budget* (George Pappas, consultant), April 2009—'the Pappas Review'; and (v) Department of Defence, *Review of the Defence Accountability Framework* (Associate Professor Rufus Black), January 2011—'the Black Review.'

30 See, for example, ANAO Audit Report No.26, 2012–13, *Remediation of the Lightweight Torpedo Replacement Project;* ANAO Audit Report No.37, 2009–10, *Lightweight Torpedo Replacement Project;* and Appendix 4 to ANAO Audit Report No.52, 2011–12, *Gate Reviews for Defence Capital Acquisition Projects* (Case Study 2—LAND 112 Phase 4 – ASLAV enhancement, and Case Study 3—AIR 9000 Phase 2, 4, 6 – MRH-90 helicopter).

54. Defence's inability to maintain the MOTS strategy highlights the need to consider the ideal timing of capability acquisition in formulating acquisition strategy. Developing new military helicopters or upgrading existing models involves a lengthy process of design, prototype construction, test and evaluation, airworthiness certification and full-rate production approval. There are clear advantages in acquiring helicopters after the aircraft are certified and full-rate production has commenced, because operational test and evaluation outcomes should have been factored into the design; technical and operational airworthiness issues should have been resolved; and support system arrangements established to ensure the specified level of operational availability is achieved efficiently and effectively.

55. On this occasion the recommendations of the Defence procurement process for the acquisition of this helicopter capability were not adopted by the then Government. While it is open to government to decide on the acquisition of Defence capability and to have regard to wider strategic considerations, Defence needs to be confident in its advice to government so that decision-making is properly informed, including in respect to cost estimates and the developmental risks associated with proposed acquisitions. Put another way, any significant uncertainties in relation to key factors on which decisions are likely to be based should be drawn to the attention of government.

56. The shortcomings in the MRH90 Program requirements, and the lack of recognition of aircraft immaturity, resulted in the acquisition and sustainment contracts containing inadequate protections for the Commonwealth. These contracts also did not provide effective performance incentives, measurement and feedback systems. These key components have had to be negotiated into the acquisition and sustainment contracts at a time when the Commonwealth had reduced bargaining power; that is, following the signing of the decade-long acquisition and sustainment contracts. The sustainment contract involves a model whereby functions normally performed by a DMO Systems Program Office are instead the responsibility of the MRH90 acquisition and sustainment Prime Contractor; a model which is considered to offer potential efficiencies but also involves some risks. Should a similar model be adopted for future major capital equipment programs, sufficient attention should be given from the outset to the development of appropriate performance incentives and related performance management approaches.

Key findings by chapter

Additional Troop Lift Helicopter project definition and tender evaluation (Chapter 2)

57. AIR 9000 Phase 1 produced the 2002 *ADF Helicopter Strategic Master Plan*, which sought to rationalise the number of helicopter types in service with the ADF through the acquisition of a multi-role platform. The Master Plan envisaged that fleet rationalisation would generate efficiencies in through-life support and personnel requirements. Following the October 2002 Bali Bombings, in December 2002, the then Australian Government accelerated the purchase of additional troop lift helicopters (AIR 9000 Phase 2) to enable a squadron of helicopters to be based in Sydney. Consistent with the strategic intent to reduce aircraft types, Defence considered at the time that the helicopter chosen for AIR 9000 Phase 2 would be the preferred solution for Phase 4 and possibly Phase 6.[31]

58. In May 2003, Defence released an RFP for AIR 9000 Phase 2 to three prospective suppliers. AgustaWestland offered the EH101 Merlin, Australian Aerospace offered the NH90 (to be developed for Australia as the MRH90) and Sikorsky offered the S-70M Black Hawk.[32] In December 2003, the then Minister for Defence agreed to a Defence recommendation to set aside the AgustaWestland EH101 offer[33], and to proceed with bids from Australian Aerospace and Sikorsky for a combined AIR 9000 Phases 2 and 4. Defence noted in ministerial advice that despite seeking a Military-Off-The-Shelf (MOTS) solution, there was continuing uncertainty about development and certification risks for the two remaining offers. Notwithstanding this assessment, in early 2004, at the time of the commencement of the AIR 9000 Phases 4 and 6 Offer Development and Refinement Process (ODRP), Defence identified few high technical risks for the project as a consequence of the MOTS strategy. Further, Defence's ministerial advice did not address the

31 The AIR 9000 Phases are summarised in paragraph 3.

32 The Sikorsky S-70M Black Hawk is the direct commercial sale version of the Sikorsky UH–60M produced for the US Army, and shares the UH–60M design characteristics.

33 Citing as reasons that despite being a MOTS aircraft in service with the United Kingdom, Portugal and Canada, the EH101 had poor maneuverability; limitations in support of amphibious operations due to its larger size; its payload and range advantage reduced markedly in hot and high operations (performing worse than the S-70M but still better than the MRH90); and was unsuitable for Counter Terrorism operations.

technical risks associated with aircraft immaturity in any detail throughout the remainder of the AIR 9000 source selection process.

59. In June and early July 2004, Defence recommended to the Minister for Defence: a combined Second Pass approval for AIR 9000 Phases 2 and 4; the acquisition of 12 S-70M Black Hawk helicopters; and either upgrading the ADF's existing 34 S-70A-9 Black Hawk aircraft to the S-70M standard, or replacing these with 36 new S-70M aircraft. Defence noted that the recommendation was supported by a range of Defence senior officers, including the Secretary for Defence, the Chief of the Defence Force, Service Chiefs and the Chief Executive Officer Defence Materiel Organisation. While reaching the conclusion that both the MRH90 and S-70M Black Hawk would meet the required capability, Defence preferred the S-70M Black Hawk on the basis of its cost advantage[34], crashworthiness, robustness and battlefield survivability. On the other hand, Defence considered that the MRH90 was a more marinised aircraft, and that the Australian Aerospace offer had Australian industry capability advantages.

60. On 30 July 2004, Defence received probity advice on the potential legal implications of the Government departing from the source selection process[35], which had recommended the S-70M Black Hawk. The probity adviser noted that the ODRP process was subject to the selection of a preferred respondent on the basis of 'value for money, consistent with Commonwealth purchasing policies, affordability, *strategic considerations and other whole of government considerations*'.[36] The probity adviser also observed that 'it would potentially be open to the Government to decide that, despite the conclusions of the ODRP evaluation and the Source Selection Report, the [Australian Aerospace] proposal represented better value for money than the Sikorsky proposal, when those conclusions are considered in light of overarching strategic or whole of government considerations'. The adviser further noted that this scenario assumed such strategic or whole of government considerations existed, and

34 Following a bid clarification process and the application by Defence of contingency and other cost adjustments to both bids, on 2 July 2004 Sikorsky's Black Hawk bid was over $380 million less than the Australian Aerospace MRH90 bid.

35 The Australian Government Solicitor (AGS) was appointed by Defence as probity adviser for the AIR 9000 Program commencing on 16 July 2002.

36 Emphasis added in original.

that the Government could reasonably argue that they outweighed the Sikorsky price advantage.[37]

61. In accordance with direction provided by the Minister for Defence and government, Defence developed alternate draft submissions, initially to ask ministers to choose between the two aircraft options, and later recommending acquisition of the MRH90 for Phase 2 only (see below). On the same day as receiving the abovementioned probity advice (30 July 2004), Defence provided a draft submission to its Minister that left open the recommendation as to which helicopter should be selected. The submission rated the overall risk of Australian Aerospace's proposal as medium and Sikorsky's proposal as medium–high. Technical risk was rated as medium for both proposals and the differentiating factor was cost risk, which was rated as medium for the Australian Aerospace proposal and high for the Sikorsky proposal.[38]

62. In early August 2004, Defence provided candid advice to its Minister regarding the possible separation of Phase 2 and Phase 4, including that cost data would be less reliable and that purchasing fewer aircraft would result in a premium of about $4 million per aircraft. On the same day, government formally indicated it was disposed to select the Australian Aerospace MRH90 helicopter for Phase 2 only, and asked the Minister for Defence to bring forward a submission outlining the case for, and financial implications of, proceeding with Phase 2 only, and selecting the MRH90 over the S-70M.[39]

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37 The adviser also stated that 'Further legal and/or probity advice could be sought as to whether the identified considerations were reasonably capable of supporting a value for money decision in favour of the [Australian Aerospace] proposal'. However, subsequent advice was not requested.

38 Defence had assessed Sikorsky's bid price as lacking sufficient detail to confidently retire all cost risk, and considered that the residual cost risk remained high, with a commensurate contingency of 21 per cent included against the proposal. The draft submission noted that Sikorsky's price was significantly lower than its RFP offer. Sikorsky had clarified that its bid price was firm and that it was able to offer such sharply competitive pricing because it would treat Australia like its best customer, the US Army. Since the RFP, the US Government had committed to Low-Rate Initial Production (LRIP) for the US Army thus improving the accuracy of manufacturing cost estimates. There were also potential economies of scale in combining AIR 9000 Phases 2 and 4 with the US LRIP program; and a significant reduction in General Electric engine costs.

Defence applied a contingency rate of 14 per cent to the Australian Aerospace proposal. The submission noted that:

> Australian Aerospace prices have remained relatively stable from those offered in the RFP, indicating reasonable fidelity in pricing. However, the ability to hold Australian Aerospace to its priced offer is not certain. This is due to the general lack of detail presented to establish confidence that prices are inclusive of all costs.

39 On 13 August 2004, Defence advised the then Minister for Defence that the acquisition of 12 MRH90 aircraft under a Phase 2 only approval would lead to significant penalties in both acquisition and operating costs, and would make the management of 5th Aviation Regiment very challenging.

63. A subsequent August 2004 submission to government recommended the MRH90 for Phase 2. The submission cited strategic and other government considerations of relevance in selecting the preferred helicopter, including the primary importance of amphibious operations for Phase 2, and the prospect of cooperation with another country in a joint MRH90 purchase. The MRH90 aircraft was also assessed as having better troop lift capacity and superiority in the amphibious role. Developing cost estimates for Phase 2 only was complicated by the fact that Defence had only low–medium confidence in cost estimates provided as part of the initial RFP process, and because the ODRP process focused on combined Phases 2 and 4 estimates. While recognising a cost advantage for the S-70M Black Hawk proposal, the submission gave limited attention to the relative acquisition cost of the two options for Phase 2 only.[40] The submission also included estimated support costs, but with low confidence. An additional squadron of MRH90 aircraft was estimated to cost $60 million per annum and a squadron of S-70M aircraft $70 million per annum.

64. On 30 August 2004, government formally approved the acquisition of 12 MRH90 aircraft, under a $1 billion project that was subject to satisfactory conclusion of negotiations. Government agreed that the MRH90 be selected as the preferred helicopter for AIR 9000 Phase 2 based on its generally better troop-lift capacity and superiority in the amphibious role. On 31 August 2004, caretaker arrangements took effect in advance of the Federal Election held on 9 October 2004, and the Government announced the acquisition of the 12 MRH90 aircraft. The Government also announced that the helicopters would be based in Townsville, which would release a squadron of Black Hawks to move to Sydney to reinforce the ADF Special Forces located there.[41] The first MRH90 was to be delivered in 2007, with all 12 aircraft to be delivered by 2008.

65. The decision to announce the acquisition prior to contract negotiations potentially placed Defence in a more difficult bargaining position. Contract negotiations for the 12 MRH90 aircraft and their support system became protracted. It was not until 2 June 2005 that the acquisition contract for

40 A table on pages 9 and 10 of the submission showed that the acquisition cost of 12 MRH90 aircraft would be $1.061 billion (13.5 per cent contingency on the prime contract) and that 12 S-70M Black Hawk aircraft would cost $892 million (16 per cent contingency excluding initial support). Defence had estimated that the premium on the price per aircraft of acquiring 12 aircraft instead of a larger combined Phases 2 and 4 fleet was $4 million per MRH90 and $4.2 million per S-70M.

41 *Press release—John Howard and Senator Hill—MRH90 acquisition announcement*, 31 August 2004.

12 MRH90 aircraft was signed, at a value of $912.49 million (January 2004 prices).[42] Under the contract, there were notable reductions in deliverables when compared to the government Second Pass approval decision.[43] The first of the Phase 2 aircraft was to be delivered in December 2007, with all 12 aircraft to be delivered by 2010. In June 2005, prior to acquisition contract signature, Defence advised government that the MRH90 aircraft were now estimated to cost $75 million more per year to sustain than the S-70M Black Hawk aircraft when personnel and fuel requirements were included. On 29 July 2005, the sustainment and program agreement contracts were signed at a value of $748.48 million (January 2004 prices). The initial 10-year sustainment period was due to start from the In-Service Date of 18 December 2007.

66. Defence subsequently pursued a combined First and Second Pass approval for both Phases 4 and 6. Defence developed two acquisition business cases: for an MRH90 option and for an S-70M Black Hawk option, drawing on tender information previously provided by Australian Aerospace and Sikorsky, while also negotiating a contract change proposal with Australian Aerospace.[44] Defence envisaged that the MRH90 aircraft would also be the preferred helicopter for Phases 4 and 6, consistent with the objective of rationalising the helicopter fleet and generating efficiencies in fleet management and through-life support. In April 2006, a submission to government for Phases 4 and 6 recommended acquiring the MRH90 to replace the Army S-70A-9 Black Hawk and Navy Sea King helicopters on the basis that: it was a better capability; there would be low through-life costs with efficiencies generated by rationalising the utility helicopter fleet and development; and the acquisition cost of the MRH90 was similar to the Black Hawk option once full fleet acquisition costs were included. Despite having already bought 12 MRH90 aircraft as part of Phase 2, the submission compared the option to acquire the additional 34 MRH90 aircraft[45] with the original 48 S-70M Black Hawk aircraft rather than a reduced number of 42 S-70M Black

42 Some MRH90 equipment options relating to significant MRH90 operational functions were not taken up in the Phase 2 contract or later for Phases 4 and 6. These included replacing the MRH90 doorway mounted self defence gun system with a window mounted system, and automating the MRH90 main rotor blade folding system.

43 As discussed in paragraph 8, the contract did not include an electronic warfare self protection support cell, a ground mission management system, a software support centre, an instrumented aircraft with telemetry, and full flight and mission simulators.

44 The DMO General Counsel advised that this contract change proposal would not be contractually binding on the Commonwealth and would not impose an obligation on Defence.

45 That is, 40 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 34 aircraft.

Hawk aircraft[46] that would be required for Phases 4 and 6. A more appropriate comparison of aircraft numbers would have shown that the Black Hawk option was less expensive.

67. On 26 April 2006, government formally approved Air 9000 Phases 4 and 6, and the MRH90 acquisition contract was amended on 30 June 2006 to include the additional 34 MRH90 aircraft and their associated support system. At the same time, government formally approved a Real Cost Increase of $206 million to purchase elements of the support system that had been missing from the Phase 2 contract. These items included ground support equipment, a simulator, aircraft maintenance trainers and aircraft modifications.

68. Six days after government formally approved AIR 9000 Phases 4 and 6, on 2 May 2006, the ANAO presented for tabling the performance audit report *Management of the Tiger Armed Reconnaissance Helicopter Project Air 87*.[47] The Tiger Armed Reconnaissance Helicopter (ARH) project was approved in August 2001 to provide a new, all-weather reconnaissance and fire support capability for the ADF. The project involves the acquisition of 22 aircraft with supporting stores, facilities, ammunition and training equipment. The first four aircraft were built in France by Eurocopter and the rest were assembled in Brisbane by Australian Aerospace.

69. The ANAO audit report concluded that while Defence had intended that the ARH aircraft be an 'off-the-shelf' aircraft, the acquisition transitioned to become a more developmental program for the ADF, which resulted in heightened exposure to schedule, cost and capability risks, both for acquisition of the capability, and delivery of through-life support services.[48]

70. On 10 May 2006, the then Prime Minister wrote to the then Minister for Defence raising concerns that the ANAO audit report identified a number of shortcomings with the management of the Tiger ARH project, and that it was unfortunate that Cabinet was not made aware of these issues in the context of its recent deliberations on Project AIR 9000 Phases 4 and 6, noting that the same prime contractor was involved. On 17 May 2006, after receiving advice

46 That is 48 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 42 aircraft.

47 The draft performance audit report had been provided to Defence on 3 March 2006, in accordance with requirements under s.19 of the *Auditor-General Act 1997*. This provided Defence with a period of 28 days to comment on the draft report.

48 Further, the lack of operational experience in maintaining this capability in other Defence Forces has meant that original cost estimates associated with the through-life support were immature, and exposed Defence to significant future budgetary risks.

from Defence, the Minister for Defence replied to the Prime Minister to allay his concerns. As part of his reply, the Minister noted that:

> The MRH 90 is less complex than the ARH and is already entering service with both France and Germany, some 18 months in advance of the Australian Defence Force (ADF) program. A total of 10 aircraft are already flying for qualification and certification purposes. Significantly, the ADF is not the lead customer and will not carry the attendant developmental risk. …
>
> Defence has applied the lessons learned from AIR 87 and the ANAO findings to the development of AIR 9000 Phases 2, 4 and 6. Similarly, Australian Aerospace and Eurocopter have a greater experience with Defence processes, which has resulted in a demonstrated improvement by Australian Aerospace during Phase 2. Defence is confident that Australian Aerospace will deliver a timely and effective MRH 90 capability for the ADF, and remains the best value for money option.

71. If there was just one lesson to learn from the history of Defence acquisition projects, it would be the need to be respectful of the inherent risks in these complex transactions and not over-confident that they are under control. Effective project management requires a deep understanding of the project status and environmental factors that have the potential to influence outcomes. For the acquisition of the MRH90 aircraft, Defence was on the back foot from the start in its ability to confidently offer advice, in not having a sound understanding of the requirements or the estimated costs, and has been endeavouring to recover ever since, with mixed success.

MRH90 capability requirements definition (Chapter 3)

72. The primary Defence Capability Definition Documents (CDDs) are: Operational Concept Documents (OCDs)[49], Function and Performance Specifications (FPSs)[50], and Test Concept Documents (TCDs).[51] These documents are developed during a project's requirements definition phase, and form part of the supporting documentation for the Second Pass capability

49 OCDs are intended to inform system acquirers and developers of the ADF's operational requirements.

50 FPSs define ADF requirements of the system in terms of system functions, and how well those functions are to be performed.

51 TCDs provide an outline of the test strategy to be used to verify and validate that the design and operational requirements of the capability have been complied with.

proposal to government. They need to accurately reflect the user's expectations of the system.[52,53]

73. AIR 9000 Phase 2 was a pilot project for the development of a set of CDDs under a revised Defence approach to the Capability Definition Phase of major projects. Defence recognised a lack of internal expertise in the development of CDDs at the time, and engaged a professional services provider to write the CDDs for Phase 2. However, there was still a need for Defence to verify that the delivered CDDs were of adequate quality. The Phase 2 OCD only partially followed the OCD guidance documents applicable at the time. The OCD describes the future multi-role helicopter capability, but not the functionality and performance required of the helicopters and their associated support system, for each proposed solution. As a consequence, the extent to which the MRH90 and the S-70M Black Hawk meet the specified operational concepts is unclear from the OCD. Further, there was scope for the FPS to be more specific, in order to reduce the risk of contractual disagreements during system design reviews and requirements verification and validation. While the Phase 2 FPS is large and detailed, it did not follow DMO's then FPS guidelines, nor did it include functional modelling[54] or trace the functional and performance requirements that should flow from the OCD.[55,56] The Phase 2 FPS was also utilised for AIR 9000 Phases 4 and 6[57], and demonstrated the same shortcomings at the time these phases received government approval in April 2006.

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52 It may be extremely costly to fix requirements or design defects found late in a project's design and test phase. This underscores the critical importance of systems engineering processes based on adequate CDDs, particularly regarding user requirements specified in OCDs and FPSs, and progressive verification of requirements compliance in accordance with TCDs.

53 Requests for Tenders containing deficient CDDs will most likely result in tender evaluation teams evaluating tenders against incomplete specifications, which heightens the risk that the major system being acquired and its associated support system, will not meet ADF requirements.

54 Functional modelling would have assisted the FPS developers to visualise the system's intended functions and to present those functions using logical diagrammatic techniques. This modelling would have also assisted stakeholders to verify that the system's required functionality had been adequately specified.

55 Further, there are requirements for MRH90 operations with the RAN's Landing Platform Amphibious (LPA) ships HMAS *Manoora* and HMAS *Kanimbla,* which were withdrawn from service in May and November 2011 respectively, but none for the RAN's Landing Helicopter Dock (LHD) ships, the first of which, HMAS *Canberra*, is scheduled to achieve the Initial Operational Capability milestone in December 2014. ANAO Report No.12, 2013–14, Assurance Report, *2012-13 Major Projects Report*, December 2013, p.208.

56 The FPS also contains headings that are missing requirements, namely: The Function and Performance Specifications for Personal Flotation Devices and Restraints; Flotation Collar; Survival Aids; Individual Armour Protection; and Supplemental Oxygen.

57 A number of additional annexes were added to the Phase 2 FPS for Phases 4 and 6.

74. Many important MRH90 mission requirements were not included in the OCD and/or contract FPS; and the compliance or fitness for purpose of the MRH90 against many mission requirements has yet to be demonstrated, with some key requirements remaining subject to redesign work. A prominent example illustrating immaturity in aspects of the aircraft's design relates to the operation of the Self Defence Gun System (SGDS) and Fast Roping and Rappelling Device (FRRD). The FPS states that the MRH90 aircraft shall be able to be fitted with a Self Defence Gun Mount in each of the cabin doorways. However, the installation of door mounted guns interferes with a range of helicopter cabin workflow requirements. Troops need to move around the guns as they enter and leave the aircraft[58], the doors need to be open when the guns are in use, and the FRRD cannot be safely used in the same doorway as the gun.

75. These and other issues have been partially addressed through changes to the MRH90 acquisition contract, and some of the design modifications are being implemented for Product Baseline 3 (PBL3)[59] MRH90 aircraft. A key design change has been the development of an Enhanced MRH90 Armament System (EMAS). The EMAS reduces but does not eliminate the obstruction caused by the gun in the door, and the Army is therefore pursuing other options to improve the operation of the gun system and roping device. In a similar vein, there were no specific requirements in the OCD or FPS related to the width of troop seats, and as part of the Deed 2 settlement of a claim for Liquidated Damages and common law damages, Australian Aerospace is having the seats redesigned so that they are wide enough to cater for troops outfitted in Patrol Order.[60]

76. The need to rectify these and other issues has delayed the introduction into operational service of the MRH90 aircraft. In March 2014, the Chief of

58 There is still the option of some troops leaving through the rear ramp, depending on the final cabin layout.

59 Due to the immaturity of the design, DMO agreed to accept the MRH90 aircraft with three Product Baselines (known as PBL 1, PBL 2 and PBL 3), which are expected to enable the MRH90 aircraft to achieve their contracted specifications; and three software versions (known as SUS 1.1, SUS 2 and SUS 3). Australian Aerospace informed the ANAO that SUS 1.1, SUS 2 and SUS 3 are evolutionary software improvements expected as part of normal software sustainment activities.

60 Patrol Order consists of webbing, personal weapon and ammunition, which a standard infantry soldier has a requirement to wear at all times. The average weight used for a soldier in Patrol Order is 210 lb (95 kg). Webbing consists of pouches on a belt containing a large variety of equipment for a soldier. The webbing takes up a significant amount of space around a soldier's waist and will place restrictions on the minimum size of troop seats.

Army approved a revised Acceptance Into Operational Service (AIOS) schedule due to deficiency rectification and delayed aircraft delivery. The Chief of Army also directed that further investigation of options be undertaken to achieve relevant OCD requirements, including the potential for changes to tactics, techniques and procedures, to inform a subsequent decision.

77. The AIR 9000 OCD and FPS outlined a range of marinisation requirements, including a rotor brake, manual folding blades, the ability to operate on Landing Platform Amphibious ships and corrosion protection. However, there were gaps in the specification of marinisation requirements related to: automatic folding blades[61]; and cargo hook compatibility with a Navy rigid cargo strop.[62] Trials of the MRH90 manual folding blades initially identified difficulties and risks in installing the blade pins. In April 2014, Defence informed the ANAO that manual blade fold speed and efficiency had improved with increasing flight deck team experience. Another aspect of embarked operations is the conduct of vertical replenishment. The MRH90 cargo hook was found to be incompatible for use with a rigid strop when embarked, which would impede the MRH90 from conducting vertical replenishment operations with US and other coalition ships that use the rigid strop as standard load rigging equipment. In April 2014, Defence informed the ANAO that an MRH90 cargo hook redesign to accommodate a rigid strop was underway, and that an alternate vertical replenishment configuration has been authorised.

78. It is also notable that the MRH90 aircraft are not being fitted with a recovery assist, securing and traversing system, which would better enable helicopter operations in wide ranging sea states from the RAN's frigates and destroyers, consistent with the operating intent of the aircraft. In correspondence on this issue, Defence informed the ANAO in June 2014 that the MRH90 aircraft is replacing the Sea King aircraft in the Maritime Support Role, and the Sea King performed this mission effectively without a recovery assist, securing and traverse system.

79. Crashworthiness of helicopters is particularly important, because they operate at greater risk of fatal accidents, when compared to fixed-wing

61 The acquisition of an MRH90 automatic blade fold capability has been the subject of considerable debate within Defence, culminating in the development of a contract change proposal, which has not been implemented.

62 For Navy operations the 'rigid strop' is utilised to allow load hook-ups while the aircraft maintains a high hover so as to remain clear of the deck or other obstructions.

aircraft.[63] The risks are further heightened for military helicopters that operate in a challenging environment. At the time of development of the Phase 2 OCD and FPS and contract signature, the US Department of Defense military standard for crashworthiness of helicopters (MIL-STD-1290A) was inactive.[64] The 2004 version of the Defence *Airworthiness Requirements Design Manual* did not specify any standard for crashworthiness, and instead included a brief overview of crashworthiness design principles, which could have been used as the basis for some high-level crashworthiness requirements for the multi-role helicopter capability. However, there were significant gaps in the specification of crashworthiness requirements in the Phase 2 OCD and FPS. In terms of aircraft design, the MRH90 is qualified[65] to a 'modified' MIL-STD-1290A, which the NH90 partner nations had agreed to prior to Defence being involved in the project.[66] Defence informed the ANAO that it is not aware of any aircraft which currently meets the full untailored requirements of MIL-STD-1290A[67], and expressed comfort with the overall crashworthiness design features of the MRH90. During the course of the program, Defence has identified modification options to improve MRH90 crashworthiness, and the Chief of Army has sought approval from the Defence Aviation Authority for a range of temporary and permanent waivers relating to MRH90 crash protection design shortfalls.

MRH Acceptance and Sustainment (Chapter 4)

80. Systems engineering standards and DMO system acquisition contracts involve the design and development of Mission Systems, and require

63 Crashworthiness involves the ability of aircraft to: maintain a protective space for occupants throughout the crash impact sequence; prevent occupants, cargo, or equipment from breaking free of their normal location and positions during a crash sequence; limit the magnitude and duration of accelerations and loads experienced by occupants to within survivable levels; prevent catastrophic injuries and fatalities resulting from contact with barriers, projections, and loose equipment; and limit the threat to occupant survivability posed by fire, drowning, exposure, entrapment and other factors, following the cessation of the crash impact sequence.

64 MIL-STD-1290A was reinstated in January 2006 prior to the establishment of contractual arrangements for AIR 9000 Phases 4 and 6.

65 'Qualified' means that the aircraft is built to, but not certified to, a standard. So while the intent to meet a standard may exist, there is not yet adequate assurance that it has been met.

66 The standard has been modified in the sense that the survivable impact velocities specified in MIL-STD-1290A were not adopted for the MRH90. Instead the MRH90 specification, which is based on a version of the NH90 TTH specification, contains reduced survivable impact velocities, for reasons that are not readily apparent.

67 Defence further informed the ANAO that all aircraft (including the MRH90) are required to meet, in full, myriad military and civilian standards for both crash protection and other airworthiness requirements, and that this activity is the focus of Design Acceptance activities.

contractors to produce a *Verification Cross Reference Matrix* (VRCM) that cross references the contracted requirements with the procedures by which compliance with those requirements are to be, or have been, verified.[68] DMO Project Office personnel make compliance findings against each of the contractor's compliance statements. As at April 2014, six and a half years after the In-Service Date of December 2007, DMO had accepted Australian Aerospace's compliance statements for 494 out of 553 requirements (89 per cent). Further, as at May 2013, the MRH90 Program Office had identified 35 acquisition contract requirements that the MRH design and construction had failed to achieved, relating to a broad range of design issues, including embarking and egress of troops, ballistic vulnerability and external sling load operations. These non-conformances were accepted by the Commonwealth and waivers granted as part of the Deed 2 negotiations[69] in order to increase the value for money of sustainment arrangements through contract changes. Defence informed the ANAO that as at April 2014, there remained another 32 temporary and four permanent design deviations not accepted by the Commonwealth. In June 2014, Defence further informed the ANAO that the number of permanent design deviations for the MRH90 aircraft is not unusual.

81. The ADF's Technical Airworthiness Regulations set out the Australian Military Type Certificate (AMTC)[70] and Service Release[71] process. The AMTC and Service Release are issued after aircraft design issues and sustainment

68 VCRMs should provide complete traceability between each Function and Performance Specification and Operational Concept Document requirement, and derived requirements, and each corresponding test item, test procedure, and test report. Defence Materiel Organisation, *ASDEFCON (Strategic Materiel) Handbook*, March 2002, Part 3 Draft Statement of Work, Sect. 7.1.3. Since 2002, DMO has produced other versions of *ASDEFCON (SM)*, with the latest *ASDEFCON (SM) Handbook* being published in 2004.

69 Refer to paragraph 43.

70 At Type Certification, the aircraft or Aeronautical Product is deemed by the certifying authority to comply with regulations in respect of design and manufacture at that time. Type Certification recommendations from the ADF Technical Airworthiness Regulator, the Director General Technical Airworthiness (DGTA), require DGTA to be satisfied that the aircraft's Design Acceptance has been completed in accordance with the Technical Airworthiness Regulations, and that all airworthiness issues have been satisfactorily resolved or are being managed through DGTA approved Issue Papers.

71 Service Release is the process of permitting the actual in-service use of ADF aircraft. It requires that all engineering, logistics and operational issues are resolved, or alternatively approved processes are in place to resolve outstanding issues.

limitations identified during Special Flight Permit[72] periods, and assessed by Airworthiness Boards, are resolved to the satisfaction of the Defence Aviation Authority. As a consequence of the ongoing delivery of MRH90 aircraft that did not comply with contracted specifications, the Chief of Air Force, in his role of Defence Aviation Authority, issued a series of Special Flight Permits, which authorised the scope of flying activity prior to AMTC and Service Release being granted.[73] By the time of the Airworthiness Board meeting in April 2013, 16 MRH90 Airworthiness Issue Papers had been closed and nine remained open. These nine were reported to generally relate to longer-term corrective actions and, with mitigations in place, did not preclude a recommendation for AMTC and Service Release. The MRH90 aircraft achieved AMTC and Service Release in April 2013. The 53-month delay in obtaining AMTC and Service Release required the aircraft to be operated under Special Flight Permits for longer than originally anticipated, and with more incremental variations to the Special Flight Permits than originally anticipated. At the same time, Service Release was granted subject to three limitations, including prohibition of the use of the Heavy Stores Carrier and the External Aircraft Fuel Tank, and prohibition of night formation flying. Defence expects that these aircraft limitations will be temporary.

82. Australian Aerospace has been engaged under the sustainment contract to undertake the majority of management tasks that are normally the responsibility of a DMO Systems Program Office (SPO). This outsourced SPO model was intended to create efficiencies in the delivery of SPO services to Navy and Army, and to significantly reduce the number of military and public service employees engaged in the support of the MRH90 fleet. Within this arrangement, Australian Aerospace is required to act on behalf of the Commonwealth, including fulfilling the role of Authorised Engineering Organisation (AEO) and Approved Maintenance Organisation (AMO), managing the logistics supply chain and sub-contractors, and identifying opportunities to improve MRH90 fleet performance and reduce its cost of

72 Special Flight Permits authorise ADF and Contractor aircrew to operate the ADF aircraft to undertake an In-Service Date demonstration and production acceptance flights, in-country flight tests, and initial instructor training flights. The MRH90 aircraft have operated under a total of ten Special Flight Permits from 2007 through to April 2013. There are 80 Contractor Statement of Compliances (CSOCs) critical to safety of flight required to meet the scope of flying activity for the Special Flight Permits period.

73 The Chief of Air Force is the Defence Aviation Authority, and in that role he is responsible for the authorisation, development, implementation and audit of a joint airworthiness regulatory system (covering the Navy, Army and Air Force), which includes ADF aircraft Type Certification and continuing airworthiness management.

ownership. Commonwealth personnel in the MRH90 Logistics Management Unit retain responsibility for design acceptance and governance of outcomes, and for verifying and approving the payment of sustainment contract invoices received from Australian Aerospace.

83. Australian Aerospace is a wholly owned subsidiary of Eurocopter[74] and so is responsible to its parent company to meet financial objectives and represent the interests of the parent company in Australia. Australian Aerospace is therefore under contract to deliver efficient and effective support to Defence while also having responsibility to its parent company, to maintain profitability and represent the interests of the parent. The experience of the MRH90 Program to date, including the high cost of sustaining the aircraft, highlights the potential for tensions to arise in the pursuit of these differing objectives. It also highlights the primary importance of an appropriate performance measurement regime to drive value for money and provide sufficient oversight of outsourced arrangements.

84. The sustainment contract for the first 12 MRH90 aircraft was signed on 29 July 2005. It was amended on 20 June 2006 to include the additional 34 MRH90 aircraft, and amended again in March 2012 and July 2013 to include agreements reached with Australian Aerospace as part of the Deed negotiations. The pre-2012 contract provisions were found to be largely ineffective, as they were based on the premise that the number of fully developed (mature) MRH90 aircraft delivered through the MRH90 acquisition contract would be sufficient to achieve value for money via performance incentives and other incentives within the contract. Until June 2013, DMO was unable to apply the sustainment contract's performance management regime, as there were insufficient MRH90 aircraft placed into operational service to trigger that regime. Furthermore, other sustainment issues affected the availability of the delivered MRH90 aircraft and further brought into question the value for money and cost-effectiveness of MRH90 sustainment expenditure.[75]

85. DMO and Australian Aerospace negotiated amendments to the MRH90 sustainment contract, which took effect on 1 July 2013 and are scheduled to

74 Now Airbus Helicopters.

75 Under the original sustainment contract, MRH90 operating costs per flight hour were found to be five times that of the Army's Sikorsky S-70A-9 Black Hawk aircraft, which were acquired between 1988 and 1991. The Sikorsky S-70A, designated the UH-60A Black Hawk by the US Army, entered service in the US in 1979.

expire on 19 December 2019. These amendments seek to improve MRH90 sustainment outcomes by reducing the total cost of ownership throughout the Life-of-Type, and increasing the number of serviceable MRH90 aircraft. The amendments establish a new performance management regime, which involves: financial incentives to improve MRH90 serviceability rates[76]; and a Quarterly Performance Management Fee based on a number of Key Performance Indicators (KPIs).[77] The sustainment contract amendments are a part of DMO's decision to settle a claim for Liquidated Damages and common law damages, in return for improvements to MRH90 aircraft affordability and serviceability.

86. The contracted number of flight hours for the mature MRH90 fleet of 47 aircraft is 10 300 hours per year, which is an average of 220 hours per aircraft per year, or 4.2 hours per week. For the period July 2007 to April 2014, the MRH90 fleet's actual flight hours consistently fell short of Army and Navy authorised flight hours.[78] The shortfall was a result of the MRH90 aircraft being offered to DMO for acceptance when only partially compliant with their acceptance criteria, as well as a complex mix of sustainment shortfalls. A consequence of the reduced MRH90 flight hours, and the withdrawal from service of the RAN's six Sea Kings in December 2011, has been the need for Navy to use its anti-submarine S-70B-2 Seahawk helicopters in utility helicopter roles.[79] The reduced flight hours of the MRH90 aircraft have also constrained Navy helicopter pilot flight training, as well as Navy's ability to develop the MRH90 capability to the extent necessary to achieve the maritime Operational Capability milestones. The reduced MRH90 flight hours have resulted in the Army retaining its 34 S-70A-9 Black Hawk helicopters in operational service longer than planned. They have also constrained Army

76 That regime focuses on a Repair By the Hour Sustainment (RBHS) Scheme whereby Australian Aerospace will be paid a minimum monthly floor price, regardless of the number of hours flown by the MRH90 fleet, and a fixed amount per MRH90 flight hour. The price paid covers the cost of all Breakdown Spares and Repairable Items.

77 The Commonwealth has unilateral measurement rights over the KPIs to avoid disputes relating to measurement techniques. The primary KPI for MRH90 capability is the number of serviceable MRH90 aircraft.

78 During the period April 2013 to April 2014, the average number of serviceable MRH90 aircraft was 48 per cent. This compares with the MRH90 sustainment contract's performance target for serviceable MRH90 aircraft of 65 per cent for operational squadrons and for the Army Aviation Training Centre. The primary reasons for MRH90 aircraft being unserviceable were unscheduled maintenance, followed by aircraft awaiting Repairable Item or Breakdown Spare replacements and scheduled maintenance.

79 On these occasions, the Seahawk helicopters have not been available to conduct crew training exercises aligned to their core military role.

helicopter pilot flight training, and the ability to achieve the Army's first Operational Capability milestone for the MRH90 aircraft.

87. DMO, Navy and Army records indicate that MRH90 fleet reliability and maintainability has fallen significantly short of expectations. In the 28 months up to and including April 2014, the MRH90 reliability rate exceeded the sustainment contract target of 24 faults or less per 100 flight hours on 18 occasions. Further, the MRH90 fleet's Operational Level maintenance man-hour per flight hour was averaging 27 hours per flight hour by April 2014, down from a peak of 97 hours in January 2012. Notwithstanding the decline, Operational Level maintenance man hour per flight hour remains high, particularly when compared to advice provided by Eurocopter to the Minister for Defence in February 2003 that the NH90 was designed to exploit new-generation technologies to drastically reduce Life Cycle Costs and enhance reliability. In April 2014, Defence informed the ANAO that it would take at least a year before the impact of the July 2013 sustainment contract revisions on aircraft reliability, maintainability and sustainment costs becomes apparent.

88. During the AIR 9000 Phases 2 and 4 ODRP in 2004, the Minister for Defence directed that there should be a high level of Australian industry involvement in the MRH90 program in areas of greatest importance, while containing cost and schedule within *Defence Capability Plan* limits. Defence advised its Minister when negotiating the acquisition contract in May 2006 that an overarching Australian Industry Commitment target of 37 per cent translated to a $1.1 billion investment in Australian industry for the combined Phases 2, 4 and 6. The approved MRH90 acquisition and sustainment contracts for Phases 2, 4 and 6 contained an Australian industry activity program, which was developed around themes and objectives. Defence informed the ANAO that it validates this program's activities under the acquisition and sustainment contracts by examining invoices and accounting documentation. However, Defence had not measured or assessed the value of the Australian industry activities actually delivered. Further, following on from Deed 2, Defence and Australian Aerospace are negotiating a new Local Industry Plan, which will include activity milestones and performance measures.

Summary of agency and company responses

89. The proposed audit report was provided to Defence, and relevant extracts of the report were provided to the Department of the Prime Minister and Cabinet, Australian Aerospace Limited and Sikorsky Aircraft Australia Limited.

Defence

90. Defence's covering letter in response to this audit report is reproduced at Appendix 1. Defence's response to the audit report is set out below:

> Defence welcomes the ANAO audit report on the Multi-Role Helicopter (MRH90) Program. This extensive report demonstrates the complex nature of Australia's helicopter replacement program which is integral to the Australian Defence Force and its conduct of combined operations. The report accurately highlights a number of challenges that Defence faces in transitioning from its current 3rd generation helicopters to 4th generation platforms.
>
> Defence has made significant progress towards increasing efficiencies and maximising combat capability over a decade of continuous force mobility improvements and acquisitions. The experience gained from the MRH90 acquisition program stands Defence in good stead for acquisitions not only of helicopter systems, but across other capability acquisitions as well. In particular, DMO has learned substantial lessons in establishing and maturing a sustainment support system, by both Defence and industry; contract management; and accurate assessment of the maturity of proposed capability solutions.
>
> Defence acknowledges that there is scope to realise further improvements in the MRH90 capability and anticipates continued maturity to the sustainment arrangements with associated benefits to cost of ownership. Defence is committed to managing the complexities of its mission and appreciates the regular reviews undertaken by the ANAO.

Australian Aerospace

91. Australian Aerospace's full response to an extract of the audit report is reproduced at Appendix 1. Australian Aerospace's summary response is set out below:

> It is acknowledged that introduction of the MRH90 has been protracted for the reasons discussed in the Extract but Australian Aerospace is of the view that the aircraft is now gaining strong pilot support as a capable and safe aircraft by virtue of its modern avionics and advanced performance and flight

characteristics. Australian Aerospace and its NHI Partner are committed to working with Defence on improvements to the cabin and related role equipments which will make the MRH90 a potent battlefield capability for the Australian Army and Royal Australian Navy in the future. As the Extract points out, significant changes to the MRH90 sustainment construct were agreed through Deed 2 and these arrangements are now showing very positive trends in Demand Satisfaction Rates and flight hours achieved. Australian Aerospace is confident that the issues with the MRH90 Program identified in the Extract are well known and are being addressed as quickly as possible in order to deliver the required capability for the ADF, in a cost effective way for the life of type of the helicopter.

Sikorsky

92. Sikorsky's letter in response to the proposed report extract is reproduced at Appendix 1.

Audit Findings

1. Introduction

This chapter outlines the Multi-Role Helicopter Program, which is acquiring 47 helicopters for the Australian Defence Force. The chapter also sets out the audit objective and scope.

Background

1.1 At a budgeted cost of $4.013 billion[80], the AIR 9000 Phases 2, 4 and 6 Multi-Role Helicopter (MRH90) Program is to acquire 47 helicopters and their support system for the Australian Defence Force (ADF). The Australian Government's decision to acquire these helicopters stems from the ADF's experience leading the International Force for East Timor (INTERFET) in 1999, which revealed a need for additional troop lift helicopters that were capable of operating off Royal Australian Navy (RAN) ships. The *Defence 2000* White Paper subsequently reaffirmed the long-held requirement for the Australian Army to be capable of responding swiftly and effectively to any credible armed lodgement on Australian territory, and to provide forces for more likely types of operations in Australia's immediate neighbourhood.[81]

1.2 Terrorist attacks in New York on 11 September 2001 and the bombings on the Indonesian island of Bali on 12 October 2002, together with increasing concerns surrounding the proliferation of weapons of mass destruction, prompted the then Government to issue an update to *Defence 2000.* This update, *Australia's National Security–A Defence Update 2003*, included the establishment of the Special Operations Command and an additional Tactical Assault Group. This elevated the priority for acquiring additional, more capable, troop lift helicopters and accelerating their In-Service Date.[82]

1.3 At the same time, it was recognised that ADF helicopters would be instrumental in the planned expansion of the ADF's amphibious deployment and sustainment capability. The $3.073 billion Joint Project 2048 Phase 4A/4B Amphibious Ships Program is responsible for the acquisition of two

80 June 2013 prices and exchange rates.

81 This was to be achieved by maintaining six battalion groups of approximately 1000 personnel each at 30 to 90 days notice to move, and an additional Special Air Service regiment of approximately 700 personnel, and light Airmobile forces available for immediate deployment. Department of Defence, *Defence 2000: Our Future Defence Force*, pp.78–79.

82 Department of Defence, *Australia's National Security – A Defence Update 2003*, pp.14 and 24.

27 000 tonne Canberra-class Landing Helicopter Dock (LHD) ships. These are to be named HMAS *Canberra* and HMAS *Adelaide*, and are scheduled to enter service in 2014 and 2015 respectively.[83] Each LHD is designed to hangar up to 12 helicopters, and the integration of the MRH90 capability with the LHD ships will be a significant aspect of the MRH90 Acceptance into Operational Service.[84]

1.4 Figure 1.1 shows an MRH90 aircraft in a standard configuration.

Figure 1.1: Multi-Role Helicopter (MRH90)

Source: Department of Defence.

Government approval and contractual arrangements

1.5 On 30 August 2004, government formally approved the acquisition of 12 new helicopters, to be acquired through AIR 9000 Phase 2, and delivered by 2008.[85] Nine months later, on 2 June 2005, Defence signed the acquisition

83 These ships are to replace the former Kanimbla-class Landing Platform Amphibious (LPA) ships HMAS *Kanimbla* and HMAS *Manoora*, and the heavy landing ship HMAS *Tobruk*.

84 The new helicopters will also provide a humanitarian assistance role throughout Australia's neighbouring regions during times of natural disasters.

85 See Media Release, Senator The Hon Robert Hill, Minister for Defence, *New Helicopters for Army*, 31 August 2004.

contract with Australian Aerospace Limited[86], to supply these 12 helicopters and an interim support system. This was followed by a sustainment contract signed on 29 July 2005.

1.6 On 26 April 2006, government formally approved the acquisition of an additional 34 helicopters through AIR 9000 Phases 4 and 6, as replacements for the Army's S-70A-9 Black Hawk aircraft and the RAN's Sea King aircraft. At the same time, government formally approved a Real Cost Increase of $206 million to purchase elements of the MRH90 aircraft support system that had been omitted from the Phase 2 contract.[87] On 30 June 2006, the MRH90 acquisition contract was amended to include these additional 34 MRH90 aircraft, and their related support system. These 34 MRH90 aircraft were to be delivered by July 2014.

1.7 The final MRH90 aircraft support system includes an electronic warfare self protection support cell, a ground mission management system, a software support centre, an instrumented aircraft with telemetry, two Full Flight and Mission Simulators, and facilities infrastructure at Townsville, Oakey, Holsworthy and Nowra.

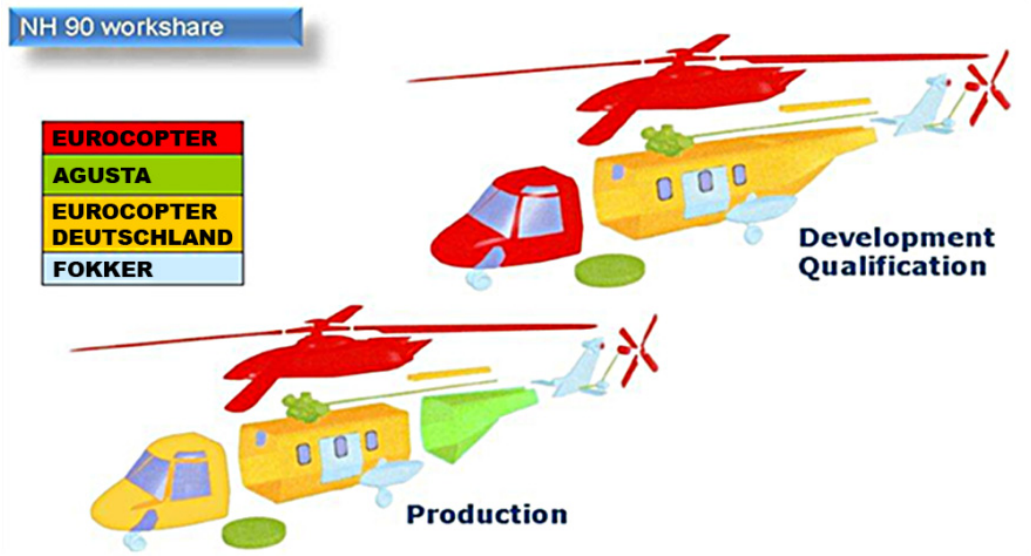
1.8 On 9 May 2013, Australian Aerospace agreed to provide Defence with an additional MRH90 aircraft, as part of the settlement and release of commercial, technical and schedule issues (see paragraph 1.43). Defence estimated the value of this MRH90 aircraft at $40 million. This brought the total number of MRH90 aircraft to be acquired to 47.

1.9 The 47 Australian MRH90 aircraft are a variant of the NATO Helicopter Industries (NHI) NH90 Troop Transport Helicopter (TTH). NHI was established in 1992 to develop and produce the NH90, and is a partnership between Eurocopter (France), Eurocopter Deutchland (Germany), AgustaWestland (Italy) and Stork Fokker Aerospace (Netherlands). Figure 1.2 shows the workshare arrangement used to develop and produce the NH90.

86 A fleet of 22 ARH (Tiger) aircraft has also been acquired from Australian Aerospace through AIR 87 Phase 2. The ARH acquisition project was the subject of an ANAO performance audit in 2005–06. See ANAO Audit Report No.36, 2005–06, *Management of the Tiger Armed Reconnaissance Helicopter Project — Air 87*, Department of Defence, Defence Materiel Organisation, May 2006.

87 These items included ground support equipment, full flight and mission simulators and aircraft maintenance trainers and aircraft modifications.

Figure 1.2: NH90 development and production workshare



Source: Department of Defence.

1.10 The NH90 TTH is designed to the US Federal Aviation Administration's Part 29 standard (FAR 29—*Airworthiness Standard Transport Category Rotorcraft, Amendment 31*), as well as elements of a tailored military standard (MIL-STD-1290A *Military Standard for Light Fixed and Rotary Wing Aircraft Crash Resistance*). The first NH90 series production helicopter made its maiden flight in May 2004. Type Certification of the NH90 TTH variant was granted in Germany in December 2006.

1.11 NHI is the MRH90 aircraft's Original Equipment Manufacturer (OEM), and Australian Aerospace, a Eurocopter[88] subsidiary, is the Prime Contractor for the MRH90 Program, for both the acquisition and sustainment of the ADF's MRH90 fleet. The MRH90 aircraft are assembled in Brisbane by Australian Aerospace utilising assemblies supplied by Eurocopter.

1.12 Australian Aerospace is the Authorised Engineering Organisation (AEO) for sustainment of the MRH90 aircraft, and has overall Systems Program Office (SPO) responsibility for a range of services normally undertaken by a DMO SPO. Australian Aerospace is the Approved Maintenance Organisation (AMO) for MRH90 Operational Maintenance at the Army Aviation Training Centre in

88 On 2 January 2014, Eurocopter was renamed Airbus Helicopters. For the purpose of this audit, the company is called Eurocopter, as it was named for the majority of the period covered by the audit.

Oakey, Queensland, and for MRH90 Retrofit and Deeper Maintenance at its MRH90 assembly facility in Brisbane. Two other maintenance organisations have been formally accredited by the Director General Technical Airworthiness (DGTA) as AMOs for the MRH90 aircraft: Army's 5th Aviation Regiment in Townsville; and Navy's 808 Squadron in Nowra.

AIR 9000 Phases

1.13 The AIR 9000 Program consists of eight phases. This audit considers the following four phases:

- Phase 1 produced the *ADF Helicopter Strategic Master Plan*[89];
- Phase 2 is to acquire a squadron of 12 MRH90 aircraft to provide the ADF with extra mobility for forces on operations, particularly amphibious operations. This phase received government Second Pass approval[90] in August 2004; and
- Phase 4 and Phase 6 are to acquire 28 MRH90 aircraft to replace Army's Black Hawk aircraft, and six MRH90 aircraft to replace the retired RAN Sea King aircraft.[91] These phases received simultaneous Second Pass approval in April 2006.

Aircraft distribution, role and product baselines

1.14 Defence informed the ANAO that as at April 2014, 27 MRH90 aircraft had been delivered by Australian Aerospace. These aircraft were distributed as follows:

- eight were assigned to the Army Aviation Training Centre at Oakey. Seven of these aircraft were available for flying operations and one was utilised as a Technical Training Aid;

89 See Appendix 2 for details.

90 The Second Pass approval process involves government endorsing a specific capability solution and approving funding for its acquisition.

91 The other phases of AIR 9000 are as follows: Phase 3 was to upgrade the RAN's S-70B-2 Seahawk aircraft, but this phase was replaced by Phase 8; Phase 5A is the engine upgrade for the CH-47D Chinook aircraft; Phase 5C is replacing the CH-47D Chinook with CH-47F Chinook aircraft; Phase 5D is the accelerated acquisition of two replacement CH-47D Chinook aircraft; Phase 7 is the new Helicopter Aircrew Training System (HATS); and Phase 8 is acquiring 24 MH-60R Seahawk aircraft to replace the RAN's S-70B-2 Seahawk aircraft.

- six were assigned to the Navy's 808 Squadron. Five of these aircraft were available for flying operations from Nowra and one was embarked on HMAS *Success*[92];
- seven were assigned to the Army's 5th Aviation Regiment at Townsville; and
- six were undergoing maintenance at Australian Aerospace's facility in Brisbane. Five of these aircraft were undergoing Retrofit to Product Baseline 3 (see paragraph 1.19), and one was in Deeper Maintenance servicing.

1.15 The planned final distribution of the 47 MRH90 aircraft is as follows:

- 19 assigned to the Army's 5th Aviation Regiment;
- 10 assigned to the Army's 171 Squadron;
- five assigned to the Navy's 808 Squadron;
- seven assigned to the Army Aviation Training Centre as flight training aircraft;
- one assigned to the Army Aviation Training Centre as a Ground Training Aircraft; and
- five inducted into Deep Maintenance servicing at any one time.

1.16 The primary role of the Army MRH90 aircraft is Airmobile Operations in support of land combat operations, to enhance the tempo of land force manoeuvre. The secondary roles of the Army MRH90 aircraft are: battlefield support; support to Special Operations including Combat Search and Rescue (CSAR); and Aeromedical Evacuation.

1.17 The MRH90 aircraft are intended to enhance the Army's amphibious capability to operate from the RAN's Bay-class landing strategic sealift ship HMAS *Choules,* and eventually from the Canberra-class Landing Helicopter Dock (LHD) ships HMAS *Canberra* and HMAS *Adelaide.* The LHD ships are scheduled to achieve Final Operational Capability (FOC) in November 2016. The Army's objective is to generate an amphibious MRH90 aircraft squadron

92 During the MH370 search effort in the Indian Ocean, the MRH90 aircraft deployed on HMAS *Success* was reported in the media as unserviceable. Defence informed the ANAO in June 2014 that the cause of the incident will be determined by the outcomes of a formal investigation currently underway.

to support the movement of infantry and their equipment from these vessels, to and from the area of operations.

1.18 The MRH90 aircraft are also required to fulfil the RAN's requirements for Maritime Support Helicopters embarked on amphibious and afloat support platforms, and be capable of using the flight decks and hangars of the RAN's Adelaide-class FFGs and ANZAC-class FFHs, and of the Hobart-class DDGs. The DDGs are scheduled to achieve FOC in March 2020. As in the case of the MRH90 aircraft assigned to the Army, the MRH90 aircraft assigned to the RAN are to be capable of operating in high-threat environments.

1.19 Due to the immaturity of the design, DMO agreed to accept the MRH90 aircraft in three successive configuration baselines known as Product Baselines (PBL) 1, 2 and 3. Additional software configuration baselines labelled SUS 1.1, SUS 2 and SUS 3 are scheduled to address issues identified in various software Problem Reports.[93] To complete operational tests and evaluations in support of recommendations to the Chief of Army and Chief of Navy concerning the achievement of Final Operational Capability, the MRH90 aircraft must be at the PBL 3 configuration.

Multi-Role Helicopter (MRH90) capability management arrangements

1.20 The Chief of Army is the lead Capability Manager for the MRH90 fleet.[94] The Chief of Navy has capability management responsibilities for the six MRH90 aircraft assigned to Navy. These officers are responsible for overseeing and coordinating all elements necessary to achieve the MRH90 fleet's final level of operational capability by the date agreed to by government.

1.21 The Defence Materiel Organisation (DMO) MRH90 Program Office is located in Canberra and is responsible for the acquisition of the MRH90 aircraft and their transition into service. The DMO's MRH90 Logistics Management Unit is located in Brisbane, and at the time of the audit was

93 Australian Aerospace informed the ANAO that SUS 1.1, SUS 2 and SUS 3 are evolutionary software improvements expected as part of normal software sustainment activities.

94 The Chief of Army is also responsible for managing the ADF's S-70A-9 Black Hawk helicopter capability. At the time of the audit, the ADF's 34 Black Hawk aircraft were distributed as follows:
- 10 assigned to Army's 5th Aviation Regiment;
- 16 assigned to Army's 6th Aviation Regiment;
- four assigned to the Army Aviation Training Centre; and
- four inducted into Deeper Maintenance or undergoing modifications at any one time.

merging with the Armed Reconnaissance Helicopter (ARH) Logistics Management Unit to form the Reconnaissance and Mobility Systems Program Office (RAMSPO).

1.22 Army and Navy operational units provide overall fleet management in terms of flying operations and safety management, fleet-usage coordination and management of aircraft serviceability.

Cost, schedule and capability

Aircraft acquisition and sustainment costs

1.23 In August 2004, the approved budget for the acquisition of the 12 MRH90 aircraft and their support system under AIR 9000 Phase 2 was $0.9539 billon (December 2004 price basis). Since that time the approved budget for AIR 9000 Phases 2, 4 and 6 has increased to $4.013 billion (2014-15 pre-Expenditure Review Committee (PRE ERC) price basis), to fund the acquisition of the additional 34 MRH90 aircraft and their related support system. This $4.013 billion is comprised of the following amounts:

- $0.0033 billion (February 2004 price basis) pre Second Pass approval funding for project precursory activities;
- $0.9539 billion (December 2004 price basis) to fund the acquisition of the first 12 MRH90 aircraft and their initial support system;
- $2.5655 billion (December 2006 price basis) to fund the acquisition of the additional 34 MRH90 aircraft and the related support system;
- $0.0115 billion (December 2008 price basis) net return in funding to support facilities requirements;
- $0.6798 billion increase resulting from the acquisition contract's price variation provisions covering labour and materials, since February 2004; and
- –$0.2008 billion in foreign currency cost savings due to the appreciation of the A$ since February 2004, with respect to the Euro and US$.

1.24 At the time of the audit, the fixed-price contract with Australian Aerospace covering the acquisition of the 47 MRH90 aircraft and their support system was valued at $2.4921 billion (January 2004 prices and exchange rates).

1.25 The acquisition of the two MRH90 aircraft Level D Full Flight and Mission Simulators mentioned in paragraph 1.6 is not included in the contract

with Australian Aerospace, as Australian Aerospace's price for a Level D simulator of A$80.75 million was seen as unaffordable under the AIR 9000 Phase 2 budget ceiling. Two MRH90 Level D Full Flight and Mission Simulators are being acquired through AIR 9000 Phases 2, 4 and 6 from the Canadian manufacturer of simulation technologies CAE Inc and the French firm Thales Group, under an A$181.4 million (April 2007 prices and exchange rates) fixed-price contract.[95] The first simulator was delivered to Oakey in 2013 at the MRH90 Product Baseline 2 (PBL 2) configuration, and the second simulator was delivered to Townsville in May 2014 for an expected Commonwealth acceptance in October 2014. Both simulators will need to be upgraded to ensure they perform to the MRH90 Product Baseline 3 (PBL 3) configuration and the associated SUS 1.1, 2 and 3 MRH90 software upgrade and sustainment evolutions.

1.26 The current out-turned overall acquisition contract price for the first 46 MRH90 aircraft and their support system, including the simulators, is $2.9909 billion (2014-15 PRE ERC price basis). On that basis, the average Unit Procurement Cost (also known as weapon system cost) for each of the 46 MRH90 aircraft is $65.020 million, or $63.636 million if the 47th aircraft is included (2014-15 PRE ERC price basis). This cost includes: the aircraft and the cost of all fixed systems (that is, the baseline aircraft configuration, including airframe, engine and avionics); and the cost of the initial suite of support items, such as technical data and publications, technical training and training equipment, maintenance support equipment, spares and the simulators.

1.27 The above amounts do not include Liquidated Damages and common law damages settled with Australian Aerospace. The Commonwealth and Australian Aerospace settled a damages claim in 2013 to compensate for the delay in delivering supplies in accordance with the timeframes set out in the acquisition contract, including the time required to undertake the Aircraft Retrofit Program in order to upgrade the 1st to 13th MRH90 aircraft to the required PBL3 configuration. Rather than settling those damages by direct financial payments, Defence negotiated alternate compensation as part of the AIR 9000 Phases 2, 4 and 6 Deed of Agreement, Variation and Release, which is known as Deed 2.[96] The alternative compensation provided under the Deed 2 is

95 The contract price was comprised of €82.443 million and A$43.183 million.

96 As mentioned in paragraph 1.8, as part of the settlement, in May 2013 Australian Aerospace agreed to provide Defence with one additional MRH90, which was valued by Defence at $40 million.

in the form of enhanced acquisition and sustainment contract provisions. Deed 2 is discussed further in paragraph 1.50 below.

1.28 Assuming that MRH90 aircraft support (sustainment) costs may increase by three per cent per year due to price inflation, then the potential contracted services cost of sustaining the 47 MRH90 aircraft, in their current configuration, until their Planned Withdrawal Date of 2040, may be in the order of $8.730 billion (in out-turned price terms).[97] On that basis, the total cost of acquiring and sustaining the 47 MRH90 aircraft until 2040 will be some $11.7 billion.[98]

Aircraft delivery and capability milestones

1.29 Table 1.1 shows the original and current capability milestones for the MRH90 Program. The extensive delays in the achievement of milestones are primarily a result of delays in the delivery of aircraft by Australian Aerospace, delivery of immature aircraft, ongoing design issues, and low aircraft reliability, maintainability and flying hours.

Table 1.1: Program key delivery and capability milestones

Milestone	Original scheduled date	Actual or current scheduled date	Comments
In-Service Date (ISD)	December 2007	December 2007	The MRH90 aircraft ISD milestone requirements included the acceptance into service of sufficient aircraft, and the availability of qualified training personnel and training devices to enable individual and collective training to commence. To achieve that milestone, a total of two MRH90 aircraft were accepted by DMO in a noncompliant Product Baseline 1 configuration.

97 Out-turned prices include the estimated effects of labour and materials variations and currency exchange-rate movements. Then-year prices are based on the cost of labour and materials and currency exchange rates at the time the expenditure occurred.

98 Defence normally calculates net personnel and operating costs (NPOC) for its major military equipment, which represent the difference between the personnel and operating costs of the new equipment and equipment being replaced by the current acquisition program. Defence informed the ANAO in May 2014 that NPOC for the MRH90 capability was calculated in 2004 and 2006, and has not been re-visited since then.

Milestone	Original scheduled date	Actual or current scheduled date	Comments
Australian Military Type Certification (AMTC) and Service Release	December 2008	April 2013[99]	53-month delay. AMTC is issued by the Defence Aviation Authority and provides formal recognition that the aircraft design, as documented, and under defined management and operating regimes, is safe to operate in its intended roles. The operating roles will be evaluated as part of the Operational Test and Evaluation Program. AMTC is a condition for commencement of collective training, and may also be a prerequisite for individual training. Service Release is the process of permitting the actual in service use of ADF aircraft. It requires that all engineering, logistics and operational issues are resolved, or alternatively approved processes are in place to resolve outstanding issues.
12 MRH90 aircraft delivered (Phase 2)	December 2009	September 2010	Nine-month delay. These MRH90 aircraft were accepted from Australian Aerospace with known design immaturity issues and the aircraft have had to undergo a remedial Retrofit Program.
Initial Materiel Release (IMR)	June 2010	May 2013	35-month delay. IMR is the milestone that marks the completion and release of DMO Acquisition Project Supplies required to support the achievement of the Initial Operational Release (IOR) of the Initial Operational Capability (IOC).
Operational Capability–Navy	July 2010	April 2014	Scheduled 45-month delay. As at April 2014, the RAN's Test Evaluation and Analysis Authority (RANTEAA) was awaiting role equipment qualification reports prior to providing the Chief of Navy with the first phase of the MRH90 aircraft three phase Operational Capability (Maritime–OCM1) recommendation.

99 Design maturity and reliability issues delayed the MRH90 aircraft achieving Australian Military Type Certification (AMTC) until April 2013. Further, some significant operational limitations were imposed on the aircraft by the ADF's technical and operational airworthiness regulators on achieving AMTC. These limitations included: use of the Heavy Stores Carrier and the External Aircraft Fuel Tank are prohibited; night formation flying is prohibited; and use of the Chaff and Flares Dispenser is prohibited.

Milestone	Original scheduled date	Actual or current scheduled date	Comments
Operational Capability–Army	April 2011	July 2014	Scheduled 39-month delay. The initial stage of Army's MRH90 Operational Capability (OC) has been referred to as Operational Capability Amphibious 1 (OCA1). It is defined as: ... *an MRH90 troop transport helicopter capable of operating in a low-threat environment by day or night, from land or while embarked in HMAS Choules, up to and including Humanitarian Assistance and Disaster Relief (HADR) and Non-combatant Evacuation Operations (NEO) (Permissive).* Army advised the ANAO that an important purpose of declaring this quite limited capability subset as Army's OC, is to ensure that 5th Aviation Regiment can commence development of proficiencies and qualifications for embarked operations as soon as possible, so as to be ready to support OC for the Landing Helicopter Dock (LHD) in 2015.
Operational Capability–Army (next stage)	April 2011	September 2014	Scheduled 41-month delay. Army's first Airmobile capability is defined as: *a troop transport helicopter capable of land-based Airmobile operations by day, night or Night Vision Device (NVD).* It represents a high-threat combat capability, and is referred to as Operational Capability Land 1/2 (OCLI/2).
46 MRH90 aircraft delivered (Phases 4 and 6)	July 2014	March 2017	Scheduled 32-month delay.
Final Materiel Release (FMR)	October 2014	TBD	FMR is the milestone that marks the completion and release of DMO Acquisition Phase Project Supplies required to support the achievement of the Operational Release (OR) of the Final Operational Capability (FOC).
47th MRH90 aircraft delivered	July 2017	July 2017	On schedule.

Milestone	Original scheduled date	Actual or current scheduled date	Comments
Final Operational Capability (FOC)	July 2014	April 2019	Scheduled 57-month delay FOC is the point in time at which the final subset of a Capability System that can be operationally employed is realised. FOC is a capability state endorsed at project approval at Second Pass, and reported as having been reached by the Capability Manager.

Source: ANAO analysis of Defence records.

1.30 Both Army and Navy have adopted an incremental approach to MRH90 Acceptance into Operational Service, which allows for the build-up of MRH90 systems knowledge and maturity through the release of capability in a measured and safe manner. At the commencement of the acquisition contract, it was envisaged that the Australian Military Type Certificate (AMTC) and Service Release would be awarded for the full capability, allowing all required operational tests and evaluations to be conducted in accordance with Operational Airworthiness Regulations.[100] However, the 53 month delay in obtaining AMTC and Service Release required the aircraft to be operated under Special Flight Permits issued by the Defence Aviation Authority for longer than originally anticipated, and with more incremental variations to the Special Flight Permits than originally anticipated. These were necessary to allow incremental increases in operational tests and evaluations to proceed within defined operational limitations. Further, as at April 2014, the MRH90 fleet was yet to achieve the first of 11 Operational Capability milestones, for both maritime and land capability.

1.31 The inability to achieve the key capability development milestones as scheduled, and the numerous technical issues arising in the program, indicate the MRH90 aircraft has in key respects been developmental in nature with significant systems immaturity issues remaining to be addressed.

100 Following the issue of an AMTC for the MRH90 aircraft, Certificates of Airworthiness are issued by the MRH90 Design Acceptance Representative for MRH90 aircraft that satisfy Production Acceptance Procedure criteria. That procedure is designed to ensure that MRH90 production aircraft are built as specified and function in accordance with the approved Type Design, and that deviations from design and construction specifications have been identified and accepted, and that all airworthiness related issues outside of those previously identified and mitigated for the applicable MRH90 configuration block have been resolved.

Acquisition history

Initial production and testing of the aircraft

1.32 The first four MRH90 aircraft acquired under AIR 9000 were built in France by Eurocopter between 2007 and 2008, and the maiden flight for the first MRH90 aircraft occurred in France on 28 March 2007. Airworthiness certification of the MRH90 aircraft was reliant upon the European-based certification activities for the German NH90, in its enhanced Initial Operating Capability (IOC+) configuration. By August 2007 a risk to the project schedule was already emerging due to earlier delays in the certification of the German NH90.

1.33 Two of the four French-built MRH90 aircraft were accepted into service by DMO on schedule on 18 December 2007. However, these were immature Product Baseline 1 (PBL 1) aircraft, which had much reduced levels of operational capability and did not satisfy contractual requirements.[101] These aircraft were accepted by DMO on the basis of an agreed partial achievement of the contracted MRH90 capabilities, and were delivered with 13 Permanent Design Deviations and 63 Temporary Design Deviations.[102]

1.34 By 20 October 2008, the accrued hours flown by the three MRH90 aircraft accepted at that time totalled 33.5 hours, significantly below the 240 planned flight hours. This shortfall was due primarily to the MRH90 aircraft experiencing poor systems reliability and spares support, which affected the conduct of acceptance tests and evaluations intended to measure contractor compliance against the aircraft's contracted specifications. The conduct of aircrew Transition Stage Training was also affected by system immaturity and low aircraft availability.[103]

1.35 The remaining 43 MRH90 aircraft were to be assembled by Australian Aerospace at its facility in Brisbane.[104,105] Australian Aerospace received the

101 The first five MRH90 aircraft were delivered at PBL1 build standard, and these were followed by eight PBL 2 MRH90 aircraft. All of these MRH90 aircraft require retrofit to the PBL 3 standard.

102 As at April 2014, there were a total of 4 Permanent and 32 Temporary Design Deviations for MRH90 aircraft of the PBL3 build standard. Defence also agreed to permanent waivers for 35 Design Deviations as part of contractual changes made through Deed of Agreement 1.

103 By way of comparison, Defence advised that at the time of the audit, its MH-60R Program, which is procuring a mature MOTS product, was ahead of schedule and on track to fly all of the first year planned allocation of 600 flying hours.

104 The facility also assembled 18 of the 22 Australian Army (Tiger) Armed Reconnaissance Helicopters (ARH).

first fuselage sections on 25 March 2007, and the first MRH90 aircraft assembled in Australia was accepted by DMO on 19 December 2008.

1.36 In January 2009, type acceptance test and evaluations of PBL1 MRH90 aircraft resulted in the following statement:

> Overall, the MRH90 handled well and will be safe to fly within the limitations outlined above under an SFP [Special Flight Permit] or AMTC/SR [Australian Military Type Certification/Service Release], however, at this stage the systems continue to show a level of immaturity, which will restrict the scope of training activities significantly. System immaturity will also impact on training by reducing the efficiency of training sorties/programs as aircrew are required to deal with potential emergencies and subsequent administration. A commensurate increase in the training package is anticipated. Significant specific ground training on system immaturity is recommended.

Management of design and contractual issues

1.37 The developmental nature of the MRH90 system design and the support system has resulted in unplanned program management complications for DMO, Army and Navy. DMO is managing a complex commercial and engineering acquisition environment in terms of requirements verification and validation, design certification, the fitness for purpose of some role equipment, and the establishment of an effective support system which provides value for money. DMO has also had to manage complex contractual change negotiations arising as a consequence of system development, support and affordability issues. Army and Navy have been compelled to frequently reschedule the MRH90 aircraft transition into service, particularly aircrew and groundcrew training programs. Further, a capability gap has emerged for Navy, following the withdrawal from service in December 2011 of the Sea King helicopter fleet and the lack of available MRH90 aircraft.

1.38 On 20 April 2010, an MRH90 aircraft suffered an engine failure in one of its two main engines. DMO subsequently suspended contractual acceptance of the MRH90 aircraft from Australian Aerospace in November 2010 as a result of persistent technical issues. At the time, DMO had already accepted five PBL 1 and eight PBL 2 aircraft, all of which were contractually noncompliant aircraft.

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105 However, aircraft 15 and part of 17 were assembled in Germany to recover schedule.

1.39 On 1 February 2011, the then Government announced that the MRH90 acquisition would be the subject of a diagnostics review, known as a Gate Review, to be conducted by a DMO-appointed Gate Review Assurance Board.[106] The MRH90 Gate Review was held on 18 February 2011 and it determined, amongst other things, that:

> Five years into the acquisition contract the project is more than twelve months behind schedule, aircraft availability is low and there remain areas of uncertainty around technical compliance and reliability.
>
> The current acquisition contract is built on a construct of accepting mature aircraft. So whilst local aircraft assembly is on schedule and of good quality, acceptance of aircraft has stopped based on the grounds of their being non-conforming supplies due to a range of technical issues.
>
> The sustainment contract has been operating for about three years. It is not linked to the acquisition contract performance and there is concern that it is not delivering value for money. As a performance based contract, triggers appear to be inappropriately set.

1.40 On 15 April 2011, DMO's General Manager Systems wrote to Australian Aerospace's Chief Executive Officer to advise him of the Gate Review's main findings. The letter noted:

- An understanding of the developmental nature of the MRH90 helicopter system and the significant number of technical problems which remain to be resolved by [Australian Aerospace / NHI] before Acceptance of Aircraft can resume.
- The impact of technical issues and low reliability components on the rate of effort (ROE) [flight hours] that has been achieved.
- The significant commercial and operational issues which exist in respect of the Sustainment Contract and the mechanisms of which are not working as intended.
- The critical importance of finding an expeditious resolution of the technical and operational issues, such that a significant capability gap does not emerge with the withdrawal of Sea King and Black Hawk.

106 Gate Reviews involve an assessment by a DMO-appointed body (known as a 'Gate Review Assurance Board') of a project's readiness to proceed to the next stage of its lifecycle: that is, through a project 'gate'. Generally, the assessments are held before the project reaches a major milestone. DMO intends that the board should comprise senior DMO management and external members. ANAO Audit Report No.52, 2011–12, *Gate Reviews for Defence Capital Acquisition Projects,* June 2012, p.13.

- The lack of linkages between the Acquisition and Sustainment Contracts and the need to have a commercial arrangement for the Sustainment Contract which better reflects the Commonwealth's current and anticipated support requirements and [Australian Aerospace's] level of performance of both the Acquisition and Sustainment Contracts.

1.41 On 29 April 2011, the then Minister for Defence Materiel announced that the Gate Review recommended the project not be added to the DMO Projects of Concern list[107], and that Defence work with Australian Aerospace to implement a remediation plan to improve the availability of the helicopters, by addressing engineering and reliability issues. The Minister also announced that the project would be the subject of a further diagnostic review later that year to examine the effectiveness of the action taken, and the need for any further action.

1.42 The strategy recommended by the Gate Review and progressed by Defence included:

(a) the conduct of a non-advocate review of the sustainment arrangements to identify and achieve agreement on the root causes of the poor rate of effort achieved to date;

(b) re-baselining the contract schedule to reflect an achievable schedule given the maturity of the aircraft;

(c) Defence seeking compensation for the consequences of delays;

(d) improving linkages between the current acquisition and sustainment contracts; and

(e) improving the contractual terms to enhance Defence's contractual position and Intellectual Property rights.

1.43 Defence commenced working with Australian Aerospace in April 2011 to implement a remediation plan. The intention was to form a single Deed of Agreement between the Commonwealth and Australian Aerospace that resolved all technical, commercial and legal issues associated with the MRH90 acquisition and sustainment contracts. Initially it was expected that the Deed would be agreed by the middle of 2011, with detailed contract changes in place

107 The Projects of Concern process was established in 2008 by the then Government to focus the attention of the highest levels of government, Defence and industry on remediating problem projects.

by December 2011. However, as a result of a difficult negotiation process[108], and in order to have some prospect of providing helicopters for Army and Navy in a reasonable timeframe, Defence agreed to negotiate two deeds. Deed of Agreement 1 (Deed 1) would address engineering issues and technical non-conformances, while Deed of Agreement 2 (Deed 2) would address reliability and supportability matters.

1.44 By September 2011, the project remained subject to significant risks, as the suitability of Australian Aerospace's proposed fixes was yet to be demonstrated. After a second MRH90 Gate Review, held on 22 September 2011, the Gate Review Assurance Board concluded that there were no compelling reasons to mitigate against a decision to list and manage the MRH90 Program as a Project of Concern.

1.45 On 5 October 2011, Defence and Australian Aerospace signed Deed 1. The Deed addressed a range of technical, legal and commercial issues that had arisen between the parties in respect of the acquisition and sustainment contracts.[109] DMO agreed to accept a further three MRH90 aircraft after Deed 1 was signed. In later correspondence between the DMO Program Office and the Chief of Army and the Chief of Navy, the Program Office stated:

> The MRH90 PBL03 configuration with modifications implemented from the First Deed of Agreement (Deed 1) essentially meets the contracted requirements. However, the aircraft does not meet user expectations and it is possible further deficiencies may be identified during Operation Test and Evaluation.
>
> ... regardless of the contract, the aircraft does not fully meet the ADF's needs and therefore further modifications will need to be made rapidly and at a reasonable cost.

1.46 On 25 October 2011, the Board and the Acting Chief Executive Officer of DMO recommended that the MRH90 Program be listed as a Project of Concern. By 9 November 2011, Defence had also contemplated options to terminate or truncate the MRH90 acquisition contract and pursue alternate options being developed by the Defence Capability Development Group

108 By August 2011 the negotiations were progressing more slowly than anticipated by Defence. Australian Aerospace would not agree provisions without the consent of NHI, who in turn required the agreement of its partner companies Eurocopter (France and Germany), AgustaWestland and Stork Fokker.

109 Appendix 3 of this audit describes the technical issues addressed by Deed 1.

(CDG). These options included procuring (by purchase or lease) an alternative helicopter capability such as the UH-60M Black Hawk or MH-60S Knighthawk.[110] Defence informed the Minister for Defence that progression of these options would depend on an assessment of the MRH90 Program's performance, including the outcomes of tests and evaluations over coming months, as well as a more detailed capability gap analysis. On 28 November 2011 the Minister for Defence announced the MRH90 Program's listing as a Project of Concern.[111]

1.47 Acceptance of MRH90 aircraft was again suspended by DMO in February 2012 due to an issue with the aircraft cargo hook, and recommenced in May 2012. During this period DMO reached agreement with Australian Aerospace on further remediation of MRH90 design and sustainment issues.[112] On 6 March 2012, Deed 1 was varied to:

(a) incorporate an interim performance management regime within the MRH90 sustainment contract; and

(b) allow DMO to accept, without prejudice, additional MRH90 aircraft at PBL3, which is a lesser configuration than that required under the acquisition contract.

1.48 DMO agreed to accept a further three aircraft from Australian Aerospace at the point in time of varying Deed 1. However, Defence remained concerned about the MRH90 aircraft capability and sustainment deficiencies. In November 2012, a submission from Defence's CDG to the Defence Capability Investment Committee (DCIC)[113] made the following key points:

- AIR 9000 Phase 2/4/6 is a Project of Concern valued at over $3.6 billion, and key project decisions are approaching.

110 The MH-60S Fleet Combat Support Helicopter first flew on 27 January 2000; entered service with the US Navy in February 2002 and was approved to enter full-rate production in August 2002. As of July 2013, the US Navy was operating 234 MH-60S aircraft.

111 The MRH90 Program was still listed as a Project of Concern in June 2014.

112 See ANAO Report No. 15, 2011-12, Assurance Report, *2011-12 Major Projects Report*, Defence Materiel Organisation, December 2012, p.214.

113 The DCIC consists of the: Chief of the Defence Force (Chair); Secretary of Defence; Vice Chief of the Defence Force; Chief of Navy; Chief of Army; Chief of Air Force; Chief Executive Officer Defence Materiel Organistion; Chief Defence Scientist; Chief Financial Officer; First Assistant Secretary Capability Investment and Resources; and Deputy Secretary Strategy and Plans.

- While progress has been made, it is not clear whether an acceptable level of capability and availability can be achieved at an affordable or value for money cost.
- Addressing Army and Navy capability expectations would require an expensive developmental program to modify the aircraft and would be outside the project's budget.
- A decision to further commit to the project through Deed 2 is likely to be required in early 2013.

1.49 Following the November 2012 DCIC meeting, Defence proceeded with Deed 2 negotiations. The submission to DCIC noted [emphasis in original]:

> **Capability issues that are not in the scope of the contract but potentially mean the MRH is not fit for purpose without a [Real Cost Increase].** Senior Army representatives at the September 2012 DMO Gate Review (and in other forums) have stated that elements of the cabin and role equipment are not fit for purpose. In particular, the seat size and harness is unacceptable as soldiers do not fit into the seats while wearing combat equipment and require assistance to fasten the harness.
>
> In addition, the gun mounted in the side door may be unacceptable. The current configuration impedes ingress/egress, as well as the ability to defend the aircraft with the gun during embarkation and disembarkation. As a result, Army representatives have stated that the MRH-90 may be unable to meet certain Airmobile support to Special Operations roles. ...
>
> The design changes to fix these issues are outside the scope of the current contract. [Australian Aerospace] has proposed a number of improvements, but these represent significant design changes with potentially high cost and technical risk. In addition, the time that would be required to make the changes could seriously impact availability of the aircraft.
>
> Navy's capability concerns are more limited than Army's given the different operating environment. Senior Navy representatives have stated that Navy can accept the MRH-90 to achieve an Initial Operating Capability if a problem with the cargo hook is fixed. While [Australian Aerospace] is currently in the process of fixing the cargo hook to make it contractually compliant, Navy has indicated that the hook may require replacement to operate effectively with existing equipment.[114]

114 Defence subsequently determined that the cargo hook needs to be replaced, and as at April 2014, NHI was modifying the design.

MRH90 sustainment contract and Deed 2

1.50 The sustainment contract for the first 12 MRH90 aircraft was signed on 29 July 2005. It was amended on 20 June 2006 to include the additional 34 MRH90 aircraft, and amended again in March 2012 and July 2013 to include agreements reached with Australian Aerospace as part of the Deed negotiations. These latter amendments were to improve the performance measures contained within the pre–2012 contract provisions. These provisions were found to be largely ineffective, as they were based on the premise that the number of fully developed (mature) MRH90 aircraft delivered through the MRH90 aircraft acquisition contract would be sufficient to achieve value for money via performance incentives and other incentives within the contract. However, the number of MRH90 aircraft offered for acceptance by DMO continues to fall well short of the acquisition contract's delivery schedule, and these aircraft are not yet mature.[115] Until June 2013, DMO was unable to apply the sustainment contract's performance management regime as there were insufficient MRH90 aircraft placed into operational service to trigger that regime. Furthermore, other sustainment issues affected the availability of the delivered MRH90 aircraft and further brought into question the value for money and cost-effectiveness of MRH90 aircraft sustainment expenditure.[116]

1.51 DMO negotiated changes to the acquisition and sustainment contracts through Deed 2, which was signed on 9 May 2013 and took effect on 1 July 2013. Under Deed 2, Defence has been granted some additional access to Intellectual Property; the linkages between the acquisition and sustainment contracts have been strengthened; a more pragmatic MRH90 aircraft acceptance process that does not compromise the DMO's ability to reject significant deficiencies has been adopted; and Defence's access to Liquidated Damages, capped at 5 per cent of the acquisition contract value across future

115 At the time of the audit fieldwork, fully contractual compliant MRH90 aircraft were defined as PBL3 aircraft complete with SUS 1.1, which is anticipated to be achieved between 2015 and 2017.

116 Under the original MRH90 sustainment contract, MRH90 operating costs per flight hour were found to be five times that of the Army's Sikorsky S-70A-9 Black Hawks, which were acquired between 1988 and 1991. The Sikorsky S-70A, designated the UH-60A Black Hawk by the US Army, entered service in the US in 1979.

contract milestones, has been extended.[117] Deed 2 also seeks better outcomes from the MRH90 Local Industry Plan.

1.52 As part of the Deed 2 negotiations, Defence settled a Liquidated Damages and common law damages claim, by re-baselining the acquisition contract in return for a range of improvements, including new aircraft cabin seats, the 47th MRH90 aircraft, a Repair By the Hour Sustainment Scheme, final spares and support equipment, a warranty that sufficient major spares had been procured to support the mature rate of effort, configuration changes and obsolescence resolution. DMO informed the ANAO that it considers the revised sustainment contract has incorporated an improved performance incentive structure (see paragraphs 4.48 to 4.53).

Current status

1.53 As at April 2014, 27 MRH90 aircraft had been accepted by DMO. Operational test and evaluation was continuing to validate the ability of the MRH90 aircraft to satisfy the 11 Operational Capability milestones set by the Army and Navy. Fourteen MRH90 aircraft built to PBL 3 configuration had been accepted by DMO, and a further three aircraft had been retrofitted to bring them up to the PBL 3 standard. Thus far, the Retrofit Program for PBL 1 MRH90 aircraft has taken an average of 456 days to complete per aircraft.

1.54 As at April 2014, the MRH90 Program was dealing with a range of challenges related to immaturity in the MRH90 system design and the support system. The challenges include:

- resolving MRH90 cabin and role equipment design issues so that operational test and evaluation validates the MRH90 aircraft's ability to satisfy Operating Capability Milestones set by Army and Navy;
- the continuing need to conduct a wide range of verification and validation activities on problematic or deficient aircraft systems;
- increasing the reliability, maintainability and flying rate of effort of the MRH90 aircraft;

117 The additional Intellectual Property obtained via Deed 2 permits the Commonwealth, or a third party on its behalf, to perform Deeper Maintenance and acquire or support Training Devices. These rights also allow some minor modifications to be performed by the Commonwealth or a third party. However, there are restrictions on who the third party is, such as restrictions on engaging with direct competitors.

- embedding revised sustainment arrangements directed toward improving the value for money of these arrangements;
- establishing a new Local Industry Plan including milestones and performance metrics;
- funding and managing the extended concurrent operation of the Army Black Hawk and MRH90 aircraft fleets; and
- managing a Navy capability gap following the retirement of the RAN Sea King aircraft in December 2011.

1.55 Appendix 4 lists the MRH90 issues, risks and constraints under management by Army and DMO, as at July 2013.

1.56 By March 2014, total MRH90 Program acquisition and sustainment contract expenditure was $2.447 billion.

Audit objective and scope

1.57 The audit objective was to assess the Department of Defence's progress in delivering Multi-Role Helicopters (MRH90s) to the ADF through AIR 9000 Phases 2, 4 and 6, within approved cost, schedule and performance parameters.

1.58 The timeline covered by this audit extended from the MRH90 Program's requirements definition phase in 2002, to progress achieved by April 2014.

1.59 The audit approach closely followed the systems engineering processes that Defence uses to manage the capability lifecycle of projects. The ANAO did not intend, nor was it in a position, to conduct a detailed analysis of the full range of engineering issues being managed within the MRH90 Program. Rather, the audit focused on the MRH90 Program's progress thus far in establishing the management structures and processes used to deliver the aircraft within approved cost, schedule and performance parameters.

1.60 The high-level criteria developed to assist in evaluating Defence's performance were as follows:

- the requirements definition phase of the MRH90 Program, acquisition strategies and plans, and capability development policy and processes should be in accordance with internal Defence systems engineering procedures;

- the criteria used in the tender evaluation and selection process should reflect the approved capability identified through the requirements definition phase;
- the acquisition phase of the MRH90 Program, and test and evaluation leading to system acceptance, should meet the required technical, operational and safety regulatory requirements;
- the process involved in certifying the safety and fitness for service of the aircraft should meet the required technical, operational and safety regulatory requirements; and
- MRH90 sustainment arrangements should enable the aircraft to achieve agreed operational readiness requirements within approved budgets.

1.61 The audit report, which responds to the audit objective, refers to submissions received, and formal decisions made by government in August 2004 and April 2006. These submissions and decisions were central to the course of the MRH90 aircraft acquisition, and to an understanding of issues involved in the tender processes undertaken and their consequences. I have concluded that the inclusion of this information is not contrary to the public interest.[118] The audit report does not extend to commenting on the deliberations of government beyond matters reflected in formal decisions.

1.62 The audit was conducted in accordance with the ANAO audit standards at an approximate cost to the ANAO of $665 000.

118 Section 37 of the *Auditor-General Act 1997* outlines the circumstances in which particular information is not to be included in public reports, including if the Auditor-General is of the opinion that disclosure of the information would be contrary to the public interest.

Structure of this Audit Report

1.63 The remainder of the Audit Report is arranged as follows:

Table 1.2: Structure of this Audit Report

Chapter	Overview
2. Additional Troop Lift Helicopter Project Definition and Tender Evaluation	Examines the AIR 9000 Phases 2, 4 and 6 acquisition strategy, tender evaluation and Second Pass approval.
3. MRH90 Capability Requirements Definition	Examines the AIR 9000 Phases 2, 4 and 6 requirements definition and the impact of requirements definition shortcomings.
4. MRH90 Acceptance and Sustainment	Examines the progress made toward the MRH90 aircraft being accepted into operational service, from the perspective of design acceptance compliance, and the verification and validation of contractual compliance. The chapter also examines MRH90 aircraft operational availability and sustainment.

2. Additional Troop Lift Helicopter Project Definition and Tender Evaluation

This chapter examines the AIR 9000 Phases 2, 4 and 6 acquisition strategy, tender evaluation and Second Pass approval.

Helicopter design requirements

2.1 Military helicopter designs vary significantly according to each helicopter type's operational requirements. Army and Navy medium troop lift and utility helicopter designs in the 8000 to 11 000 kilogram gross weight range, generally allow rapid entry and exit of personnel and their equipment, and have large payload capacities. These helicopters may be fitted with ballistic protection armour and self defence gun systems, as well as electronic self protection systems to detect and counter missile attacks.[119] Army and Navy combat helicopters are smaller and are designed for land and maritime target acquisition, identification and attack.[120] Helicopters that operate at sea must be marinised to inhibit structural degradation initiated by sea environments and to withstand hazards associated with landing on, and being stored in a ship.[121] Training helicopters tend to be smaller, easier to fly and less costly to operate.[122] More general characteristics of military helicopters include structural crashworthiness and the ability to operate in a broad range of conditions such as hot, dry, dusty, cold, icy and humid conditions.

2.2 Multi-role helicopters suitable for both Army and Navy operations invariably require design compromises and capability tradeoffs. For example, maritime helicopters generally require strengthened undercarriages and flight deck securing systems, and ideally automatic folding blades and deck traversing systems that facilitate safe flight deck movement and storage within confined spaces. These maritime requirements add weight, which in turn reduces the capacity to transport personnel and equipment, and increases the amount of fuel used, hence reducing operational range. Helicopters that are to operate in high-threat environments need to fulfil both the utility transport

119 An example in current service is the UH-60M Black Hawk.
120 An example in current service is the Tiger Armed Reconnaissance Helicopter.
121 An example in current service is the Maritime Helicopter MH-60R Seahawk.
122 An example in current service is the B-206 Kiowa.

role and have ballistic protection systems, a self defence gun and electronic self protection, which all introduce design trade-offs between payload and range.

2.3 AIR 9000 Phase 2 involved assessments of three aircraft—the Mark III version of the Sikorsky UH-60 Black Hawk Army Utility Transport helicopter[123], the Mark I version of the NATO Helicopter Industries (NHI) NH90 Troop Transport helicopter (TTH) and the Mark II version of the AgustaWestland EH101.

2.4 This chapter commences with an examination of strategic planning for AIR 9000. It then examines the selection of the NH90 TTH to meet Army's requirements for Airmobile Operations, battlefield support, Special Operations and Aeromedical Evacuation, and the RAN's requirements for a Maritime Support Helicopter.

Timing of helicopter acquisition

2.5 Developing new military helicopters or upgrading existing models involves a lengthy process of design, prototype construction, test and evaluation, airworthiness certification and full-rate production approval. The timeline for these activities may extend to beyond a decade. This timeline needs to be taken into account when deciding the most suitable time to sign acquisition and sustainment contracts.

2.6 There are clear advantages in acquiring helicopters after the aircraft are certified and full-rate production has commenced. By this time: operational test and evaluation outcomes should have been factored into the design; technical and operational airworthiness issues should have been resolved; and support system arrangements established to ensure the specified level of operational availability is achieved efficiently and effectively. Furthermore, it is only at this time that an acquisition of a helicopter should be classified as 'Military Off The Shelf' (MOTS), and therefore benefit from the above development framework, as well as from the economies of scale and supply chain efficiency that accompany the acquisition of aircraft and a support system which are compatible with those of other countries. For those reasons the 2002 *ADF Helicopter Strategic Master Plan*, discussed in the following section, specified that the additional troop lift helicopters to be acquired under

123 Development of the Mark I UH-60A Black Hawk commenced in 1972, development of the Mark II UH-60L Black Hawk commenced in 1987 and development of the Mark III UH-60M Black Hawk commenced in 2001.

AIR 9000 would be MOTS helicopters, taking into account commonality with existing fleets.

2.7 In the late 1980s, when Australia was deciding to acquire the Sikorsky S-70A-9 Black Hawks, the Mark I Sikorsky UH-60A Army Utility Transport model was nearing the end of production. At the same time, full-rate production of the Mark II Sikorsky UH-60L Black Hawk was yet to commence. This situation was repeated in 2004 when the AIR 9000 Phase 2 additional troop lift helicopter acquisition decision was made, and repeated again in 2006 when a decision concerning the AIR 9000 Phase 4 Black Hawk mid-life upgrade was taken.

2.8 Between 2003 and 2006, the Mark II UH-60L Black Hawk was nearing the end of its production; and the Mark III UH-60M Black Hawk test and evaluation, and airworthiness certification, was still underway, with full-rate production scheduled to commence in May 2007. During this period the Mark I NH90 was still being developed, and airworthiness certification of the German NH90 TTH variant occurred in December 2006.[124] Figure 2.1 shows the UH-60M Black Hawk, NH90 Troop Transport and MRH90 helicopter development and acquisition milestones.

2.9 As indicated in Figure 2.1, there are distinct differences between the MOTS system development management framework mandated for US Department of Defense systems acquisition programs[125], and that used by the European designers of the NH90 aircraft and its support system.[126] The NH90 aircraft entered full-rate production before the completion of flight trials and Type Certification. In contrast, the US UH-60M Black Hawk received airworthiness certification and completed operational testing prior to the commencement of full-rate production. The US system integrates both the technology and logistics development phases, and mandates milestones at which an independent Milestone Decision Authority may authorise a weapon system's progress through the next development phase, consistent with phase-specific entrance criteria and statutory requirements. The overall aim is

124 The NH90 and MRH90 airframes are constructed from glass and carbon fibre composite material, and both aircraft have fly-by-wire flight controls.

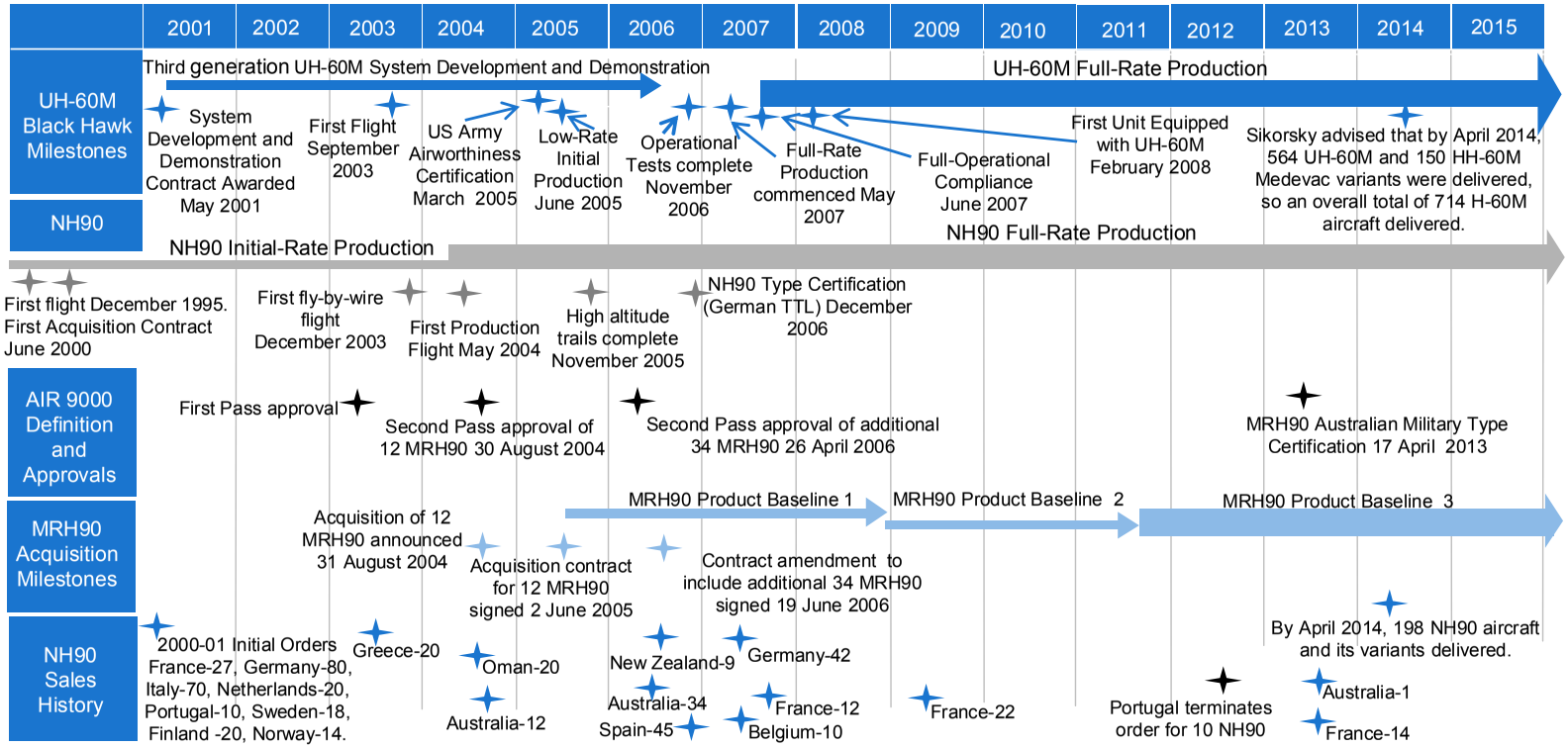
125 See US Department of Defense Instruction 5000.2, *Operation of the Defense acquisition system*, May 2003.

126 The ADF's Tiger Armed Reconnaissance Helicopter, acquired by the AIR 87 Program, was developed using a similar management framework to that of the NH90.

to ensure that full-rate production commences after operational test and evaluation and certification have been satisfactorily completed.

2.10 Development of the MRH90 aircraft, and its support system, has not followed an extensively prescribed system development management framework, such as that used by the US Government. Consequently, even though the MRH90 aircraft entered full-rate production in mid-2005, there are a variety of MRH90 mission systems and support systems that remain under development in early 2014, and their service release remains subject to various risks and issues.

Figure 2.1: UH-60M Black Hawk, NH90 Troop Transport and MRH90 development and acquisition milestones



Source: ANAO analysis of Defence records.

Australian Defence Force (ADF) helicopter acquisition policy and strategy

2.11 As mentioned in paragraph 1.1, as a result of leading the International Force for East Timor (INTERFET) in 1999, Defence identified a need for sufficient troop lift helicopters that were capable of operating off Navy ships. Subsequently, the Defence White Paper of 2000 identified the need for a 'program of rapid enhancement of a range of combat capabilities for our land forces', including:

> An additional squadron (about 12 aircraft) of troop-lift helicopters to provide extra mobility for forces on operations. In particular, these helicopters will enhance our capability to operate off our newly acquired troop ships, HMAS *Manoora* and *Kanimbla*. These helicopters are planned to enter service around 2007.[127]

2.12 In 2001, the acquisition of additional troop lift helicopters was entered into the *Defence Capability Plan 2001-2010.* The acquisition of these helicopters was to occur under AIR 5046 Phases 5 and 6, Additional Troop Lift Helicopters (ATH). This program was to procure MOTS helicopters that took into account commonality with existing fleets, at an estimated cost of between $350 million and $450 million. The additional troop lift helicopters were to be in service in 2007.[128]

2.13 In July 2001, AIR 9000 Phase 1 commenced with the intent of developing the *ADF Helicopter Strategic Master Plan*. In April 2002, AIR 5046 Phases 5 and 6 were transitioned into AIR 9000 Phase 2.[129]

ADF Helicopter Strategic Master Plan

2.14 The *ADF Helicopter Strategic Master Plan* was directed toward developing a coherent and efficient management framework for all of the ADF's helicopter fleets, by rationalising aircraft types where efficient and operationally effective to do so. Table 2.1 shows the ADF helicopter acquisition projects that were included in the Master Plan.

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127 Department of Defence, *Defence 2000: Our Future Defence Force*, Canberra, 2000, pp.82–83

128 Department of Defence, *Defence Capability Plan 2001–2010 Public Version*, Canberra, 2001, pp.5–6

129 AIR 9000 was endorsed in December 2000, and in April 2001 its scope was expanded to include all helicopter projects.

Table 2.1: ADF helicopter acquisition projects included in the *ADF Helicopter Strategic Master Plan*

Project and helicopter type	Project phase and acquisition approval date	Number contracted	Acquisition cost ($m)
AIR 87 Tiger Armed Reconnaissance Helicopter (ARH) for Army	AIR 87 Phase 2 March 1999	22	2031.5
AIR 9000 Phases 2, 4 and 6 Multi-Role Helicopter (utility helicopter for Army and Navy) – MRH90	AIR 9000 Phase 2 August 2004 AIR 9000 Phases 4 and 6 April 2006	47 (40 for Army, 6 for RAN,1 for maintenance training)	4013.2
AIR 9000 Phase 5B Army Medium Lift – Chinook CH-47F	AIR 9000 Phase 5C February 2010	7	564.0
AIR 9000 Phase 7 Helicopter Aircrew Training System	AIR 9000 Phase 7 – awaiting approval	awaiting approval	awaiting approval
AIR 9000 Phase 8 Maritime Warfare Helicopter – MH-60R 'Romeo' Seahawk	AIR 9000 Phase 8 June 2011	24	2958.3
Total approved		**100**	**9567.0**

Source: Department of Defence.

2.15 Table 2.2 lists the other ADF helicopters in service at the time of the audit.

Table 2.2: ADF helicopter fleet, as at November 2013

Helicopter type and manufacturer	Number	Planned withdrawal
Black Hawk S-70A-9 Sikorsky	34	In April 2014, Defence informed the ANAO that the Black Hawk fleet's withdrawal from service commenced in January 2014, and is to be completed by June 2018.
Chinook CH-47D Boeing	6	Medium lift helicopter for Army – planned withdrawal as the CH-47F aircraft reach Final Operational Capability.
Seahawk S-70B-2 Sikorsky	16	Maritime warfare helicopter – planned withdrawal from 2014 as the Seahawk 'Romeo' reach Final Operational Capability.
Kiowa B-206 Bell	41	Training helicopter – planned withdrawal as the Helicopter Aircrew Training System aircraft reach Final Operational Capability.

Helicopter type and manufacturer	Number	Planned withdrawal
Squirrel A5350B Eurocopter	13	Training helicopter – planned withdrawal as the Helicopter Aircrew Training System aircraft reach Final Operational Capability.
Bell 429 Bell	3	Contracted for a four year period under the RAN's Retention and Motivation Initiative 2.
Total	**113**	

Source: *Portfolio Budget Statements 2013–14*, Defence Portfolio.

2.16 The *ADF Helicopter Strategic Master Plan* sought to reduce the cost of the ADF's helicopter capability though greater fleet commonality. However, in 2009, the Defence Science and Technology Organisation (DSTO) used the sustainment history of Black Hawk and Seahawk aircraft to investigate the potential benefits (if any) of fleet commonality. Although the Black Hawk and Seahawk fleets originated from the same basic type (i.e. the Sikorsky UH-60), the study found that relatively small sustainment gains were made, and that there were a range of factors inhibiting the management of commonality.

Strategic Partnership

2.17 A core feature of the Master Plan was to form a partnership with a Prime Contractor to implement the AIR 9000 Program through a Strategic Agreement. The Strategic Agreement was to complement long-term sole-source helicopter acquisition and sustainment contracts, through the sharing of goals, risks and communication strategies, and by providing for cost visibility and audit access.

2.18 AIR 9000 Phase 2 was to be the first of the AIR 9000 acquisition projects to be implemented under the Master Plan. Consequently, Defence recognised that decisions taken in Phase 2 would directly impact on the objectives of the overall AIR 9000 Program. The strategic objectives set for AIR 9000 Phase 2 included:

- the aircraft must be capable of performing several ADF roles, allowing optimum levels of commonality across the ADF helicopter fleet, with a resultant decrease in through-life support issues;
- an aircraft which meets the objectives of AIR 9000, of either a type currently in service or a type proposed for introduction, must ultimately reduce cost, personnel liability, complexity and risk to the lift capability; and

- the requirement is for a MOTS procurement. This precludes aircraft in development or yet to be certified, thus reducing the risk of cost escalation and schedule slippage.[130]

2.19 Consistent with the strategic intent to reduce aircraft types, Defence considered at the time that the helicopter that was chosen for AIR 9000 Phase 2 would also be the preferred solution for Phase 4 and possibly Phase 6. Therefore, the helicopter selected as part of Phase 2 would form the basis of the ADF troop lift helicopter fleet for the next 20 years.

Troop Lift Helicopter selection process

2.20 In April 2002, after considering the *ADF Helicopter Strategic Master Plan*, the Defence Capability Investment Committee (DCIC) agreed that existing helicopter projects be consolidated within the *Defence Capability Plan* under AIR 9000. At the same time the DCIC agreed that industry be solicited to provide information about the wider AIR 9000 concept, recognising the significant capability and commercial advantages to Defence in contractually linking AIR 9000 Phase 2 (Additional Troop Lift Helicopters) and Phase 4 (Black Hawk Upgrade/Replacement). In light of these decisions, in September 2002, the DCIC recommended to the then Minister that AIR 9000 Phase 2 be delayed by one year.

2.21 During this period there were widespread concerns about terrorist activities and the possible utilisation of weapons of mass destruction. Following the October 2002 Bali Bombings, in December 2002, the then Prime Minister announced that:

> The Government has decided to accelerate the purchase of additional Troop Lift Helicopters [Phase 2] to enable a squadron of helicopters to be based in Sydney. This would provide a potent addition to Australia's East Coast Special Forces capabilities.[131]

2.22 Defence proposed to send an existing Black Hawk Special Operations Squadron to Sydney, and to assign the yet to be acquired additional troop lift helicopters to Townsville. That arrangement would satisfy the Special Force's troop lift helicopter needs in a timely manner, and provide Defence the time

130 *AIR 9000 ADF Helicopter Strategic Master Plan*, Strategic Summary, Issue 2, June 2004, p.21.

131 *Transcript of the Prime Minister the Hon John Howard MP Press Conference*, Campbell Barracks, WA, 19 December 2002.

needed to reconfigure its helicopter fleets, in part by using AIR 9000 Phases 2 and 4 to procure multi-role helicopters suitable for operations from selected RAN ships.

AIR 9000 Phase 2 Request for Proposal

2.23 On 7 May 2003, Defence released a Request for Proposal (RFP) for AIR 9000 Phase 2 to three prospective suppliers. In response to the RFP, AgustaWestland offered the EH101 Merlin, Australian Aerospace offered the NH90 (to be developed for Australia as the MRH90) and Sikorsky Aircraft Australia Limited offered the S-70M Black Hawk.[132] As part of the RFP, the prospective suppliers were not provided with a draft contract. They were instead asked to consider the standard Defence contracting templates, which are normally subject to considerable tailoring for specific projects.

2.24 The three proposals were evaluated by a Source Selection Board between 11 August and 3 October 2003. The board was unable to come to a clear conclusion and recommended that either:

- a further Offer Development and Refinement Process (ODRP), for a combined Phases 2 and 4, be pursued with the remaining contenders, to improve the low to medium confidence in cost estimates;
- failing this, that the MRH90 aircraft should be selected for Phases 2 and 4 (noting that the then Chief of Army had concerns about aircraft numbers, performance in hot conditions and the potential transition [from Black Hawks] to a different aircraft type); or
- if the lead time between phases was less than two years, then the S-70M Black Hawk aircraft be acquired.

2.25 The Source Selection Board report noted that there was an underestimation of the cost of Phase 2[133], and that a substantially longer engagement process would be required before committing to major acquisitions under a strategic partnering arrangement. The board recommended that Phases 2 and 4 be combined to achieve more cost-effective outcomes, including better industry outcomes. Defence estimated this would

132 The Sikorsky S-70M Black Hawk is the direct commercial sale version of the Sikorsky UH-60M produced for the US Army, and shares the UH-60M design characteristics.

133 The *Defence Capability Plan 2004-2014 Public Version* contained a Phase 2 budget estimate of $0.750 billion to $1.0 billion.

require 'probable' project funding of $3 billion to acquire 48 S-70M aircraft or $2.8 billion to acquire 40 MRH90 aircraft.[134] On that basis, the estimated Unit Procurement Cost of each S-70M aircraft was $62.5 million, and $70 million for each MRH90 aircraft.[135]

Combined AIR 9000 Phases 2 and 4

2.26 Following consideration of the Source Selection Board report at its meeting on 24 October 2003, the DCIC agreed to recommend to the Minister for Defence that the AgustaWestland EH101 offer be set aside[136], and that an ODRP be pursued to maintain competitive pressure and further clarify the two remaining offers. A Defence minute dated 30 October 2003 advised the Minister that despite seeking a MOTS solution, there was continuing uncertainty about development and certification risks for the two offers. Defence also recommended that the In-Service Date of 2007 be retained, as the RFP process showed that a plan to achieve an accelerated In-Service Date of late 2006 would introduce a high-level of risk into the project.[137]

2.27 On 11 December 2003, the Minister for Defence agreed to decline AgustaWestland's proposal for the EH101. He also reaffirmed the Government requirement for acceleration of the purchase[138], and that the available funding for AIR 9000 Phases 2 and 4 was $2.5 billion, consistent with the maximum amounts reported in the *Defence Capability Plan 2004–2014*.[139]

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134 The *Defence Capability Plan 2004-2014 Public Version* contained a Phase 4 budget estimate of $1.0 billion to $1.5 billion. The combined maximum budget estimate for Phases 2 and 4 was $2.5 billion.

135 The Unit Procurement Cost (also known as weapon system cost), includes: the aircraft and the cost of all fixed systems (that is, the baseline aircraft configuration, including airframe, engine and avionics); and the cost of the initial suite of support items, such as technical data and publications, technical training and training equipment, maintenance support equipment and spares.

136 Citing as reasons that despite being a MOTS aircraft in service with the United Kingdom, Portugal and Canada, the EH101 had poor maneuverability; limitations in support of amphibious operations due to its larger size; its payload and range advantage reduced markedly in hot and high operations (performing worse than the S-70M but still better than the MRH90); and was unsuitable for Counter Terrorism operations.

137 The minute noted that the NH90 aircraft was in the last stages of certification testing. However, the schedule for the MRH90 aircraft sent as part of the tender documentation shows that the fifth NH90 prototype had not yet started flying, and that the German variant would not receive airworthiness certification until December 2006, some three years later. The minute also noted that 'the S-70M has yet to fly in other than early prototype version', and that the cost of operating the MRH90 fleet would be less than a Black Hawk fleet.

138 Discussed in paragraph 2.21.

139 Department of Defence, *Defence Capability Plan 2004-2014 Public Version*, pp.56 and 60. See also footnote 134.

2.28 On 19 December 2003, the Minister for Defence directed Defence to engage Australian Aerospace and Sikorsky in an expedited, competitive process to develop tender quality offers for AIR 9000 Phases 2 and 4 that would lead to contract signature in November 2004. The Minister expressed frustration that the timelines put forward by Defence were too lengthy, and did not respond adequately to the Prime Minister's December 2002 announcement of an acceleration of the acquisition process.

2.29 On 19 January 2004, the Minister for Defence approved a DMO recommendation to proceed with bids from Australian Aerospace and Sikorsky for a combined AIR 9000 Phases 2 and 4. Combining Phase 2 with Phase 4 resulted in the acquisition being expanded to include at least 40 helicopters – 12 additional troop lift helicopters for the Army (under AIR 9000 Phase 2) and 28 Black Hawk upgrade or replacement helicopters (under AIR 9000 Phase 4).

AIR 9000 Phases 2 and 4—Offer Development and Refinement Process

2.30 On 16 March 2004, Defence released the ODRP Terms of Engagement for the ADF Rotary Wing Capability (including the additional troop lift helicopters) to Australian Aerospace and Sikorsky.

2.31 In contrast to the Phase 2 RFP documents, the ODRP Document Package included a draft Strategic Agreement, acquisition contract and support contract. From 5 April to 16 April 2004, offer development and refinement meetings were conducted over a four day period with the two firms, at their overseas offices.

2.32 On 14 May 2004, Australian Aerospace and Sikorsky provided Defence with their Revised Document Package (RDP) responses. These responses included marked up copies of the draft Strategic Agreement, acquisition contract and support contract, as well as associated plans and schedules.

AIR 9000 Phases 2 and 4 – proposed solutions

Australian Aerospace—MRH90

2.33 The Australian Aerospace proposal involved the provision of 40 MRH90 aircraft.[140] The proposed overall price for the 40 MRH90 aircraft and their support system was A$1.887 billion. The support system consisted of:

- a Ground Mission Management System ($49.488 million);
- an Instrumented Aircraft System ($4.569 million);
- a Full Flight and Mission Simulator ($81.231 million);
- a Software Support Facility ($29.097 million);
- an Electronic Warfare Self Protection Support System ($3.512 million)
- Support Equipment—operations, engineering, maintenance, supply and deployments kits ($230.354 million);
- a Training Sub-System—training needs analysis, maintenance training, aircrew conversion training, training aids and training courseware ($108.076 million); and
- a Management System—program management, engineering management, Integrated Support Management, Logistics Support Analysis, verification and validation recording, acceptance and design, quality management and transition management ($100.381 million).

2.34 The overall cost of these 40 MRH90 aircraft and their support system yielded a Unit Procurement Cost of A$47.2 million for each helicopter complete with the Australian Aerospace proposed support package.[141]

2.35 The proposed MRH90 aircraft design was based on the NH90 TTH development specification, and included some Australian modifications. That specification included:

> The TTH shall be primarily a tactical transport helicopter for delivery of 16 combat ready troops and/or materials from a pick up zone on friendly

140 DSTO had calculated that either 40 MRH90 or 48 S-70M helicopters would be required to give the same lift capability. DSTO discounted the capacity provided by the centre seats and two side seats for the MRH90 aircraft on the basis that these seats impeded access to the doorways and would not be used.

141 The Unit Procurement Cost is summarised in footnote 135.

territory to a landing zone on friendly territory possibly close to the [Forward Edge of Battle Area], but in principle outside direct fire threat from the enemy.

When specially equipped other missions can be performed such as:

- Heliborne operation;
- [Search and Rescue] in peacetime;
- Parachuting; and
- Casualties evacuation.

2.36 This part of the TTH development specification was quoted in the operational and technical assessment section of the Source Selection Report produced as part of the Defence evaluation process. It was also quoted in documentation sent to the Minister for Defence.

2.37 However, there was a need for the MRH90 design to meet additional functions and performance specifications to that covered by the NH90 TTH development specification. These functions and specifications reflected the ADF's broader roles, missions and tasks, as described in the AIR 9000 Phase 2 Operational Concept Document and Function and Performance Specification. These roles included operations in high-threat environments, where direct fire threats exist (see paragraphs 1.16 to 1.17). Furthermore, asymmetric warfare involves the ADF in operations in areas that cannot be guaranteed of being classed as 'friendly' or outside areas of direct fire threats. The MRH90 design therefore needed to include combat role equipment, such as a self defence gun system, more crashworthy seats and ballistic protection, which all needed to be designed and verified to meet ADF requirements. Consequently, the design proposed by Australian Aerospace was immature in a number of key respects, and further brought into question the extent to which Australian Aerospace's proposal represented a viable off-the-shelf solution to ADF requirements. As discussed, the *ADF Helicopter Strategic Master Plan* and the *Defence Capability Plan 2001-2010* had identified the need for a MOTS solution.

2.38 Australian Aerospace also proposed that the following activities would be undertaken in Australia:

- the manufacture and repair of a range of MRH90 airframe components;
- the assembly, test and support of the MRH90 gas turbine engines;
- maintenance of MRH90 gear boxes and hydraulic equipment;

- the development and conduct of ongoing maintenance and support of the MRH90 mission software and data links; and
- sensor integration and electronic warfare system support.

2.39 Australian Aerospace estimated that Australian industry content accounted for 50 per cent of the value of its proposed support contract.

Sikorsky—Black Hawk

2.40 Sikorsky offered Defence three options: twelve L-model Black Hawk aircraft—for Phase 2; twelve new Block 1 M-model Black Hawk aircraft and 36 remanufactured aircraft to M-model specifications—for the combined Phases 2 and 4[142]; and an alternate proposal of 48 new M-model aircraft—for the combined Phases 2 and 4.

2.41 For reasons which have not been documented by Defence, Sikorsky did not include in its offer its marinised MH-60S Knighthawk Multi-Mission Naval Helicopter developed for the US Navy, which had entered full-rate production in 2002.

Option 1: Twelve new L-model Black Hawk aircraft

2.42 If helicopters were required immediately, Sikorsky indicated that it could deliver 12 new UH-60L Black Hawk aircraft by mid-2005. However, despite being MOTS, these helicopters were reaching the end of their production run. Defence considered that this helicopter's analogue instrument technology, although fit for purpose, was outdated, and that the helicopters would need to be retrofitted to the M-model too soon after acquisition.

Option 2: Twelve new M-model Black Hawk aircraft and 36 remanufactured aircraft to M-model specifications

2.43 The second option was to build 12 S-70M aircraft (based on the US Army UH-60M Black Hawk) and to remanufacture in Australia the Army's existing fleet of 36 S-70A-9 Black Hawk aircraft to the S-70M standard by July 2012.[143] However, Sikorsky noted that there was little need to upgrade these helicopters as the Australian S-70A-9 Black Hawk aircraft had an average of

142 Block 1A S-70 M aircraft were intended to incorporate lessons learned from operations in Afghanistan and Iraq, notably the need for an aircraft Health and Usage Monitoring System and a fly by wire capability.

143 Remanufacture of helicopters involves disassembling the airframe and aircraft sub-systems, and rebuilding the aircraft with state-of-the-art sub-systems and refurbished airframe assemblies. This is a common practice with helicopters, as helicopter designs offer relatively easy access for the replacement of propulsion and airframe structural components that degrade with use.

less than 3000 flight hours per aircraft. The leading US equivalent had accumulated over 10 000 flight hours per aircraft.

2.44 By the end of the AIR 9000 Phases 2 and 4 ODRP in May 2004, Sikorsky's refined offer included delivery of 12 S-70M Black Hawk aircraft by July 2007, at a cost of US$175.83 million (US$14.652 million each).

2.45 Sikorsky also offered a US$130.402 million S-70M support package, consisting of:

- a Ground Mission System sub-system consisting of Mission Management (Planning and Reporting), Electronic Warfare Self Protection Mission Management, and a Health and Usage Monitoring System (HUMS) (US$6.916 million)[144];
- an Instrumented Aircraft sub-system (US$4.725 million);
- a Full Flight and Mission Simulator (US$31.178 million);
- a Software Support Facility (US$4.371 million);
- an Electronic Warfare Self Protection Support System (US$2.658 million);
- Support Equipment – operations, engineering, maintenance, supply and deployments kits (US$17.313 million);
- a Training sub-system – training needs analysis, maintenance training, aircrew conversion training, training aids and training courseware (US$34.784 million); and
- a Management System – program management, engineering management, Integrated Support Management, Logistics Support Analysis, verification and validation recording, acceptance and design, quality management and transition management (US$28.457 million).

2.46 The overall cost of the 12 S-70M aircraft and their support package was US$306.182 million (May 2004 price basis). This yields a Unit Procurement

144 A typical HUMS system will consist of sensors distributed throughout the airframe and its components, linked to a central computer with a data recording and storage system. After landing, the data is downloaded for analysis on a ground-based computer system. Specialists can then determine whether the aircraft has developed (or is likely to develop) faults requiring rectification. This is achieved by comparing the actual data trends and exceptions detected by HUMS against the design parameters for the aircraft type and the role it is being used in.

Cost of US$25.515 million for each aircraft complete with the Sikorsky proposed support package.

2.47 The proposed remanufacture process for the Army's 36 existing S-70A-9 Black Hawk aircraft was to involve each being disassembled, overhauled and repaired; with installation, final assembly and acceptance testing to the S-70M standard to occur within a 36 week schedule. During that time, seven helicopters were scheduled to be undergoing remanufacture at any one time. If agreed, the remanufacture was to occur in Australia, and was to cost US$446.815 million or US$12.412 million for each aircraft, with Australian industry content estimated at 34.3 per cent. The Sikorsky offer also included an S-70M support package costing US$53.783 million.[145]

2.48 The overall cost of the 36 remanufactured S-70M Black Hawk aircraft and their support package was US$500.637 million (May 2004 price basis). This yielded a Unit Procurement Cost of US$13.906 million for each of these 36 aircraft complete with Sikorsky's proposed support package.

Option 3 (alternative option): 48 new M-model Black Hawk aircraft

2.49 Sikorsky's alternative option was to provide 48 new S-70M Black Hawk aircraft to satisfy the combined Phases 2 and 4. This offer was accompanied by a commitment to provide the equivalent value and quality in a revised industry package if the option to buy new S-70M Black Hawk aircraft was considered, rather than the remanufacture of existing aircraft. Sikorsky offered to deliver these 48 Black Hawk aircraft by March 2009, at a cost of US$669.115 million or US$14.652 million each, with Australian industry content estimated at 15.8 per cent. This offer was accompanied by a US$179.700 million S-70M support package offer that included:

- a Ground-based Mission Support System comprised of a Mission Management (Planning and Reporting) System, an Electronic Warfare Self Protection Support System, and a Health and Usage Monitoring System (HUMS). The total cost of these systems was US$6.831 million;

145 This support package was to be comprised of:
- Support Equipment—operations, engineering, maintenance, supply and deployments kits (US$22.588 million);
- Management—program management, engineering management, Integrated Support Management, Logistics Support Analysis record verification and validation–acceptance and design, quality management and transition management ($US17.539 million); and
- In-Country Support ($US13.656 million).

- an Instrumented Aircraft sub-system, (US$4.668 million);
- a Full Flight and Mission Simulator, (US$29.972 million);
- a Mission System Software Support Facility, (US$4.262 million);
- an Electronic Warfare Self Protection Support System (US$2.626 million);
- Support Equipment – operations, engineering, maintenance, supply and deployments kits (US$43.374 million);
- a Training Sub-System – training needs analysis, maintenance training, aircrew conversion training, training aids and training courseware (US$33.457 million);
- Management – program management, engineering management, Integrated Support Management, Logistics Support Analysis record verification and validation – acceptance and design, quality management and transition management (US$41.157 million); and
- In-Country Technical Support (US$13.346 million).

2.50 The overall cost of the 48 S-70M Black Hawk aircraft and their support package was US$848.815 million (May 2004 price basis). This yielded a Unit Procurement Cost of US$17.684 million for each of these 48 aircraft complete with Sikorsky's proposed support package.

Sikorsky Australian industry involvement

2.51 During the tender process, Sikorsky increased its Australian presence through the acquisition of a Brisbane based company, Helitech Pty Ltd. This purchase was directed toward developing a sustainable engineering skills base in Australia. Sikorsky's proposal involved the Australian manufacture of major structures and parts for more than 400 Black Hawk helicopters over a 12-year period, which Sikorsky valued at more than $500 million. Sikorsky planned to team with Boeing Australia Limited and Kaman Aerospace International. Further, Hawker de Havilland was to manufacture the Black Hawk main cabin, composite tail cone, tail rotor pylon and stabilator. Sikorsky also planned to establish a major new capability to undertake the conversion of fixed wing passenger aircraft into cargo transport aircraft in Adelaide; and to team with DSTO to develop a unique capability in helicopter fatigue testing and usage monitoring that would contribute to the local support of the ADF's aircraft, as well as international Sikorsky programs.

2.52 Sikorsky's offer included an opportunity for Australia to access the Sikorsky global supply chain, to be part of the large US Government S-70M Black Hawk aircraft new build and remanufacture program, and the manufacture of aircraft components for domestic consumption and export.

Cost comparison of proposed solutions

2.53 Table 2.3 provides a cost comparison of the Australian Aerospace and main Sikorsky offer for Phases 2 and 4. The costs are shown in equivalent Australian Dollar terms, based on the budget exchange rate applied in Defence's June 2004 Source Selection Report.[146] The figures shown include the cost of the support packages offered by Australian Aerospace and Sikorsky. The figures also include some adjustments made by Defence to calculate the potential contract cost for each offer.[147]

Table 2.3: Cost comparison of proposed solutions

Company	Offer	Total cost	Unit Procurement Cost
Australian Aerospace	40 new MRH90 aircraft	A$2.061 billion	A$51.5 million
Sikorsky	12 new S-70M aircraft; and 36 remanufactured S-70M aircraft	A$1.664 billion	A$34.7 million

Source: Department of Defence, *AIR 9000 Additional Troop Lift Helicopter Source Selection Report*, Volume 5, Affordability EWG Report, 8 June 2004, pp.6 and 11.

AIR 9000 Phases 2 and 4—Source Selection recommendations

2.54 A tender evaluation team assessed the Australian Aerospace and Sikorsky proposals, and on 8 June 2004 completed a Source Selection Report, which focused on each company's ability to meet the specified operational, commercial and affordability criteria.

2.55 The Source Selection Report identified the operational and technical, commercial and affordability risks arising from each company's response to the draft acquisition and support contracts. These risks were assessed as

146 The exchange rate was A$1 = US$0.7465.

147 Defence made further adjustments to calculate the probable project cost, including other project elements and contingency. These other adjustments are not included in Table 2.3.

Medium for both Australian Aerospace and Sikorsky, with Sikorsky ranked as preferred in the overall ranking.

2.56 The Source Selection Report recommended:

(a) approval of the combined Phase 2 and 4 program;

(b) the selection of Sikorsky as preferred Strategic Partner, and as the preferred supplier of the 12 new and 36 remanufactured S-70M as the AIR 9000 Phase 2 and 4 aircraft to replace the S-70A-9 helicopter;

(c) following Government approval of the recommendation at subparagraph (b) above, that the Commonwealth commence negotiations with Sikorsky in relation to the draft Strategic Agreement, and draft Acquisition and Support Contracts for Phase 2 and 4; and

(d) given the potential risks identified in relation to Sikorsky's proposal, that Australian Aerospace's proposal not be declined at this stage to provide the Commonwealth with flexibility in the event that negotiations with Sikorsky were not concluded satisfactorily.

2.57 Furthermore, the Source Selection Report noted that:

> ... in making these recommendations, [Sikorsky] has also proposed an alternative option of the supply of 48 new S-70M aircraft and the disposal of the current S-70A-9 fleet. This alternative has been set aside for full consideration following selection of the preferred Respondent in accordance with the Source Selection Plan. However, should the recommendations above be approved, this alternative could be discussed and pricing finalised with [Sikorsky] during the negotiation phase.

2.58 However, with respect to the proposals from Australian Aerospace and Sikorsky, the Source Selection Report also stated that it was not possible under the evaluation timetable to properly assess the financial implications of all the identified risks. Furthermore, while contingency funding was applied to both proposals in relation to equipment and support costs where risk in these areas was identified, this contingency funding did not address contractual risks.

2.59 On 16 September 2004, Defence's probity adviser[148] noted that the absence of any analysis of the financial impact of identified contractual risks could affect the fidelity of the evaluation team's commercial and affordability

148 The Australian Government Solicitor (AGS) was appointed by Defence as probity adviser for the AIR 9000 Program commencing on 16 July 2002.

assessments. The adviser also noted that a decision by Defence to delay the selection of a preferred respondent, by even a short period of time, would have allowed financial analysis of the contractual risks to be carried out.

2.60 Notwithstanding Defence's October 2003 ministerial advice that there was continuing uncertainty about development and certification risks for the two offers (see paragraph 2.26), analysis of overall aircraft and support system maturity for the two options did not feature prominently in the Source Selection Report.

Source Selection Board consideration

2.61 The 8 June 2004 Source Selection Report was considered by a Source Selection Board. The board agreed with the recommendations of the report, and concluded that the significant price advantage of the Sikorsky proposal outweighed operational and Australian industry capability advantages identified for the Australian Aerospace proposal. The Sikorsky proposal was therefore assessed as offering the best overall value for money by the board. Further, the probity adviser concluded that the Source Selection Report and its recommendations were defensible from a probity perspective.

2.62 The DCIC meeting on 15 June 2004 discussed AIR 9000 Phases 2 and 4 and agreed with the recommendation of the Source Selection Board that the Black Hawk aircraft be selected. The minutes of the DCIC meeting stated that:

> In their introductory comments, CA, CAF, DCN[149] each said that they favoured the Sikorsky bid on capability grounds, and agreed with the recommendation of the Source Selection Board. In addition to the Sikorsky bid being around $275 million cheaper than the [Australian Aerospace] bid, they noted the battlefield worthiness and robustness of the S-70M aircraft and, although it is not as marinised as the MRH-90, the S-70M aircraft are nevertheless adequate for limited amphibious operations. CA, CAF, DCN and CCDG[150] agreed nevertheless that the MRH-90 would meet the required capability. ...
>
> The Committee then considered how the helicopters would be utilised and the issue of marinisation. Taking into account that the MRH-90 has a better blade folding rotor head and tail folding design for better storage and superior corrosion resistance, it was recognised as a better marinised capability in the littoral environment than the S-70M. In the case of the S-70M, funding has

149 That is, the Chief of Army, Chief of Air Force and Deputy Chief of Navy.
150 That is, the Chief Capability Development Group.

been set aside in contingency to improve the corrosion resistance of the aircraft, but accommodating for this unique Australian requirement would be the subject of further discussions with Sikorsky. However, the primary use of the aircraft would be battlefield movement, and Sikorsky is a stronger contender in this respect because the aircraft are more robust with better ballistic protection and crashworthiness. A secondary role would be to contribute to amphibious lift, and in this respect Sikorsky was adequate.

2.63 On 15 June 2004, it was agreed that a number of risks and areas of uncertainty be addressed through a further bid clarification process. Clarification meetings were held with Australian Aerospace and Sikorsky and a Supplementary Report was prepared for probity sign-off on 2 July 2004. This Supplementary Report supported the conclusions of the Source Selection Report, including the source selection recommendations. The significant difference in the two prices put forward by the respondents, and the relative value for money (including affordability) identified in the Source Selection Report were confirmed in the Supplementary Report.

Government approvals and AIR 9000 Phase 2 decision

2.64 In order to identify the factors underpinning the then Government's Second Pass approval of AIR 9000 Phase 2, which resulted in a decision to purchase Australian Aerospace's MRH90 aircraft rather than Sikorsky's S-70M aircraft, the ANAO examined the five submissions provided by Defence to its Minister in mid-2004. The key recommendations contained in these submissions are outlined in the following sections.

Defence's 17 June advice

2.65 On 17 June 2004, prior to the ODRP bid clarification process, Defence provided a minute to the Minister for Defence recommending that he seek a combined Second Pass approval for AIR 9000 Phases 2 and 4. Defence recommended the acquisition of 12 S-70M aircraft as well as, either upgrading the existing 34 Black Hawk aircraft to the S-70M standard, or replacing these with 36 new S-70M aircraft.

2.66 The draft Second Pass submission attached to this minute stated that the S-70M aircraft was preferred by Defence on the basis of its cost advantage, crashworthiness, robustness and battlefield survivability. The draft submission also stated that the Australian industry component of the Sikorsky offer for Phases 2 and 4 included:

- the remanufacture of the existing Black Hawk fleet at Helitech in Brisbane;
- a sustainable engineering skills base;
- increased involvement in engine support;
- a capability to support mission systems including a laboratory to maintain and develop aircraft software;
- training systems; and
- a high level of aircraft component manufacture with access to Sikorsky's global supply chain.

2.67 The business case for the MRH90 aircraft attached to the draft submission stated that 'the MRH-90 has been designed as a maritime helicopter'. However, this does not accord with the NH90 TTH development specification quoted in paragraph 2.35 above.

2.68 In April 2014, Defence informed the ANAO that:

> The NH90 was designed initially to meet a requirement for an embarked frigate helicopter system. The design was broadened to meet the TTH requirement and both variants share the same fuselage, transmission and rotor systems. Thus it is true to say the NH90 was designed as a maritime helicopter. The NFH has been optimised to operate at sea from 'small' ships like frigates while the TTH has been optimised to operate over land, but the basic design maintains an inherent degree of 'marinisation'.

2.69 However, the TTH variant offered by Australian Aerospace does not have automatic blade folding, and interface equipment necessary for shipboard recovery assist, securing and traverse systems. Marinisation requirements for the MRH90 aircraft are discussed from paragraph 3.39.

Defence's 2 July advice

2.70 On 2 July 2004, Defence provided a minute to the Minister for Defence and a draft submission, reiterating its earlier Black Hawk acquisition recommendation. By that time, the ODRP process, including bid clarification, was complete. Defence noted that some previously assessed technical, cost and schedule risks for the S-70M aircraft had been reduced, and accordingly the contingency and other adjustments made to Sikorsky's offer had been reduced

by $117 million. The overall result was that Sikorsky's Black Hawk bid was over $380 million less than the Australian Aerospace MRH90 bid.[151] Attachments to the draft submission reflected those updates. The minute noted that the Black Hawk recommendation had the support of the: Secretary for Defence, Chief of the Defence Force, Chief Capability Development Group, Chief Executive Officer Defence Materiel Organisation, Chief of Army and Chief of Air Force.

2.71 On 30 July 2004, the probity advisor sent a letter to Defence on the potential legal implications of the Government departing from the source selection process. The advice had been sought by Defence on the basis that a further submission would outline the strengths and weaknesses of the respective proposals, and leave it to ministers to determine which of the proposals provided the best value for money. The probity adviser noted that the ODRP evaluation process was subject to the following statement:

> ... selection of a preferred Respondent will be made on the basis of value for money, consistent with Commonwealth purchasing policies, affordability, *strategic considerations and other whole of government considerations.* [Emphasis added by the probity adviser.]

2.72 The probity adviser went on to note that:

> ... it would potentially be open to the Government to decide that, despite the conclusions of the ODRP evaluation and the Source Selection Report, the [Australian Aerospace] proposal represented better value for money than the Sikorsky proposal, when those conclusions are considered in light of overarching strategic or other whole of government considerations.

2.73 The adviser further noted that 'this of course assumes both that such strategic or whole of government considerations existed and were able to be demonstrably enunciated, and that the Government could reasonably argue that these considerations outweighed the Sikorsky price advantage'. The adviser also stated that 'Further legal and/or probity advice could be sought as to whether the identified considerations were reasonably capable of supporting a value for money decision in favour of the [Australian Aerospace] proposal'.

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151 The original difference occurred despite $413 million (2004-2005 prices and exchange rates) added to the Sikorsky offer by way of adjustments to a range of items, as well as a contingency of 21 per cent, or $353 million (2004-2005 prices and exchange rates). In contrast the Australian Aerospace bid included a 14 per cent contingency.

Defence's 30 July advice

2.74 On 30 July 2004, the same day that Defence received the above probity advice, the department provided its Minister with a further minute and a third draft submission. The minute stated that:

> ... as you have directed, the submission has been changed to leave open the recommendations as to which helicopter should be selected.

2.75 The minute noted the potential legal implications of selecting the helicopter option not supported by the departmental tender evaluation process. The draft submission assessed both helicopters as suitable for the necessary roles, albeit with different strengths and weaknesses. The MRH90 was portrayed as a relatively new design[152] with greater troop lift capacity. In terms of robustness and marinisation, the draft submission stated that:

> The S-70M offers a high degree of ballistic tolerance and crashworthiness, and has demonstrated it can survive crash impacts 30-40 per cent more severe than the MRH-90 limits. It is based on a battle-proven design with commonality with our current aircraft, but it will have limited corrosion protection, it will not be certified for ditching in water and has a relatively clumsy manual blade folding system. The MRH-90 is designed for maritime operations, it is better protected against corrosion, has a better manual blade folding system and is certified for ditching. However, while the MRH-90 is a modern damage tolerant design, it has not been designed or tested to the same level of ballistic tolerance and crashworthiness. Both helicopters have strengthened undercarriages, rotor brakes and tie-down points and marinised engines, key features for sustained shipboard operations.

2.76 The draft submission contained a table that compared key features of the two aircraft. However, the table was deficient in that it did not inform the reader that the 18 seats in the MRH90 configuration were too narrow, as reported in the Source Selection Report, nor did it include advice about the developmental nature of the MRH90 window mounted gun.

2.77 More broadly, the minute and other ministerial advice prepared by Defence during the Source Selection process did not assess the overall maturity of the two aircraft options (including their support systems) in any detail, or the potential implications of immaturity. Further, Defence's AIR 9000

152 The Department of Defence's capital equipment acquisition includes the need to exploit the latest available technology within its funding priorities and technical risk management ability. This technology may provide an advantage in military capability.

submissions as part of the Source Selection process did not address difficulties arising in the acquisition of Tiger Armed Reconnaissance Helicopters (the AIR 87 Program) from Australian Aerospace (refer to footnote 161 and paragraphs 2.107 to 2.112).

2.78 The draft submission rated the overall risk of Australian Aerospace's proposal as medium and Sikorsky's proposal as medium-high. The following table summarises the risk assessments in the draft submission.

Table 2.4: Australian Aerospace and Sikorsky bid risk comparison

Risk Source	Australian Aerospace Risk Level	Sikorsky Risk Level
Technical Risk	Medium	Medium
Cost Risk	Medium	High
Schedule Risk	Medium	Medium
Overall	Medium	Medium-High

Source: Department of Defence, Draft Defence submission, *Project Air 9000 – Additional troop lift helicopters and helicopter rationalisation*, 30 July 2004.

2.79 Defence had assessed Sikorsky's bid price as lacking sufficient detail to confidently retire all cost risk, and the residual cost risk remained high with a commensurate contingency of 21 per cent included in the proposal. The draft submission noted that Sikorsky's price was significantly lower than its RFP offer. Sikorsky had clarified that its bid price was firm and that it was able to offer such sharply competitive pricing because it would treat Australia like its best customer, the US Army. Since the RFP, the US Government had committed to Low-Rate Initial Production (LRIP) for the US Army thus improving the level of accuracy in relation to manufacturing cost estimates. There were also potential economies of scale in combining the AIR 9000 Phases 2 and 4 acquisition with the US LRIP program, and Sikorsky had reported a significant reduction in General Electric engine costs.

2.80 Defence applied a contingency rate of 14 per cent to the Australian Aerospace proposal. The draft submission noted that:

> Australian Aerospace prices have remained relatively stable from those offered in the RFP, indicating reasonable fidelity in pricing. However, the ability to hold Australian Aerospace to its priced offer is not certain. This is

due to the general lack of detail presented to establish confidence that prices are inclusive of all costs. ...

To the extent that pricing assumptions in the Australian Aerospace proposal were inadequately identified and costed, or where the approach taken is not clearly and satisfactorily articulated, the Commonwealth faces the prospect that achieving a satisfactory and fairly priced arrangement may be compromised.

Advice on separating Phases 2 and 4

2.81 On 10 August 2004, Defence provided advice to the Minister for Defence regarding the possible separation of Phase 2 from Phase 4. Defence advised its Minister that the Commonwealth had explicitly preserved its rights not to proceed with any, or all, of AIR 9000's phases. Defence further advised that if the Australian Government were to choose the MRH90 aircraft over the Black Hawk aircraft, it would have to either:

(a) argue within the current process in terms of overarching strategic or other whole of government considerations (in accordance with the selection criteria); or

(b) terminate the current solicitation process in favour of a sole source acquisition, justifying this through external factors that led to a change in Australia's strategic circumstances and/or Australian Government policy.

2.82 Defence advised the Minister that the most reliable cost data for an AIR 9000 'Phase 2 only' purchase came from the May 2003 Request for Proposal (see paragraph 2.23). Defence further advised that purchasing fewer aircraft would result in a premium of around $4 million per aircraft. There was also a risk that this premium might rise as the 'Phase 2 only' option was not explored as part of the Offer Development and Refinement Process (see paragraph 2.30).[153]

Consideration by government

2.83 PM&C advised the ANAO that it had no record of an official submission from Defence when government first formally considered AIR

153 The other disadvantages of the 'Phase 2 only' option included reliance on overseas training for aircrew and maintenance personnel, and the difficulties associated with maintaining both the MRH90 and Black Hawk fleets at the same time.

9000 Phases 2 and 4 on 10 August 2004.[154,155] Government was disposed to select the Australian Aerospace MRH90 aircraft for Phase 2 only, and asked the Minister for Defence to bring forward a submission outlining the case for, and financial implications, of proceeding with Phase 2 only, and selecting the MRH90 aircraft over the S-70M aircraft. While this approach limited the initial acquisition decision to 12 aircraft and their support system, Defence still intended to pursue the fleet rationalisation strategy outlined in the *ADF Helicopter Strategic Master Plan*, which made the selection of a different aircraft for Phases 4 and 6 less likely.

Defence's 13 August advice

2.84 On 13 August 2004, Defence submitted a minute to the Minister for Defence accompanied by a further draft submission produced in line with guidance from the Minister and government. The minute was based on approval of the MRH90 aircraft for AIR 9000 Phase 2 only with a deferred decision for Phase 4. The minute noted that:

> Acquiring only 12 MRH-90 would lead to significant penalties in both acquisition and operating costs, and would make management of 5 Aviation Regiment very challenging.

Defence's 23 August advice

2.85 A minute to the Minister for Defence dated 23 August 2004 again proposed the MRH90 aircraft for Phase 2 only. The draft submission attached to the minute cited strategic and other government considerations that must be taken into account in selecting the preferred helicopter. These considerations included that:

> An Offer Development and Refinement Process has been undertaken with Sikorsky and Australian Aerospace for a combined AIR 9000 Phase 2/4. There are, however, strategic and other government considerations that must be taken into account. Amphibious operations are of primary importance for the

154 As discussed, Defence had prepared three draft submissions to this point.

155 In this context, during a caretaker period, public sector agencies are expected to return all Cabinet documents, including files, submissions, memoranda, business lists, minutes (decisions) and papers related to matters that were considered without submission (under the line items) to the custody of the Cabinet Liaison Officer in the Parliamentary Business Section, or equivalent, in each agency, for storage until the result of the election is known. The Cabinet Liaison Officer is required to advise the Cabinet Secretariat in PM&C when they have accounted for all documents and ensured they are securely stored. See Department of the Prime Minister and Cabinet, *Guidance on Caretaker Conventions*, 2013, p.10.

first buy; there is now the prospect of cooperation with [another country] in a MRH90 buy; and there are longer term uncertainties associated with Black Hawk variants.

2.86 The body of the draft submission elaborated further on strategic and whole of government considerations, which included:

(a) the benefits of a multi-role helicopter type that is well marinised and has a large troop-lift capacity, for operations in the immediate region;

(b) potential opportunities for regional cooperation on troop lift helicopters with another country, which had expressed an interest in acquiring around 8-10 MRH90 in a joint purchase with Australia. That would allow a larger buy in Phase 2 with possible cost reductions and potentially increased Australian industry opportunities;

(c) that a Black Hawk variant would provide improved manoeuvrability in built-up areas for counterterrorism operations and critical aircrew training continuity in a period of uncertainty and potential risk of terrorism; and

(d) that it would be undesirable to acquire a helicopter that might end up being largely an orphan. While the MRH90 aircraft was considered to have a relatively certain future, with 370 firm sales to eight countries, the UH-60M aircraft, on which the S-70M was based, may be superseded soon after delivery by a newer, more modern variant.[156]

2.87 Developing cost estimates for Phase 2 only was complicated by the fact that Defence had only low–medium confidence in cost estimates provided as part of the initial RFP process, and because the ODRP process focused on combined Phases 2 and 4 estimates. Defence's draft submission gave limited attention to the relative cost of the two options for Phase 2 only. A table on pages 9 and 10 of the submission showed that the acquisition cost of 12 MRH90 aircraft would be $1.061 billion (13.5 per cent contingency on the prime contract) and that 12 Black Hawks would cost $892 million (16 per cent contingency excluding initial support). The draft submission also included estimated support costs, but with low confidence. An additional squadron of MRH90 aircraft was estimated to cost $60 million per annum to support, and a

156 As indicated in Figure 2.1, by April 2014, 564 UH-60M aircraft had been delivered.

squadron of S-70M aircraft was estimated to cost $70 million per annum to support.

2.88 Notwithstanding the timeline and revised procurement process Defence was working to, the relatively low level of confidence in the acquisition and support cost estimates was a significant shortcoming in such an important and expensive acquisition. The draft Defence AIR 9000 Phase 2 submission was circulated as an exposure draft to relevant ministers on 27 August 2004.

AIR 9000 Phase 2 approval

2.89 PM&C informed the ANAO that it also has no record of an official submission when government formally approved AIR 9000 Phase 2 on 30 August 2004. Government approved the acquisition of 12 MRH90 aircraft, together with associated training and support equipment and facilities, under a $1 billion project that was subject to satisfactory conclusion of negotiations. Government agreed that the MRH90 be selected as the preferred helicopter for AIR 9000 Phase 2 based on its generally better troop-lift capacity and superiority in the amphibious role.

2.90 The following day, on 31 August 2004, caretaker arrangements took effect in advance of the Federal Election held on 9 October 2004. On the same day, the then Government announced the acquisition of the 12 MRH90 aircraft and that the helicopters would be based in Townsville, which would release a squadron of Black Hawks to move to Sydney to reinforce the ADF Special Forces located there.[157] The first MRH90 aircraft was to be delivered in 2007, with all 12 aircraft to be delivered by 2008. The decision to announce the acquisition prior to contract negotiations potentially placed Defence in a more difficult bargaining position.

2.91 On announcing the Government's selection of Australian Aerospace to supply 12 new troop lift helicopters, the Minister for Defence stated at a joint media event with the then Prime Minister, that:

> We are confident that the right choice has been made, particularly emphasis upon the amphibious capabilities. This is the state-of-the-art helicopter, a European helicopter, fly-by-wire system with a longer range, some 900 kilometre range, able to carry a larger number of troops – up to 20 in patrol

157 *Press release—John Howard and Senator Hill—MRH90 acquisition announcement*, 31 August 2004.

order.[158] It has electronic folding blades[159], it has ditching capabilities, it has particular suitability for the amphibious role and therefore will complement the new amphibious ships that the Government is committed to purchase.[160]

Contract negotiations for Phase 2

2.92 Once the MRH90 aircraft acquisition decision was announced, acquisition and sustainment contract negotiations commenced with Australian Aerospace. During September through November 2004 Defence conducted a series of clarification conferences with Australian Aerospace and its major subcontractors, and separated all aspects of its final bid (which was a combined Phases 2 and 4 offer) into a Phase 2 stand alone acquisition. Negotiations commenced in December 2004 to finalise clauses in the acquisition contract documentation.

2.93 During contract negotiations, the Minister for Defence directed that there should be a high-level of Australian industry involvement in the MRH90 Program. However, there was tension between this objective and the capacity of Australian Aerospace to assemble MRH90 helicopters at its Brisbane facility, which was still completing the assembly of Tiger Armed Reconnaissance Helicopters (ARH) for the ADF.[161]

2.94 It was decided to build the first four aircraft in France and to assemble the remaining eight aircraft in Australia. The estimated additional cost of assembling the eight aircraft in Australia was $28 million, reflecting the initial investment in the Australian MRH90 assembly venue. The aircraft were to be scheduled for delivery at the end of 2009, rather than the end of 2008 if built in France.

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158 ANAO comment: although Australian Aerospace had advised that the MRH90 had the capacity to carry 20 troops in crashworthy seats, DSTO had discounted some of these seats in its analysis, citing that some seats would not be used as they blocked access to the doorway.

159 ANAO comment: automatic blade folding was not part of the MRH90 capability at the time the Phase 2 decision was announced (see paragraphs 3.46 to 3.55).

160 Transcript of the Prime Minister The Hon John Howard MP, Defence Announcement, Defence Office, Russell, 31 August 2004, pp.1 and 2.

161 Delivery of all 22 Tiger ARH aircraft on order from Australian Aerospace was due to be completed by April 2008. However, technical issues and schedule delays resulted in all 22 ARH not being delivered to the Army until November 2011, some 43 months later than scheduled. Many ARH development problems came to the attention of DMO by November 2002, thus raising the possibility of schedule delays also being likely to occur with the MRH90, given the MRH90 and ARH Tiger aircraft share engineering and contractual relationships. ANAO Audit Report No. 36, 2005-06, *Management of the Tiger Armed Reconnaissance Helicopter Project—Air 87*, May 2006, pp.11, 17, 49, 52–53, 63.

2.95 Contract negotiations for the 12 MRH90 aircraft and their support system became protracted. It was not until 2 June 2005 that the acquisition contract for the 12 MRH90 aircraft was signed, at a value of $912.49 million (January 2004 prices). The first of these aircraft was to be delivered in December 2007 with all 12 to be delivered by 2010. Prior to acquisition contract signature, Defence advised the Minister that the MRH90 aircraft were now estimated to cost $75 million more per year to sustain than the Black Hawk aircraft. As previously discussed at paragraph 2.87, at the time of Second Pass approval of Phase 2, Defence estimated that the annual support cost of the MRH90 aircraft would be $10 million less than the S-70M Black Hawk aircraft.

2.96 On 29 July 2005, a $15.9 million (January 2004 prices) Strategic Partner Program Agreement was entered into by the Commonwealth and Australian Aerospace, to provide an overarching framework for the delivery of strategic planning activities and future phases of Air 9000, within the context of both the *ADF Helicopter Strategic Master Plan* and the *Aerospace Sector Plan*.[162] At the same time the MRH90 aircraft sustainment contract was signed at the then estimated cost of $748.48 million (January 2004 prices). The initial 10-year sustainment period was due to start from the In-Service Date of 18 December 2007.

Scope of the MRH90 acquisition contract

2.97 The acquisition contract included several options that have not been taken up. Some of these options are integral to the level of operational capability of the aircraft, including:

- the option to develop a window mounted solution for the gun; and
- the option to develop Automatic Folding Blades for the MRH90 aircraft.

2.98 A number of items were removed from the MRH90 aircraft acquisition contract to ensure AIR 9000 Phase 2 remained within its approved budget. Defence intended to later roll the removed items back into the scope of the acquisition contract in Phase 4 if the MRH90 aircraft was chosen to replace the Army Black Hawk aircraft, or as a Real Cost Increase via a Contract Change Proposal (CCP) if another aircraft was chosen. These items included:

162 The Strategic Agreement was nominally renewed in 2013 – as part of Deed negotiations. The nominal renewal reflected the continuing disagreements between the partners.

- the Full Flight and Mission Simulator (FFMS) – the FFMS was too expensive to be bought as part of the Phase 2 budget. Instead, two MRH90 aircraft were to remain in France so that aircrew could have access to the Eurocopter training system that included qualified test pilots, procedural trainers, course-ware and classrooms. Two FFMSs were subsequently purchased (see paragraph 1.24);
- the Australian Software Support Integration Rig (ASSIR) system, later referred to as the MRH Software Support Centre (MSSC), was subsequently purchased (see paragraph 2.114);
- the Troop Lift Helicopter Instrumentation System (TLHIS), later referred to as the MRH Instrumentation System (MRHIS). This system is essential to conduct First Of Class Flight Trials (FOCFTs) to allow the aircraft to operate off ships. As indicated in paragraph 2.85, the main strategic consideration cited for the selection of the MRH90 aircraft was the ability to operate off ships. A system was subsequently purchased (see paragraph 2.114);
- a Ground Mission Management System (GMMS). The GMMS allows pilots to perform mission planning, rehearsal and debrief. Mission/flight plans and data can be uploaded from the GMMS to the aircraft via a proprietary data interface device and downloaded from the aircraft. A system was subsequently purchased (see paragraph 2.114); and
- an Electronic Warfare Self Protection (EWSP) system was subsequently purchased (see paragraph 2.114).

2.99 A helicopter is not a standalone capability, as all the Fundamental Inputs to Capability need to be taken into consideration when forming helicopter squadrons. These include Personnel, Organisation, Collective Training, Major Systems, Supplies, Facilities, Support, Command and Management. However, the MRH90 aircraft acquisition contract did not include some key training, testing and support systems even though these elements had been included in the advice before Government, when it made its approval decision in August 2004.[163]

163 The final draft submission stated that:

> The estimates include the costs of: 12 aircraft, limited ground mission management systems, training systems (including one full motion mission simulator), test and evaluation, in country

Footnote continued on the next page…

2.100 The experience of removing items from the acquisition contract to stay within budget, only to later acquire the items through contract amendments and separate contracts, results in additional administrative overheads and exposes the project to potentially higher costs at a later stage. It also raises some questions about the original basis on which value for money offered by the acquisition was assessed, and the effectiveness of the planning and budgeting arrangements employed by the MRH90 Program at that time.

Government approval of AIR 9000 Phases 4 and 6

2.101 The objective of Air 9000 Phase 4 is to upgrade or replace the Army's S-70A-9 Black Hawk helicopters. AIR 9000 Phase 6 is to replace the Navy's six SK-50 Sea King helicopters that were used in the Maritime Support Helicopter role. These Navy helicopters were retired in December 2011.

2.102 The combined First and Second Pass approval for AIR 9000 Phases 4 and 6 was expected to occur in August 2006. However, the AIR 9000 Phase 2 contract included not–to–exceed prices and additional Australian Industry Commitments (AIC) so long as a Contract Change Proposal (CCP) for the purchase of additional aircraft was signed by October 2006, leaving insufficient time to develop a CCP between August and October 2006. Defence therefore proposed to start developing and negotiating a CCP to the Phase 2 acquisition contract with Australian Aerospace in October 2005[164], anticipating that the preferred acquisition strategy for AIR 9000 Phase 4 was to purchase additional MRH90 aircraft. Defence envisaged that this would maximise its negotiation leverage, and would ensure Defence received price discounts that relied on uninterrupted production following on from Phase 2.[165]

2.103 In November 2005, the DCIC agreed to seek a combined First and Second Pass approval for both Phases 4 and 6.[166] Two acquisition business cases were developed: for an MRH90 aircraft option and for a Sikorsky S-70M

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support infrastructure, facilities, ship modifications, management and administration, the first three years of through life support and contingency.

164 The DMO General Counsel advised that this CCP would not be contractually binding on the Commonwealth and would not impose an obligation on Defence.

165 However there was little need to hasten these negotiations from that perspective, as production of MRH90 aircraft under Phase 2, was not scheduled to complete until late 2009.

166 Defence considered that a separate tendering process for AIR 9000 Phase 6 would introduce delay and result in penalties associated with introducing another helicopter type to the fleet.

Black Hawk aircraft option. In March 2006, the DCIC endorsed the MRH90 aircraft as the preferred option.

2.104 On 26 April 2006, a Phases 4 and 6 Defence submission was presented to government. The submission recommended acquiring the MRH90 aircraft to replace the Army Black Hawk and Navy Sea King aircraft on the basis that:

- the MRH90 aircraft was considered to provide a better capability;
- there would be low through-life costs, with operational, support and personnel efficiencies generated by rationalising the utility helicopter fleet; and
- the estimated acquisition cost of the MRH90 option was assessed as being similar to the Black Hawk option once full fleet acquisition costs were included.

2.105 The original DSTO analysis for Phases 2 and 4 stated that either 40 MRH90 aircraft or 48 S-70M Black Hawk aircraft were required to achieve the equivalent troop lift capacity.[167] Despite having already bought 12 MRH90 aircraft as part of Phase 2, the submission compared the option to acquire 34 MRH90 aircraft[168] with the original 48 Black Hawk aircraft rather than a reduced number of 42 Black Hawks aircraft[169] that would be required for Phases 4 and 6. A more appropriate comparison of aircraft numbers would have shown that the Sikorsky option was less expensive. The acquisition cost for 48 S-70M Black Hawk aircraft was stated to be $2540.1 million (pre-ERC 2006-07 constant price and exchange), including a 17 per cent contingency and other Defence adjustments to Sikorsky's offer.

2.106 On 26 April 2006, government formally approved AIR 9000 Phases 4 and 6. The approved acquisition funding was $2720.3 million (pre ERC 2006-07 constant price and exchange) for the 34 MRH90 aircraft and their support system. Government also formally approved a Real Cost Increase of $206 million (pre-ERC 2006–07 constant price and exchange) for AIR 9000 Phase 2 for additional items including ground support equipment, a simulator, aircraft maintenance trainers and aircraft modifications. As previously discussed in

167 Although Australian Aerospace had advised that the MRH90 had the capacity to carry 20 troops in crashworthy seats, DSTO had discounted some of these seats in its analysis, citing that some seats would not be used as they blocked access to the doorway.

168 That is, 40 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 34 aircraft.

169 That is, 48 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 42 aircraft.

paragraph 2.98, Defence had removed some approved items from the Phase 2 acquisition contract on the basis that they could be funded through Phase 4 or a Real Cost Increase.

Tabling of the Armed Reconnaissance Helicopter Tiger audit

2.107 Six days after ministers approved AIR 9000 Phases 4 and 6, on 2 May 2006, the ANAO presented for tabling the performance audit report *Management of the Tiger Armed Reconnaissance Helicopter Project Air 87*.[170]

2.108 The Tiger Armed Reconnaissance Helicopter (ARH) project was approved in August 2001 to provide a new, all-weather reconnaissance and fire support capability for the ADF. The project involves the acquisition of 22 aircraft with supporting stores, facilities, ammunition and training equipment. The first four aircraft were built in France by Eurocopter and the rest were assembled in Brisbane by Australian Aerospace. The ANAO audit report concluded that:

> Defence had intended that the ARH aircraft was to have been an 'off-the-shelf' delivery of proven, operational technology, lowering the risk of schedule, cost and performance shortfalls. The ARH acquisition transitioned to become a more developmental program for the ADF, which has resulted in heightened exposure to schedule, cost and capability risks, both for acquisition of the capability, and delivery of through-life support services. The lack of operational experience in maintaining this capability in other Defence Forces has meant that original cost estimates associated with the through-life support were immature, and exposed Defence to significant future budgetary risks.

2.109 The audit report also found that the ADF did not have an effective Tiger ARH capability, and only had a limited ability to train aircrews. Further, DMO had accepted the first three aircraft in a state that did not meet contractual specifications but did not withhold part payment as was allowed by the contract. The report contained five recommendations, which were all agreed by Defence and DMO. The recommendations are listed in Appendix 5.

2.110 On 10 May 2006, the then Prime Minister wrote to the Minister for Defence as follows:

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170 The draft performance audit report had been provided to Defence on 3 March 2006, in accordance with requirements under s.19 of the Auditor-General Act 1997. This provided Defence with a period of 28 days to comment on the draft report.

> The Auditor-General, Mr Ian McPhee PSM, has forwarded to me a copy of the Australian National Audit Office (ANAO) performance audit entitled *Management of the Tiger Armed Reconnaissance Helicopter Project Air 87.*
>
> The ANAO report identifies a number of shortcomings with the management of this project. It is unfortunate that Cabinet was not made aware of these issues in the context of its recent deliberations on Project Air 9000 Phase 4 and 6 (Blackhawk and Sea King Helicopter replacements), noting that the same prime contractor is involved in these projects.
>
> While I am advised that Defence is confident that projects Air 87 and Air 9000 will both provide the Australian Defence Force with capable helicopters, I seek your assurance that Defence has a firm grip on the capability, cost and schedule dimensions of both projects. This advice should be prepared for consideration at the 23 May 2006 meeting of the National Security Committee of Cabinet.

2.111 On 17 May 2006, after receiving advice from Defence, the Minister for Defence replied to the Prime Minister to allay his concerns, advising that 'The ANAO report makes five recommendations, which are largely process-related and relatively benign'. He continued:

> The Defence Materiel Organisation (DMO) has agreed to, and implemented, all recommendations of the ANAO report. However, the DMO does not support some of the observations made in the report, and considers that the report presents an overly critical and unbalanced assessment of the project. AIR 87 has been impacted by the slippage in the Franco-German program, which has resulted in increased certification workload being transferred to the Australian program, and has caused delays to the aircrew training program. ... The problem is in delivery of trained pilots; not delivery of the aircraft. The issues faced on the ARH program do not translate to the MRH 90 program.
>
> The MRH 90 is less complex than the ARH and is already entering service with both France and Germany, some 18 months in advance of the Australian Defence Force (ADF) program. A total of 10 aircraft are already flying for qualification and certification purposes. Significantly, the ADF is not the lead customer and will not carry the attendant developmental risk. ...
>
> Defence has applied the lessons learned from AIR 87 and the ANAO findings to the development of AIR 9000 Phases 2, 4 and 6. Similarly, Australian Aerospace and Eurocopter have a greater experience with Defence processes, which has resulted in a demonstrated improvement by Australian Aerospace during Phase 2. Defence is confident that Australian Aerospace will deliver a timely and effective MRH 90 capability for the ADF, and remains the best value for money option.

2.112 In the event, Defence's confidence did not result in the delivery of a timely and effective MRH90 capability to the ADF. The last of the 22 ARH aircraft was originally scheduled to be accepted by DMO in April 2008. In the *2011-12 Major Projects Report*, DMO noted that 'In February 2011, Australian Aerospace advised the Project that it would not be able to deliver all 22 ARH by July 2011 as currently contracted and that a potential further five month delay was likely.'[171] The acceptance of the 22nd ARH aircraft occurred on 25 November 2011, an overall delay of some 43 months.[172]

Contract for Phases 4 and 6

2.113 On 30 June 2006, the Commonwealth entered into a *Deed of Contract Change Proposal Number CCP—MRH-Ph4/6-001* (CCP1) with Australian Aerospace. CCP1 amended the original acquisition and sustainment contracts, and the Strategic Agreement, to include the $2.5656 billion (December 2006 prices and exchange rates) acquisition of the additional 34 MRH90 aircraft and their associated support system. These 34 MRH90 aircraft were to replace the Army Black Hawk and Navy Sea King helicopters, bringing the total to 46 aircraft.

2.114 CCP1 noted the need for additional analysis of contract options in order to fulfil changes in project scope and deficiencies in equipment and services. This analysis was performed prior to CCP2 signature. Additional changes to the MRH90 aircraft contracts (CCP2) were made on 31 October 2006, at a value of $81.770 million (December 2006 prices and exchange rates). The changes added the following items to the contracts:

- an Electronic Warfare Self Protection (EWSP) system;
- an MRH Software Support Capability (MSSC – previously ASSIR);
- an MRH Instrumentation System (MRHIS—previously TLHIS);
- Ground Mission Management System (GMMS); and
- two part-task training systems and other aircraft options.

171 See ANAO Report No.15, 2011–12, Assurance Report, *2011–12 Major Projects Report*, Defence Materiel Organisation, December 2012, pp.297 and 302.

172 ANAO Report No.12, 2013–14, Assurance Report, *2012–13 Major Projects Report*, Defence Materiel Organisation, December 2013, p.247.

Conclusion

2.115 AIR 9000 Phase 1 produced the 2002 *ADF Helicopter Strategic Master Plan*, which sought to rationalise the number of helicopter types in service with the ADF through the acquisition of a multi-role platform. The Master Plan envisaged that fleet rationalisation would generate efficiencies in through-life support and personnel requirements. Following the October 2002 Bali Bombings, in December 2002, the then Australian Government accelerated the purchase of additional troop lift helicopters (AIR 9000 Phase 2) to enable a squadron of helicopters to be based in Sydney. Consistent with the strategic intent to reduce aircraft types, Defence considered at the time that the helicopter chosen for AIR 9000 Phase 2 would be the preferred solution for Phase 4 and possibly Phase 6.

2.116 In May 2003, Defence released an RFP for AIR 9000 Phase 2 to three prospective suppliers. AgustaWestland offered the EH101 Merlin, Australian Aerospace offered the NH90 (to be developed for Australia as the MRH90) and Sikorsky offered the S-70M Black Hawk. In December 2003, the then Minister for Defence agreed to a Defence recommendation to set aside the AgustaWestland EH101 offer, and to proceed with bids from Australian Aerospace and Sikorsky for a combined AIR 9000 Phases 2 and 4. Defence noted in ministerial advice that despite seeking a Military-Off-The-Shelf (MOTS) solution, there was continuing uncertainty about development and certification risks for the two remaining offers. Notwithstanding this assessment, in early 2004, at the time of the commencement of the AIR 9000 Phases 4 and 6 Offer Development and Refinement Process (ODRP), Defence identified few high technical risks for the project as a consequence of the MOTS strategy. Further, Defence's ministerial advice did not address the technical risks associated with aircraft immaturity in any detail throughout the remainder of the AIR 9000 source selection process.

2.117 In June and early July 2004, Defence recommended to the Minister for Defence: a combined Second Pass approval for AIR 9000 Phases 2 and 4; the acquisition of 12 S-70M Black Hawk helicopters; and either upgrading the ADF's existing 34 S-70A-9 Black Hawk aircraft to the S-70M standard, or replacing these with 36 new S-70M aircraft. Defence noted that the recommendation was supported by a range of Defence senior officers, including the Secretary for Defence, the Chief of the Defence Force, Service Chiefs and the Chief Executive Officer Defence Materiel Organisation. While reaching the conclusion that both the MRH90 and S-70M Black Hawk would meet the required capability, Defence

preferred the S-70M Black Hawk on the basis of its cost advantage[173], crashworthiness, robustness and battlefield survivability. On the other hand, Defence considered that the MRH90 was a more marinised aircraft, and that the Australian Aerospace offer had Australian industry capability advantages.

2.118 On 30 July 2004, Defence received probity advice on the potential legal implications of the Government departing from the source selection process,[174] which had recommended the S-70M Black Hawk. The probity adviser noted that the ODRP process was subject to the selection of a preferred respondent on the basis of 'value for money, consistent with Commonwealth purchasing policies, affordability, *strategic considerations and other whole of government considerations*'.[175] The probity adviser also observed that 'it would potentially be open to the Government to decide that, despite the conclusions of the ODRP evaluation and the Source Selection Report, the [Australian Aerospace] proposal represented better value for money than the Sikorsky proposal, when those conclusions are considered in light of overarching strategic or whole of government considerations'. The adviser further noted that this scenario assumed such strategic or whole of government considerations existed, and that the Government could reasonably argue that they outweighed the Sikorsky price advantage.

2.119 In accordance with direction provided by the Minister for Defence and government, Defence developed alternate draft submissions, initially to ask ministers to choose between the two aircraft options, and later recommending acquisition of the MRH90 for Phase 2 only. On the same day as receiving the abovementioned probity advice (30 July 2004), Defence provided a draft submission to its Minister that left open the recommendation as to which helicopter should be selected. The submission rated the overall risk of Australian Aerospace's proposal as medium and Sikorsky's proposal as medium high. Technical risk was rated as medium for both proposals and the differentiating factor was cost risk, which was rated as medium for the Australian Aerospace proposal and high for the Sikorsky proposal.

173 Following a bid clarification process and the application by Defence of contingency and other cost adjustments to both bids, on 2 July 2004 Sikorsky's Black Hawk bid was over $380 million less than the Australian Aerospace MRH90 bid.

174 The Australian Government Solicitor (AGS) was appointed by Defence as probity adviser for the AIR 9000 Program commencing on 16 July 2002.

175 Emphasis added in original.

2.120 In early August 2004, Defence provided candid advice to its Minister regarding the possible separation of Phase 2 and Phase 4, including that cost data would be less reliable and that purchasing fewer aircraft would result in a premium of about $4 million per aircraft. On the same day, government formally indicated it was disposed to select the Australian Aerospace MRH90 helicopter for Phase 2 only, and asked the Minister for Defence to bring forward a submission outlining the case for, and financial implications of, proceeding with Phase 2 only, and selecting the MRH90 over the S-70M.

2.121 A subsequent August 2004 submission to government recommended the MRH90 for Phase 2. The submission cited strategic and other government considerations of relevance in selecting the preferred helicopter, including the primary importance of amphibious operations for Phase 2, and the prospect of cooperation with another country in a joint MRH90 purchase. The MRH90 aircraft was also assessed as having better troop lift capacity and superiority in the amphibious role. Developing cost estimates for Phase 2 only was complicated by the fact that Defence had only low–medium confidence in cost estimates provided as part of the initial RFP process, and because the ODRP process focused on combined Phases 2 and 4 estimates. While recognising a cost advantage for the S-70M Black Hawk proposal, the submission gave limited attention to the relative acquisition cost of the two options for Phase 2 only. The submission also included estimated support costs, but with low confidence. An additional squadron of MRH90 aircraft was estimated to cost $60 million per annum and a squadron of S-70M aircraft $70 million per annum.

2.122 On 30 August 2004, government formally approved the acquisition of 12 MRH90 aircraft, under a $1 billion project that was subject to satisfactory conclusion of negotiations. Government formally agreed that the MRH90 be selected as the preferred helicopter for AIR 9000 Phase 2 based on its generally better troop-lift capacity and superiority in the amphibious role. The following day, caretaker arrangements took effect in advance of the Federal Election held on 9 October 2004. On 31 August 2004, the Government announced the acquisition of the 12 MRH90 aircraft and that the helicopters would be based in Townsville, which would release a squadron of Black Hawks to move to

Sydney to reinforce the ADF Special Forces located there.[176] The first MRH90 was to be delivered in 2007, with all 12 aircraft to be delivered by 2008.

2.123 The decision to announce the acquisition prior to contract negotiations potentially placed Defence in a more difficult bargaining position. Contract negotiations for the 12 MRH90 aircraft and their support system became protracted. It was not until 2 June 2005 that the acquisition contract for 12 MRH90 aircraft was signed, at a value of $912.49 million (January 2004 prices). Under the contract, there were notable reductions in deliverables when compared to the government Second Pass approval decision. The first of the Phase 2 aircraft was to be delivered in December 2007, with all 12 aircraft to be delivered by 2010. In June 2005, prior to acquisition contract signature, Defence advised government that the MRH90 was now estimated to cost $75 million more per year to sustain than the S-70M Black Hawk aircraft when personnel and fuel requirements were included. On 29 July 2005, the sustainment and program agreement contracts were signed at a value of $748.48 million (January 2004 prices). The initial 10-year sustainment period was due to start from the In-Service Date of 18 December 2007.

2.124 Defence subsequently pursued a combined First and Second Pass approval for both Phases 4 and 6. Defence developed two acquisition business cases: for an MRH90 option and for an S-70M Black Hawk option, drawing on tender information previously provided by Australian Aerospace and Sikorsky, while also negotiating a contract change proposal with Australian Aerospace. Defence envisaged that the MRH90 aircraft would also be the preferred helicopter for Phases 4 and 6, consistent with the objective of rationalising the helicopter fleet and generating efficiencies in fleet management and through-life support. In April 2006, a submission to government for Phases 4 and 6 recommended acquiring the MRH90 to replace the Army S-70A-9 Black Hawk and Navy Sea King helicopters on the basis that: it was a better capability; there would be low through-life costs with efficiencies generated by rationalising the utility helicopter fleet and development; and the acquisition cost of the MRH90 was similar to the Black Hawk option once full fleet acquisition costs were included. Despite having already bought 12 MRH90 aircraft as part of Phase 2, the submission compared the option to acquire the additional 34 MRH90 aircraft[177] with the original 48

176 *Press release—John Howard and Senator Hill—MRH90 acquisition announcement*, 31 August 2004.

177 That is, 40 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 34 aircraft.

S-70M Black Hawk aircraft rather than a reduced number of 42 S-70M Black Hawk aircraft[178] that would be required for Phases 4 and 6. A more appropriate comparison of aircraft numbers would have shown that the Black Hawk option was less expensive.

2.125 On 26 April 2006, government formally approved Air 9000 Phases 4 and 6, and the MRH90 acquisition contract was amended on 30 June 2006 to include the additional 34 MRH90 aircraft and their associated support system. At the same time, government formally approved a Real Cost Increase of $206 million to purchase elements of the support system that had been missing from the Phase 2 contract. These items included ground support equipment, a simulator, aircraft maintenance trainers and aircraft modifications.

2.126 Six days after government formally approved AIR 9000 Phases 4 and 6, on 2 May 2006, the ANAO presented for tabling the performance audit report *Management of the Tiger Armed Reconnaissance Helicopter Project Air 87*. The Tiger Armed Reconnaissance Helicopter (ARH) project was approved in August 2001 to provide a new, all-weather reconnaissance and fire support capability for the ADF. The project involves the acquisition of 22 aircraft with supporting stores, facilities, ammunition and training equipment. The first four aircraft were built in France by Eurocopter and the rest were assembled in Brisbane by Australian Aerospace.

2.127 The ANAO audit report concluded that while Defence had intended that the ARH aircraft be an 'off-the-shelf' aircraft, the acquisition transitioned to become a more developmental program for the ADF, which resulted in heightened exposure to schedule, cost and capability risks, both for acquisition of the capability, and delivery of through-life support services.[179]

2.128 On 10 May 2006, the then Prime Minister wrote to the Minister for Defence raising concerns that the ANAO report identified a number of shortcomings with the management of the Tiger ARH project, and that it was unfortunate that Cabinet was not made aware of these issues in the context of its recent deliberations on Project AIR 9000 Phase 4 and 6, noting that the same prime contractor was involved. On 17 May 2006, after receiving advice from

178 That is 48 (combined Phases 2 and 4) less 12 (Phase 2) plus 6 (Phase 6), equals 42 aircraft.

179 Further, the lack of operational experience in maintaining this capability in other Defence Forces has meant that original cost estimates associated with the through-life support were immature, and exposed Defence to significant future budgetary risks.

Defence, the Minister for Defence replied to the Prime Minister to allay his concerns. As part of his reply, the Minister noted that:

> The MRH 90 is less complex than the ARH and is already entering service with both France and Germany, some 18 months in advance of the Australian Defence Force (ADF) program. A total of 10 aircraft are already flying for qualification and certification purposes. Significantly, the ADF is not the lead customer and will not carry the attendant developmental risk. …
>
> Defence has applied the lessons learned from AIR 87 and the ANAO findings to the development of AIR 9000 Phases 2, 4 and 6. Similarly, Australian Aerospace and Eurocopter have a greater experience with Defence processes, which has resulted in a demonstrated improvement by Australian Aerospace during Phase 2. Defence is confident that Australian Aerospace will deliver a timely and effective MRH 90 capability for the ADF, and remains the best value for money option.

3. MRH90 Capability Requirements Definition

This chapter examines the AIR 9000 Phases 2, 4 and 6 requirements definition and the impact of requirements definition shortcomings.

The systems engineering process

3.1 Systems engineering involves the orderly process of bringing complicated systems into service through an integrated set of phased processes. Defence policy requires ADF capability to be acquired through systems engineering processes, which include capability requirements definition, system design reviews, progressive tests and evaluations, and verification and validation of compliance with specified requirements covering the major system being acquired and its associated support system. The effectiveness of these processes depends upon:

- the Defence Capability Development Group's (CDG's) definition of the ADF capability requirements to ensure the systems procured are 'fit for service'[180];
- DMO's verification and validation that systems accepted from contractors comply with the requirements, and with the ADF's technical and safety regulations[181]; and
- the certification that procured systems offered for release into operational service are fit for service, and that any risks posed to safety and the environment fall within acceptable levels.

3.2 This chapter examines the AIR 9000 Phases 2, 4 and 6 requirements definition, and the impact of requirements definition shortcomings.

180 Department of Defence, *Defence Capability Development Handbook 2010 (Interim)*, April 2010, p.48. Fitness for service relates to the materiel's ability to satisfy operational requirements. Defence Instructions (General) LOG 4-5-012, *Regulation of technical integrity of Australian Defence Force materiel*, September 2010, p.2 and Definition of Terms.

181 Defence Materiel Organisation, *Defence Materiel Verification and Validation Manual,* November 2008.

Capability Definition Documents

3.3 Defence capability acquisition projects have followed a two-pass approval process for over a decade. In 2001, Defence reported that:

> ... the Government has agreed to a two-pass approval process for the acquisition of new capital equipment for the ADF. In the early stages of capability analysis, the Government will be provided with a range of new investment options to fill a capability gap. At this stage, first-pass approval is sought to develop specific options. In the second-pass process, the Government will be provided with the necessary level of detail to make an informed decision on acquisition and through-life support resource implications. Defence will undertake to deliver against the business case underpinning the approved option.[182]

3.4 The *Defence Procurement Review 2003* (the Kinnaird Review)[183] found Defence needed to further reform its acquisition management, and become more business-like and outputs focused. Key decisions flowing from the then Government's September 2003 adoption of this review included a strengthening of the capability development and assessment process prior to projects being handed to DMO, through the formation of a new Capability Development Group (CDG) within Defence Headquarters.[184] CDG commenced implementing a strengthened 'two pass' approval process.

3.5 Since 2002, a succession of Defence manuals and handbooks have provided guidance on capability requirements definition, and included measures to strengthen the process. These documents have been reinforced by a series of Defence Instructions, which placed formal requirements on Defence personnel conducting ADF capability development. The primary ADF capability definition documents, referred to as the Capability Definition Documents (CDDs) are:

- *Operational Concept Documents* (OCDs), which are intended to inform system acquirers and developers of the ADF's operational requirements;

182 Department of Defence, *Department of Defence Annual Report 2000-01*, p.281

183 Department of Defence, *Defence Procurement Review 2003*, August 2003.

184 CDG is discussed further in ANAO Audit Report No.6, 2013–14, *Capability Development Reform*, October 2013.

- *Function and Performance Specifications* (FPSs), which define ADF requirements of the system in terms of system functions, and how well those functions are to be performed[185];
- *Test Concept Documents* (TCDs), which provide an outline of the test strategy to be used to verify and validate that the design and operational requirements of the capability have been complied with.[186]

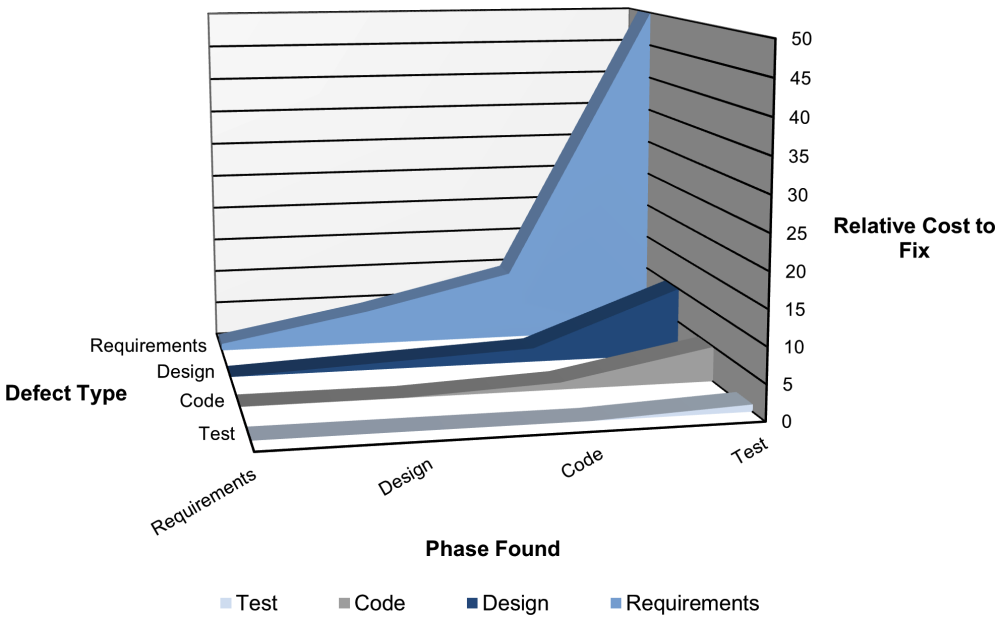
3.6 These documents are developed during a project's requirements definition phase, and form part of the supporting documentation for the Second Pass capability proposal to government. They need to accurately reflect the user's expectations of the system. Requests for Tenders containing deficient CDDs will most likely result in tender evaluation teams evaluating tenders against incomplete specifications, which heightens the risk that the major system being acquired and its associated support system will not meet ADF requirements.

3.7 Figure 3.1 provides a generic depiction of the relative cost to fix requirements or design defects found late in a software project's design and test phase. Even though the figure refers to software engineering, the concepts it portrays apply also to hardware engineering, as both need valid, objectively verifiable and achievable requirements. While there may be debate concerning the relative cost of fixing hardware or software defects, the figure underscores the critical importance of systems engineering processes based requirements specified in OCDs and FPSs, and verified progressively in accordance with TCDs.

185 Function and Performance Specifications are the basis for the contractor derived detailed design specifications, which take the form of System and sub-system Specifications and Support System Specifications. Department of Defence, Defence Capability Group, *Defence Capability Definition Documents Guide*, March 2005, p.93, and Department of Defence, *Defence Capability Definition Documents Guide*, 2009, p.1.

186 Department of Defence, Defence Instructions (General) OPS 45-2, *Capability Acceptance into Operational Service*, February 2008, pp. 2, 14.

Figure 3.1: Relative cost to fix software defects found at each system development phase



Source: Adapted from J.B. Dabney and G. Barber, Titan Corporation, *Direct Return on Investment of Software Independent Verification and Validation: Methodology and Initial Case Studies,* June 2003.

Operational Concept Document

3.8 As mentioned in paragraph 2.12, in 2001 the acquisition of additional troop lift helicopters was to be managed by AIR 5046 Phases 5 and 6, Additional Troop Lift Helicopters (ATH). This was a pilot project for the development of a set of CDDs. In April 2001, Defence's Capability Development Board noted that:

> It cannot be overstated that the most important document in the Definition phase is the OCD from which all subsequent specifications and direction will flow. Due to the compressed timeframe to gain 2nd pass approval from Government in May 2002[187], it is essential that accurate documentation is developed that requires minimal reworking.
>
> The revised DI(G) 05-1 Defence Capability Management Cycle (DCMC) has introduced a changed approach to the Capability Definition Phase. This new

187 ANAO comment: see paragraphs 1.5 and 1.6 for a discussion of the timing of Second Pass approval of the different phases of AIR 9000.

approach is in its infancy and as such there is a lack of expertise within CS [Capability Systems][188] and DMO in the production of these documents. As Air 5046 Ph 5[189] is considered a pilot project under the new process, external assistance is considered essential to ensure a quality and timely process is followed.

3.9 Under those circumstances, Defence engaged a professional service provider (PSP) to write the AIR 9000 Phase 2 CDDs (formerly AIR 5046 Phases 5 and 6). However, as Defence staff on this project at the time lacked the expertise to write the CDDs, it was likely that constraints also applied to Defence's capacity to verify that the delivered CDD's were of adequate quality.

3.10 An OCD has a specified development template[190], which steps the developers through the thought processes required to ensure that they have completely described the operations the capability is to perform. The AIR 9000 Phase 2 CDD developers also had access to higher-level guidance to aid their understanding of OCD requirements and how they should be written.[191] This guidance is based on Systems Engineering Standards that also provide guidance.[192] An OCD is required to have:

- a 'Section 3', which describes the solution-independent *future* capability and support required. For example, a description of the future multi-role helicopter capability;
- a 'Section 4', which describes the *current* capability and support. For example, a description of the current Sikorsky S-70A-9 Black Hawk aircraft and their support arrangements; and
- a 'Section 5' for *each* proposed solution, which describes the extent to which each solution will meet the needs and constraints identified in 'Section 3'. For example, there should have been a 'Section 5' for both the proposed MRH90 solution and the proposed Sikorsky S-70M Black Hawk solution.

188 Capability Systems was a Division within the Vice Chief of the Defence Force organisation until Capability Development Group was formed in February 2004.

189 ANAO comment: AIR 5046 Phases 5 and 6 transitioned into AIR 9000 Phase 2 in April 2002.

190 This template is known as a Data Item Description (DID) and is available at: http://www.defence.gov.au/dmo/gc/asdefcon/asset_library/ENG_DIDs.pdf.

191 *Capability Systems Life Cycle Management Manual 2002*, Department of Defence, 2002; and *Capability Definition Documents Guide*, Defence Materiel Organisation, Version 1.1, November 2002.

192 International Standard ISO/IEC 15288, Systems engineering – System life cycle processes, First edition, 2002-11-01, or MIL-STD-499B, Systems Engineering, Draft, 24 August 1993.

– Each 'Section 5' describes the functionality and performance required of the helicopters and their associated support system.

3.11 The AIR 9000 Phase 2 OCD only partially followed the OCD template guidance documents. The OCD included material that would normally be found in 'Section 3' of an OCD, but not the 'Section 5s', and as a consequence, the extent to which the MRH90 aircraft and the Black Hawk aircraft meet the specified operational concepts is unclear. Defence accepted the risk that without fully articulated Section 5s, it was likely that there would be:

- inadequate specifications covering the helicopters' functions and how well those functions are to be performed;
- inadequate requirements placed on the helicopters' associated support system, including training for aircrew and maintenance staff, logistics support and spares;
- inadequate descriptions of how the helicopters are required to interact with other systems, including the roles of the helicopter users, and how they will interact with the helicopters' systems; and
- inadequate descriptions of the helicopters' development direction.

3.12 For complex systems, the OCD should describe the way the system is to be used. However, the AIR 9000 Phase 2 OCD does not describe:

- the ergonomic issues related to personnel activities within the helicopters, including their movement in and out of the doorways and loading ramp;
- how the doorway-mounted aircraft self defence guns must be available to be used at all times, with the doors open and closed;
- how troops will enter or leave the aircraft quickly and safely, while the self defence guns are in operation;
- operational requirements for seat width;
- the positioning of seats and packs to allow troops to easily and quickly exit the aircraft;
- how troops may fast rope or rappel from the aircraft, assisted by a safety officer and protected by aircraft self defence guns; or
- how the sniper bar must be able to be used at the same time as the gun, and in conjunction with ballistic protection armour.

3.13 Fundamentally, the AIR 9000 Phase 2 OCD describes the capability required as 'equivalent to that provided by a squadron of Black Hawk helicopters, in terms of lift capacity, and ability to conduct simultaneous operations'. In that context, it would have been open to Defence to have developed the AIR 9000 Phase 2 OCD based on operational concepts used to develop the UH-60M Black Hawk (Army Utility Helicopter) as well as the MH-60S Knighthawk (multi-mission Naval Helicopter).[193] The OCD also describes the need to use the Troop Lift Helicopter in the amphibious environment and states that: 'the aircraft must have marinisation options, and be capable of operations from the [then] current Landing Platform Amphibious (LPAs)[194], and the foreshadowed replacements'. However, the helicopters' operational concepts related to the LPAs and their foreshadowed replacements are not specified.

3.14 As mentioned in paragraph 1.6, the acquisition contract was amended in June 2006 to include the additional 34 MRH90 aircraft and their support system purchased under AIR 9000 Phases 4 and 6. Following the development of separate Phase 4 and Phase 6 OCDs, a consolidated Phases 4 and 6 OCD was added to the acquisition contract as part of the 2006 amendments. This consolidated OCD showed an improvement by following the then Defence OCD template.

Function and Performance Specification

3.15 The MRH90 aircraft acquisition contract contains a Function and Performance-based System Specification (the FPS), against which Australian Aerospace is required to verify contractual compliance. Defence has FPS development guidelines, which describe the purpose and structure of the FPS.[195] The FPS is a contractual document and needs to describe clearly what the acquired system is required to provide in terms of its functions, and how well those functions are to be performed. The FPS must also be quite specific in

193 The MH-60S Knighthawk, which entered full-rate production in August 2002, is designed to deploy aboard helicopter-capable frigates, destroyers and amphibious mission support ships. They are fitted with saltwater corrosion protection, marinised engines, automatic blade folding, folding tails and printle-mounted guns located in the forward windows.

194 ANAO comment: The ADF's LPAs were HMAS *Manoora* and HMAS *Kanimbla*, which were withdrawn from service in May and November 2011 respectively.

195 Department of Defence, DMO, *Guidance for the Preparation of an OCD, FPS and TCD*, April 2002. Department of Defence, Defence Materiel Organisation, *Function and Performance Specification Development Guide*, v1.0, November 2004.

order to reduce the risk of contractual difficulties occurring during system design reviews and requirements verification and validation.

3.16 While the AIR 9000 Phase 2 FPS is large and detailed, it does not follow DMO's FPS guidelines published at that time, and it has the following structural weaknesses:

- The FPS does not benefit from functional modelling, which would have assisted the FPS developers to visualise the system's intended functions and to present those functions using logical diagrammatic techniques. This modelling would have also assisted stakeholders to verify that the system's required functionality had been adequately specified.
- The FPS does not trace the functional and performance requirements that should flow from the OCD.[196] This process allows stakeholders to verify that their operational requirements, expressed in the OCD, have been included in the FPS.[197, 198]

3.17 The Phase 2 FPS was utilised for Phases 4 and 6, with the inclusion of some additional annexes. The FPS was similarly incomplete at the time Phases 4 and 6 received government approval in April 2006, and at the time the acquisition contract was amended to include the additional 34 MRH90 aircraft in June 2006.

The impact of requirements on capability

3.18 If requirements have not been fully specified, the question is not so much whether or not DMO can deliver major systems and their support system to meet the FPS, but whether these systems will be fit for purpose. A number of fitness for purpose issues related to operational performance, marinisation and crashworthiness have been raised concerning the MRH90

196 The functions and associated performance requirements defined in the FPS should be traceable back to the user needs defined in the OCD, Department of Defence, Defence Materiel Organisation, *Function and Performance Specification Development Guide* v1.0, November 2004.

197 Further, the FPS includes requirements for MRH90 aircraft operations from the RAN's Landing Platform Amphibious (LPA) ships HMAS *Manoora* and HMAS *Kanimbla,* which were withdrawn from service in May and November 2011 respectively, but none for the RAN's Landing Helicopter Dock (LHD) ships, the first of which, HMAS *Canberra*, is scheduled to achieve the Initial Operational Capability milestone in December 2014. ANAO Report No.12, 2013-14, Assurance Report, *2012-13 Major Projects Report*, Defence Materiel Organisation, December 2013, p.208.

198 The FPS also contains headings that are missing requirements, namely: The Function and Performance Specifications for Personal Flotation Devices and Restraints; Flotation Collar; Survival Aids; Individual Armour Protection; and Supplemental Oxygen.

aircraft acquisition, some of which are the subject of approved permanent or temporary design waivers (see also paragraphs 3.87, 4.9, 4.10).[199]

3.19 The analysis in this section of the report highlights a range of shortcomings in the specification of mission, marinisation and crashworthiness requirements in the Air 9000 OCD and FPS. These shortcomings have had significant implications:

- The assessment of Australian Aerospace and Sikorsky's Phase 2, and combined Phases 2 and 4 proposals, was made against an incomplete set of requirements. A more comprehensive set of requirements would have provided a firmer basis for the assessment of proposals and the claims made by the respective companies, supported the identification of capability shortfalls or areas in need of developmental work for the respective aircraft, and assisted in developing more cogent advice to senior Defence committees, Defence leadership, the Minister and government on the respective strengths and weaknesses of the proposals. While Defence recommended the Black Hawk option following the ODRP process on the basis of value for money, it also found that the MRH90 aircraft would meet the capability requirement, which may not have been the case if the assessment was made against a strengthened set of requirements.
- From a contractual perspective, many key capability requirements have not been appropriately defined in the contract FPS, and as a consequence, Defence has not had contractual remedies for shortfalls in the capability to be provided by the MRH90 aircraft. Prominent examples involve the SDGS and the width of troop seats. This had led Defence to pursue costly contract amendments, expend significant resources undertaking additional developmental and testing work, and to issue temporary or permanent waivers in instances where the contract specifications inadequately reflected user expectations.

3.20 The remainder of this section examines these issues in terms of the OCD and FPS, the analysis of tender responses against those specifications during the tender evaluation process, the changes made to the specifications during the development of the MRH90 aircraft acquisition contract, and additional modifications and testing of aircraft systems.

199 A waiver is the discharge of a contractual obligation by agreement.

Mission requirements

3.21 Table 3.1 shows whether Defence included key mission requirements within the AIR 9000 Phase 2 OCD and within the contracted FPS, and whether compliance with those requirements has been demonstrated during MRH90 aircraft test and evaluations.

Table 3.1: Mission requirements in the Operational Concept Document (OCD) and Function and Performance Specifications (FPS)

Type of requirement	Is this included in the OCD?	Is this included in the contract FPS?	Demonstrated compliance, or fitness for purpose
Helicopter shall be Military–Off–the–Shelf (MOTS)	No	No. However, included in pre-contract FPS as an essential requirement.	No
Must be transportable in a Hercules C-130 transport aircraft	No	Yes[200]	No. C-130 transportation would require significant disassembly that is likely to require Deeper Maintenance support.
Self defence gun that can be used with door closed (for example, from a window)	No. Only included in pre-contract OCD.	No. Only included in pre-contract FPS.	No
Self defence gun system mounted in the doorway	Yes	Yes	This gun system has been redesigned, but the doorway installation remains operationally difficult.
Ballistic protection for the occupants of the cockpit and cabin	Yes	Yes	Yes—if fitted as role equipment.
Ballistic protection, ballistic tolerance and redundancy for Flight and Mission critical systems	Yes	Yes	Ballistic protection provided via cabin floor plates. Permanent design deviation granted for ballistic vulnerability.

200 The contracted FPS specified that the MRH90 aircraft, with reconfiguration, shall be transportable using C-130H and C-130J aircraft. Two C130 aircraft are required to transport one MRH90 aircraft, or three C130 are required to transport two MRH90 aircraft. This specification was relaxed from the original FPS, which stated that an MRH90 aircraft was to be transportable in a single C-130.

Type of requirement	Is this included in the OCD?	Is this included in the contract FPS?	Demonstrated compliance, or fitness for purpose
Ground clearance	No	No	Low ground clearance to antennas and composite underside materiel vulnerable to damage.
External sling load operations	Yes	Yes	Yes
Seats wide enough for troops in patrol order	No	No minimum width specified.	Seats being redesigned.
Appropriate aircrewman seats and workstations	Yes	Yes	Crewman seats being redesigned.
Aircrewman to have external observation for close formation flying	No	Yes. Only with doors open.	Crewman seats being redesigned.
In Fast Roping Mode, four ropes must simultaneously support three combat troops each	No	Yes	Demonstrated compliance not achieved – fast roping mode being redesigned.
Ability to safely simultaneously use door mounted defence gun and the Fast Roping and Rappelling Device (FFRD)	Yes	No	Installation of gun in the doorway remains operationally difficult.
Requirement for sniper bar?	No	Yes	Yes
Ability to use sniper bars at the same time as the self-protection guns, FFRD, forward stretcher system or doorway ballistic protection	No	No	No
Internal supply fuel tanks shall have ballistic tolerance to 7.62mm projectiles	Yes	Yes	No, only the bottom half of 2 out of 8 tanks are self-sealing.
Search lights (infra red and visible)	No	Yes	Infra red light system also emits visible light and visible search light is insufficiently bright.

Type of requirement	Is this included in the OCD?	Is this included in the contract FPS?	Demonstrated compliance, or fitness for purpose
Airframe Life of Type of at least 10 000 hours	Yes	Yes	Demonstrated compliance not achieved pending finalisation of fatigue testing. Key structural integrity documents are now scheduled for delivery in October 2014, as agreed as part of Deed 2 negotiations.[201]
Ease of troop egress	Yes	Yes	Demonstrated compliance not achieved – current door mounted self defence guns need to be stowed.
Able to hoist 2 people (590lbs or 270kg) from a minimum height of 200ft	Yes	Yes	Yes

Source: Department of Defence, AIR 9000 Phase 2 OCD and contracted FPS, and other Department of Defence MRH90 Program documents.

3.22 Table 3.1 shows that many important MRH90 aircraft mission requirements were not included in the OCD and/or contract FPS. Further, the compliance or fitness for purpose of the MRH90 aircraft against many mission requirements has yet to be demonstrated, with some key requirements remaining subject to redesign work.

Self Defence Gun System

3.23 Defence's Black Hawk helicopters have a Self Defence Gun System (SDGS) mounted in the forward gunner's cabin windows that enables the countering of threats, from both sides of the helicopter, including providing suppression fire as troops enter and exit the helicopter.[202] The MRH90 aircraft has the SDGS mounted in each doorway, which introduces operational limitations discussed below.

3.24 Table 3.2 shows that the SDGS requirements changed between the pre and post-contract OCD and FPS, to accommodate the doorway mounted MRH90 aircraft solution.

201 See paragraphs 4.27 to 4.30 for further discussion.

202 Particularly when boarding troops whilst under fire.

Table 3.2: Self Defence Gun System requirements

	2002 pre-contract documents	2004 post-contract documents
Operational Concept Document	Section 5.2.2.8: 'The machine guns must be capable of safe operation with the main doors closed.'	Section 5.2.2.8: 'The machine guns must be capable of safe operation with the main doors open.'
Function and Performance Specification	Section 2.2.8.2: 'The SDGS shall be able to be fired from both sides of the aircraft with doors in the open or closed positions.'	FPS134: 'The MRH shall be able to be fitted with a Self Defence Gun Mount (SDGM) in each of the cabin doorways.'

Source: Department of Defence, Pre and post contract AIR 9000 Phase 2 OCD and FPS.

3.25 In the Source Selection Report the door-mounted gun proposed for the MRH90 aircraft was assessed as noncompliant, and the option to mount it in the [rear] window was assessed as being partially compliant. However, only the optional window-mounted SDGS was given a risk rating, which reduced the overall risk rating for the MRH90 aircraft proposal. At the same time, the Source Selection Report did not address the potential operational issues posed by the noncompliant door-mounted gun. Eventually, the option to acquire the partially-compliant window mounted gun was not followed-up, and the MRH90 aircraft have been acquired with doorway-mounted guns fitted.

3.26 MRH90 aircraft troop egress tests and evaluations have revealed deficiencies affecting the ability of troops to exit the aircraft via the sliding doors with the SDGS in the firing position. Further, the installation of door-mounted guns interferes with a range of helicopter cabin workflow requirements, highlighting weaknesses in the MRH90 aircraft design with respect to battlefield helicopter performance. Troops need to move around the guns as they enter and leave the aircraft[203], the doors need to be open when the guns are in use, sniper bars cannot be mounted in the same doorway as the gun, and the Fast Roping and Rappelling Device (FRRD) and hoist cannot be safely used in the same doorway as the gun.

3.27 In response to these issues, an Enhanced MRH90 Armament Sub-System (EMAS) was designed to address deficiencies identified with the Pintle Mounted Gun Mount (PMGM) originally supplied by NHI. At the time of the audit, the MRH Program Office was conducting a Design Acceptance process for the EMAS. By March 2014, testing of the EMAS found it to be a

203 There is still the option of some troops leaving through the rear ramp, depending on the final cabin layout.

mature design. However, EMAS is only an interim solution that does not meet all operational requirements.

3.28 Defence informed the ANAO in April 2014 that several options are being considered to best satisfy the SDGS requirement, and that a decision on these is expected to be made by Chief of Army prior to the end of 2014.

Aircrewman seats

3.29 Military helicopters usually have two aircrewmen (previously known as load masters) who control the loading and unloading of cargo and passengers, and operate the role equipment and self defence guns. There is a requirement in the AIR 9000 Phase 2 FPS that the aircrewmen provide external observation with the cabin doors *open* to allow close formation flight and clearance for landing and take-off in confined landing pads. However, the FPS does not require external observation when the doors are closed, nor does it require a seating plan which enables aircrewmen to provide external observation when seated with the doors closed. As indicated in Table 3.1, the airmen seats are being redesigned, in order to improve the aircrewmens' field of view.

Troop Seats

3.30 There were no specific requirements in the OCD or FPS related to the width of the troop seats. The Source Selection Report assessed the troop seating offered by Australian Aerospace as compliant and noted:

> Australian Aerospace have offered 20 troop seats per aircraft; however, it is possible that only 14 will be fitted in a configuration similar to the TTH. The troop seats offered are narrower than the current S-70A-9 seats [and] may restrict the ability for troops to secure themselves.

3.31 As part of the Deed 2 settlement of a claim for Liquidated Damages and common law damages, Australian Aerospace agreed to redesign the seats so that they are wide enough. This will reduce the number of seats to 14 (including the two aircrewman seats). Figure 3.2 shows the width of the seats in the initial 20 troop seat configuration.

Figure 3.2: Narrow seating in MRH90 aircraft

Source: Department of Defence.

Fast Roping and Rappelling Device (FRRD)

3.32 As shown in Figure 3.3, fast roping is used in operations that require soldiers to exit helicopters quickly when they are carrying their weapons. The ropes used are thick to allow soldiers to safely slide rapidly to the ground. Rappelling devices allow soldiers to feed a thinner rope through a harness they wear, for use when, for example, the soldier is wearing a heavy pack.

Figure 3.3: Fast roping onto a ship from an S-70A-9 Black Hawk

Source: Department of Defence.

3.33 The AIR 9000 Phase 2 FPS specifies that in Fast Roping Mode, each rope should support the exit of three combat troops simultaneously. However, this is not possible if the rope hits the floor and steps of the aircraft. The Source Selection Report noted that the FRRD results in the ropes touching the cabin floor and steps, which exposes personnel to injury risks.

3.34 The FRRD was accepted on an interim limited basis, sufficient to meet Navy requirements for single-point fast roping. However, the FFRD was found to be unacceptable for rappelling or Special Operations fast-roping. At the time of the audit, the FRRD was being redesigned (see Table 3.1). Provision of a fully capable replacement system is likely to take between two to four years.

3.35 As indicated in paragraph 3.26, the simultaneous use of the SDGS and the FRRD poses a safety issue because of their proximity. However, there was no requirement in the AIR 9000 Phase 2 FPS relating to the ability to use both at the same time, even though this is standard military practice.

3.36 In March 2014, the Chief of Army was informed that operational test and evaluation results had found that the concurrent use of the doorway gun and the FRRD was not possible at critical points in a mission. The Chief of Army directed further investigation be undertaken, including the potential for changes to tactics, techniques and procedures, to inform a subsequent decision on this matter (see also paragraph 3.27).

Infra Red search light

3.37 The MRH90 aircraft's Infra Red (IR) searchlight is not fit for purpose because it also emits light visible to the naked eye, and is unable to produce sufficient light for searchlight requirements. The AIR 9000 Phase 2 FPS does not state that the IR searchlight is to be invisible to the naked eye or that its illumination levels should satisfy searchlight requirements. However, there is a reasonable expectation that these characteristics should be inherent in a fully effective military IR searchlight.

Sniper Bar

3.38 Sniper bars are placed across helicopter cabin doors for snipers to balance their weapons on (see Figure 3.4). There were no requirements in the AIR 9000 Phase 2 FPS stating that the sniper bar needed to be installed at the same time as other role equipment. However, if the sniper bar is fitted in the MRH90 aircraft there are incompatibilities with other role equipment. That is, if the self defence guns or the FRRD are installed in a doorway, then the sniper bar cannot be used on the same door. Further, the sniper bar is also incompatible with the hoist, the ballistic protection door plate cannot be installed, and the Stretcher System cannot be installed in the forward position next to the same door as a sniper bar. The Source Selection Report noted that the sniper bar offered was not appropriate and required further work.

Figure 3.4: Sniper bar incompatibility with ballistic protection

Source: Department of Defence.

Note: DMO purchased the sniper bars at a cost of €25 085 (June 2006 prices and exchange rate) for each set of two. See Appendix 6 for the list of MRH90 role equipment and their cost.

Marinisation requirements

3.39 In April and May 2012 the Navy conducted MRH90 flight trials from HMAS *Choules*, to determine the MRH90 Ship Helicopter Operating Limits. In summary the trials revealed that:

> ... the MRH90 handling over the deck was impressive and this is reflected in the size of the [flight] envelopes recommended. Embarkations in the LHD would be facilitated by the use of an aircraft shelter and, providing ongoing Airworthiness Issue Papers are addressed, the aircraft showed considerable potential for embarked operations.[204]

3.40 In 2004, when the then Minister for Defence announced the choice of the MRH90 aircraft for AIR 9000 Phase 2, he stated that:

204 MRH90 aircraft Airworthiness Issue Papers are discussed further in paragraphs 4.22 to 4.25.

> ... it has a particular suitability for the amphibious role …
>
> the Army particularly sees the counter terrorism capabilities and the Black Hawk as important and yet the European helicopter was seen as ahead in the amphibious role.

3.41 Working in the amphibious and maritime environment has implications for the design of a helicopter. For safety reasons naval helicopters generally require rotor brakes[205], an automatic blade folding system for the main rotor blades, a system to recovery assist, secure and traverse the helicopter into the hanger, flotation devices in the event that the helicopter ditches into the sea, and the ability for crew and passengers to free themselves from the helicopter if it starts to sink (underwater egress).[206]

3.42 The MRH90 OCD specified that the Army helicopters are required to be embarked for up to 90 days and the Navy helicopters for up to 120 days. This is significant because it implies that even the Army helicopters should be marinised to operate in the amphibious environment, or else accept the risks that arise in that environment.

3.43 Defence's fleet of Black Hawk helicopters are designed to Army specifications and have minimum marinisation features. These aircraft have a rotor brake and manually folding blades[207], and are not required to be deployed at sea for significant periods of time. The MRH90 aircraft has an additional marinisation feature than these Black Hawk aircraft, which is flotation devices that can be attached as part of a kit. Further, the MRH90 aircraft fuselage is constructed from composite materials, and is therefore considered to be less subject to corrosion.[208] Nevertheless, the MRH90 aircraft has metal parts that corrode, ranging from rivets in the tail assembly to complex assemblies in the landing gear, engine and transmission. Defence's MRH90 Annual Structural Integrity Report (ASIR), for the period 1 July 2012 to

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205 Wind conditions across the deck can create potentially destructive and dangerous vertical downward movement of the rotor blades as they slow down following engine shutdown. The aircraft must have a rotor brake to enable the rotors to be stopped rapidly.

206 In April 2014, Defence informed the ANAO that:

> Automatic Blade Fold (ABF) and secure and traverse are important for operations from small decks. ABF is less important for larger decks and secure/traverse systems are not used at all on large decks.

207 The blades require a crane to remove two of the blades, and the other two are then folded back.

208 On 14 February 2003, the then Deputy to the Chairman of Eurocopter Group in a letter to the then Australian Minister for Defence, advised that the 'NH 90 has the added features of total corrosion immunity'.

30 June 2013, reported numerous instances of corrosion occurring throughout the MRH90.[209]

3.44 Table 3.3 provides an overview of marinisation requirements, and whether they were addressed in the AIR 9000 Phase 2 OCD and contracted FPS. It also outlines whether the requirements have been delivered as part of the actual MRH90 aircraft design.

Table 3.3: Marinisation requirements in the OCD and FPS

Type of requirement	Is this included in the OCD?	Is this included in the FPS?	Delivered?
Rotor brake	Yes	Yes	Yes
Manual folding Blades	Yes – by removing the blades or through an integral blade fold mechanism	Yes	Yes
Automatic folding blades	No	No	No
Tail fold	Yes	Yes	Yes
Strong undercarriage to withstand cyclic movement on ships	Yes	No	No
Able to operate on Landing Platform Amphibious (LPA) ships and replacements above sea state 3	Only for Phases 4 and 6 OCD	Yes	Yes – up to sea state 4
Strong handling points to manoeuvre aircraft around deck and into hangar up to sea state 4	Yes	Yes	To be determined (TBD)
Corrosion protection	Yes	Yes	Additional corrosion management measures necessary
Strong tie down points to secure aircraft to deck	Yes	Yes	Remains under development
Cargo must be retained on an LPA in conditions up to and including five degrees of pitch and fifteen degrees of roll.	No	Yes	TBD

209 Defence informed the ANAO that RAN experience shows that corrosion is a maintenance issue requiring a reasonable level of monitoring and the application of appropriate corrosion prevention and treatment procedures.

Type of requirement	Is this included in the OCD?	Is this included in the FPS?	Delivered?
Navy rigid cargo strop capability	No	No	No – cargo hook is being redesigned
Underwater locator beacon	Yes	Yes	Yes
Retrieval system	No	No	No
Floatation or sink arresting devices	No	Yes	Yes
Underwater egress	No	No	The cockpit and cabin doors jettison; the cabin door windows jettison; the SDGS creates egress hazards
Able to use decks of FFGs and ANZAC-class FFHs as way points and for refuelling and emergency landing. The MRH aircraft shall be capable of being accommodated in the hangers of the FFG and ANZAC class ships.[210]	No	Yes	No

Source: Department of Defence, AIR 9000 Phase 2 OCD and FPS (Maritime Operations, Section 2.2.9), and other Department of Defence documents.

3.45 The OCD and FPS outlined a range of marinisation requirements, including a rotor brake, manual folding blades, the ability to operate on Landing Platform Amphibious ships and corrosion protection. However, there were gaps in the specification of marinisation requirements related to: automatic folding blades; and cargo hook compatibility with a Navy rigid cargo strop.

Automatic blade folding and tail folding

3.46 The RAN's Seahawk aircraft and the recently retired Sea King aircraft were both fitted with automatic blade folding systems. The AIR 9000 Phase 2 OCD noted that an electro-mechanical (automatic) blade fold facility would further enhance safety and reduce aircraft preparation times. However the MRH90 OCD does not specify automatic blade fold as a requirement and neither does the FPS.

210 The RAN's four (originally six) Adelaide Class Fast Frigate Guided (FFGs) are a derivative of the US Navy Oliver Hazard Perry FFG-7 class Guided Missile Frigates. The RAN also has eight ANZAC-class Frigates.

3.47 Naval helicopters employ automatic blade folding systems in order to:

- reduce the risk of injury to personnel;
- reduce the risk of aircraft damage;
- improve the range of conditions (wind and sea states) in which the aircraft can be operated;
- improve flight deck tempo and sortie generation rates by reducing the time and effort required to manage flight deck operations compared with manual blade fold systems. Further, reducing the aircraft preparation time on Landing Helicopter Dock (LHD) ships is essential to minimise the time between launching helicopters from a limited number of spots and any loiter time associated with forming up when airborne.

3.48 The MRH90 aircraft design is based on the NH90 Troop Transport Helicopter (TTH) Army variant, which does not have automatic folding blades. Only the NH90 NATO Frigate Helicopter (NFH) variant has these blades.[211]

3.49 In 2004, the then Minister for Defence stated that the MRH90 aircraft would have automatic folding blades.[212] By May 2006, Defence stated that 'the initial aircraft would not have a blade fold capability'.[213]

3.50 The Navy identified automatic blade fold as a requirement for its Maritime Support Helicopter (MSH) to be acquired through AIR 9000 Phase 6. This requirement was to be included as a costed option in the 2006 contract change proposal that amended the acquisition contract to include an additional 34 MRH90 aircraft and their associated support system. However, the automatic blade fold option was not included in the amended contract, and there followed a debate within Defence as to whether the automatic blade fold capability should be incorporated into the aircraft. This debate culminated in the development of a separate contract change proposal for automatic blade fold, which is yet to be implemented.

3.51 On 4 September 2007, the then Chief of Navy stated:

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211 Although the word 'variant' is used, these two helicopters are significantly different. The TTH is designed for friendly-zone troop transport operations over land, and the NFH is designed for maritime anti-surface and anti-submarine warfare operations.

212 *Press release—John Howard and Senator Hill—MRH90 acquisition announcement*, 31 August 2004.

213 *Estimates Hansard—MRH90 delays and contract*, 31 May 2006.

> ... let me strongly reiterate Navy's previous advice which is that not having ABF [automatic blade fold] on MSH aircraft will generate unacceptable personnel safety capability and operational output risks. ABF is an essential requirement for MSH operations.
>
> As the ADF's Capability Manager for Amphibious Operations, I consider that, not fitting ABF in any embarked MRH 90 could be a very significant limiting factor in ADF power projection from the sea. Fundamental restrictions on operational flexibility, tempo and freedom of manoeuvre against conventional and asymmetric threats in navigationally constrained littoral waters could occur.[214]

3.52 On 18 September 2007, the then Chief of Army also gave his support to the automatic blade fold option:

> The capability increase provided by ABF equipped MRH 90 is highly desirable for the conduct of amphibious AMO [Air Mobile Operations] in conditions where the Manual Blade Fold (MBF) system would be inadequate. A fleet [of] MRH 90 equipped solely with MBF would lead to a reduction in the range of conditions under which large, complex amphibious AMO could be conducted.[215]

3.53 By October 2008, none of the NH90 customers had decided to acquire automatic blade folding capability for the troop lift variant of the NH90. At that time, DMO considered that incorporating a developmental automatic blade fold system would be costly—estimates obtained by DMO in 2007 indicate that the cost of the automatic blade fold system would be approximately $155 million for 18 MRH90 aircraft, or $188 million for 24 MRH90 aircraft. DMO also considered that an automatic blade fold system could result in some compromise of capability, including reduced payload and infra-red radiation suppression, as well as risk to schedule. DMO considered that the additional weight of the automatic blade fold system would result in the MRH90 aircraft experiencing a decrease in operational range and payload performance, and at least a short-term decrease in reliability, maintainability and operational availability associated with the developmental nature of the MRH90 aircraft automatic blade fold system.[216] However, DMO did not

214 Minute from the Chief of Navy to the Head of Capability Systems Division of CDG, 7 September 2007.

215 Minute from the Chief of Army to the Head of Capability Systems Division of CDG, 18 September 2007.

216 Defence informed the ANAO that the Automatic Blade Fold on the NH90 NFH had a low reliability, and therefore fitting the system to the MRH90 may reduce the operational availability of the aircraft.

estimate the extent of these factors. For these reasons DMO has not progressed automatic blade folding capability.

3.54 During the first of class flight trials aboard HMAS *Choules* in April–May 2012, MRH90 aircraft blade fold tests showed that there were insufficient tactile and visual alignment cues when installing MRH90 aircraft blade pins, making pin alignment difficult, time consuming and fatiguing. There were also uncommanded releases of blade restraint fittings, which was likely to result in an unrestrained blade in high winds causing injury to personnel and damage to blades and the main rotor head.

3.55 In April 2014, Defence informed the ANAO that:

> Manual Blade Fold—Speed and efficiency of the evolution has improved with increasing flight deck team experience. MRH90 First of Class Flight Trials (FOCFT) Reports from HMA Ships *Success* and *Choules*, and HMNZS *Canterbury*, concluded that the conduct of aircraft spread and fold evolutions was SATISFACTORY.

3.56 In its response to an extract of the proposed audit report, Australian Aerospace commented that:

> Inevitably in the design of a helicopter compromises need to be made to ensure that the basic weight of the aircraft does not increase to the point where the operational range or lift capacity falls below the users requirements. For a multi role helicopter it would not be common to fit automatic blade folding and deck recovery systems[217] because they would be rarely used but add considerable weight for all operations. The MRH90 has very good handling qualities when operated to ships but does not feature some of the equipments which are found on dedicated maritime helicopters.

Navy Rigid Strop

3.57 The AIR 9000 Phase 2 OCD and FPS did not include any 'rigid strop' requirements. For Navy operations the 'rigid strop' is utilised to allow load hook-ups while the aircraft maintains a high hover so as to remain clear of the deck or other obstructions.

3.58 The MRH90 aircraft cargo hook was found to be incompatible for use with a rigid strop when embarked, which would impede the MRH90 aircraft from conducting vertical replenishment (VERTREP) operations with US and

217 ANAO comment: see paragraph 3.60 for further discussion on recovery assist, securing and traversing systems.

other coalition ships that use the rigid strop as standard load rigging equipment. By July 2010, Defence found the incompatibility of the MRH90 aircraft cargo hook and the rigid strop to be unacceptable.

3.59 In April 2014, Defence informed the ANAO that an MRH90 aircraft cargo hook redesign was underway, so as to accommodate a rigid strop. An alternate Vertical Replenishment configuration has been authorised for use until the longer-term rigid strop capability is available. Defence informed the ANAO that a fully capable MRH90 cargo hook was not expected to be available until 2016.

Naval helicopter shipboard recovery, securing and traversing systems

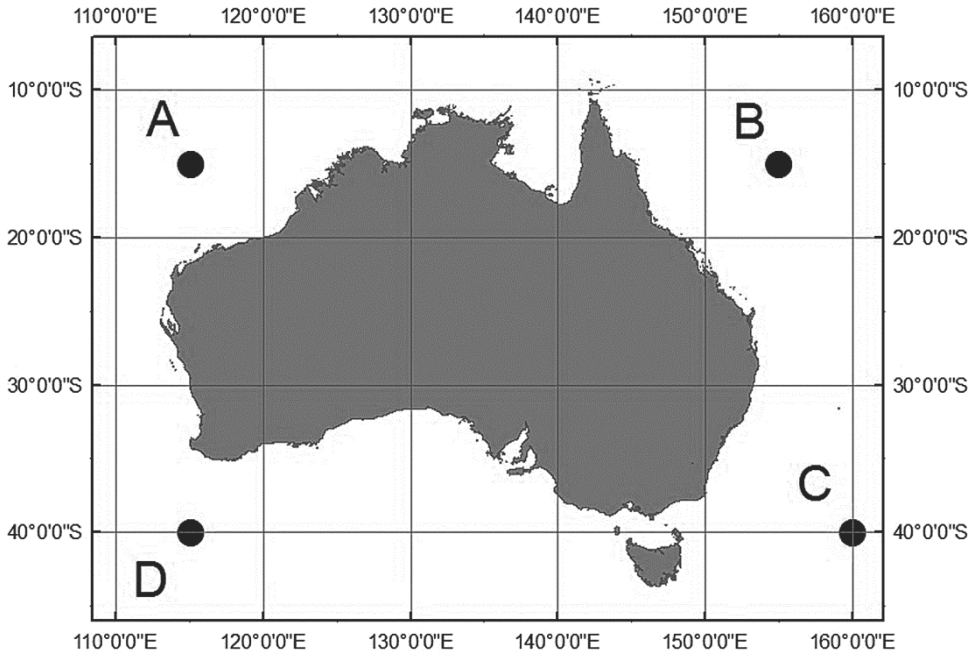
3.60 Naval helicopter recovery, securing and traversing systems enable helicopters to land on ships at sea, secure the helicopters to flight decks and traverse them across the flight deck and into hangars. These systems are designed to reduce the risks to the helicopter and ship's crew, especially during flight deck operations on frigates and destroyers in high-sea states, which may induce pitch and roll deck movements of greater than 10 degrees.[218]

3.61 Figure 3.5 shows four locations that are representative of Australian seas. These regions include: Northwest (Indian Ocean east of Christmas Island); Northeast (Coral Sea); Southeast (Tasman Sea); and Southwest (900km due south of Perth). Figure 3.6 shows the frequency of occurrence of sea states[219] at these locations, as calculated by the Bureau of Meteorology. The figure indicates that naval operations in these waters would often occur at sea state 4 and above. This analysis lends weight to the importance of investment in helicopter recovery, securing and traversing systems for ADF operations.

218 In April 2014, Defence informed the ANAO that secure/traversing systems are not required for amphibious support (LHD) or Maritime Support Helicopters. They are designed to reduce risks in sea states 5 and 6.

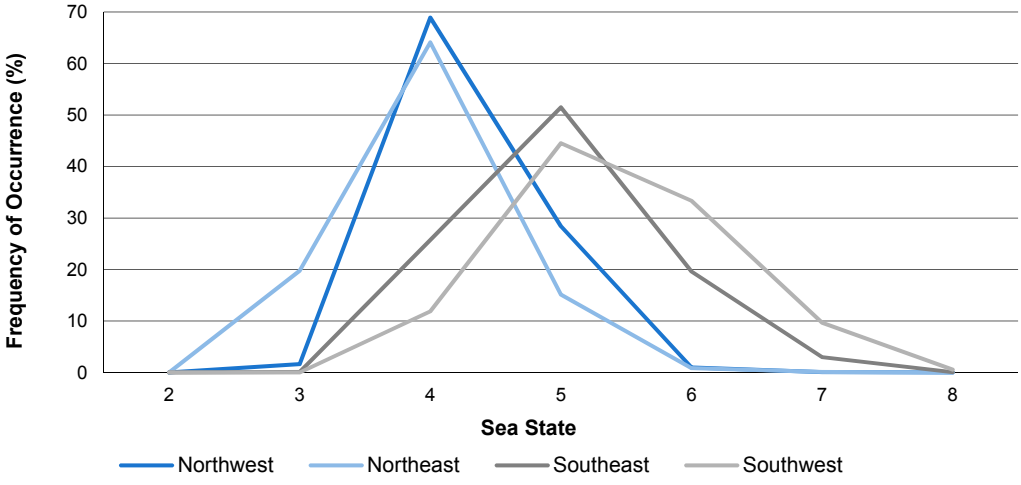
219 According to the Douglas Sea State Scale, sea surface movements range from zero, for calm–glassy conditions; to nine, for phenomenal surface movement involving 14 metre wave heights.

Figure 3.5: Representative locations used to monitor regional sea states



Source: Australian Bureau of Meteorology.

Figure 3.6: Sea state frequency in Australian waters



Source: Australian Bureau of Meteorology.

3.62 As first mentioned in paragraph 1.18, the MRH90 aircraft are required to fulfil the RAN's requirements for Maritime Support Helicopters embarked on amphibious and afloat support platforms, including the future Landing

Helicopter Dock (LHD) vessels. The LHDs are not being fitted with a recovery, securing and traversing system, as such systems are typically not required on ships such as the 27 000 tonne LHDs, which have relatively large flight decks and are more stable in pitch and roll motions than is the case of smaller vessels. Pilots must land the MRH90 aircraft unassisted on the LHD, and ensure the MRH90 aircraft is correctly attached to a towing vehicle to assist flight deck movements.

3.63 The MRH90 aircraft must also be capable of using the flight decks and hangars of the RAN's Adelaide-class FFGs and ANZAC-class FFHs. These frigate-sized vessels are fitted with a helicopter recovery assist, securing and traversing system, known as RAST[220], in order that helicopter operations may be conducted in wide-ranging sea states. Further, the RAN's future Hobart-class DDGs are to be fitted with an Aircraft Ship Integrated Secure and Traverse (ASIST) system.[221]

3.64 The Navy's MH-60R Seahawk aircraft are fitted with helicopter recovery assist, securing and traversing system components that assist the Seahawk aircraft with landing and take off from destroyers and frigates in high sea state conditions, and with on-deck traversing into their hangars. This system can operate with the ship rolling up to 24 degrees and pitching up to 11 degrees. In contrast, the MRH90 aircraft, and the Army's ARH Tiger aircraft, are not fitted with recovery assist, securing and traversing system components, to better enable them to operate in wide-ranging sea states from the RAN's frigates and destroyers.

3.65 In June 2014, Defence informed the ANAO that:

> The MRH90 is replacing the Sea King in the maritime support role. The Sea King performed this mission effectively without a recovery securing and

220 The current helicopter recovery system fitted to the RAN FFGs and FFHs is the Curtis Wright Corporation, Recovery Assist, Secure and Traverse (RAST) Mk IV system. This system is used by the current Navy Seahawks. A thin cable is dropped down from the aircraft and is attached by ground crew to a heavier cable that is drawn into the aircraft and clamped. The aircraft is then hauled down to the deck into a mechanism able to move the aircraft along a track into the hanger. The RAST requires heavy machinery including embedded rails, winches, wires and control systems to be built into the ship. It is the safest system to use in helicopter retrieval.

221 The helicopter recovery system being fitted to the RAN Hobart-class DDGs is the Curtis Wright Corporation Aircraft Ship Integrated Secure and Traverse (ASIST) system. This system provides a capability similar, but not compatible, to the RAST system. ASIST does not have a recovery-assist haul-down cable, which the RAST system provides to reduce risk of damage caused by hard landings or undercarriage damage caused by heavy sea swells.

traversing system. Of note, the MH-60S, which fulfils the equivalent role in the US Navy, is also not equipped with a recovery securing and traversing system.

MRH90 aircraft flight deck and cargo deck mooring

3.66 MRH90 aircraft first of class flight trials conducted aboard HMAS *Choules* in April–May 2012 included an MRH90 aircraft being moored on the flight deck and cargo deck, using both long-term and storm-lashing schemes. Whilst secured by storm-lashings, the MRH90 aircraft experienced a maximum deck motion of ±2 degrees pitch and ±15 degrees roll, which exceeds the MRH90 aircraft's recommended lashing specification. Under higher sea state conditions, it would be expected that HMAS *Choules* would roll significantly greater than 15 degrees. Defence's report on the first of class flight trials noted that there was no published guidance available on inspections and maintenance in the event that ship motion limits associated with MRH90 aircraft lashing schemes are inadvertently exceeded during embarked operations. In April 2014, Defence informed the ANAO that:

> The Commonwealth has requested that Industry provide enduring and detailed guidance for appropriate inspection or maintenance regimes following exceedence of deck motion limits. Industry has stated that this guidance will be provided to the Commonwealth by mid 2014.
>
> In the interim, Industry provides a relevant Technical Note (containing detailed guidance for appropriate inspection or maintenance regimes) each time the Commonwealth of Australia requests Engineering guidance following such exceedences.

3.67 In June 2014, Defence further informed the ANAO that:

> … Without published guidance, maintenance teams must refer to the Authorised Engineering Organisation [Australian Aerospace] to develop and authorise inspection criteria following each occurrence which can take a number of days to be provided to the maintenance team. Therefore, the lack of guidance translates to an operational issue as the aircraft will experience increased down time whilst maintenance crew await this advice.

Corrosion

3.68 A *Corrosion Based – Reliability Centred Maintenance study of the MRH90* was conducted during 2009–10, in conjunction with Navy's initial first of class flight trials. The study found that many components within the MRH90 aircraft corroded prior to delivery of the helicopters, and during the flight trial period. Defence formed the view that this would reduce MRH90 aircraft availability and increase the maintenance costs of the aircraft.

3.69 Figure 3.7 shows examples of MRH90 aircraft metal corrosion and composite material delamination.

Figure 3.7: MRH90 aircraft corrosion and delamination

Source: Department of Defence.

3.70 In its response to an extract of the proposed audit report, Australian Aerospace commented that:

> With regards to corrosion protection, Australian Aerospace has developed, in conjunction with the Australian Navy, local protective procedures to be applied prior to and when embarked. Australian Aerospace has undertaken deeper maintenance on four MRH90 aircraft to date, including aircraft that have seen significant embarked operations, and corrosion on these aircraft has been minor and consistent with expectations for aircraft of this type.

Flotation devices and underwater egress

3.71 Heavy items such as engines and transmission systems are located high in the fuselage of helicopters, and the top heavy nature of helicopters makes them inherently unstable on the water. As a consequence, helicopters tend to quickly overturn and sink when landed on water. Helicopters are fitted with

flotation devices designed to inflate automatically to prevent, or to slow, the sinking rate. A requirement for flotation devices was included in the AIR 9000 Phase 2 FPS, and the MRH90 Program Office has purchased 20 sets of these devices.

3.72 A December 2013 Operational Evaluation Report assessed MRH90 aircraft emergency evacuation when utilising the Enhanced MRH90 Armament Sub-System (EMAS), and identified an unacceptable deficiency in relation to underwater emergency evacuation. The installation of the EMAS reduces the MRH90 aircraft aisle widths and creates additional hazards around the emergency exits, which further contributes to the risk of personnel not being able to escape a ditched aircraft.

3.73 In April 2014, Defence informed the ANAO that:

> Whilst the EMAS does reduce aisle widths, limitations have been introduced on useable seats to maintain FAR 29[222] aisle widths and egress times. Whilst positioning the EMAS in the door creates additional hazards for egress, this risk has been assessed and found to be acceptable in the short term. In the longer term, options of alternate weapon mount designs and improved underwater egress training are being investigated.

Crashworthiness requirements

3.74 Crashworthiness of helicopters is particularly important as statistics show they operate at significantly greater risk of fatal accidents, when compared to fixed–wing aircraft.[223] Over the last decade, Australian civil helicopters were involved in 36 per cent of all accidents in general aviation, and 47 per cent of all fatal accidents. At the same time, helicopters accounted for only 13 per cent of the Australian civil fleet, and their flight hours totalled approximately 2.4 million hours versus 8.9 million hours flown by general aviation aircraft.[224]

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222 US Federal Aviation Administration's Part 29 standard (FAR 29—*Airworthiness Standard Transport Category Rotorcraft*, Amendment 31).

223 Crashworthiness involves the ability of aircraft to: maintain a protective space for occupants throughout the crash impact sequence; prevent occupants, cargo, or equipment from breaking free of their normal location and positions during a crash sequence; limit the magnitude and duration of accelerations and loads experienced by occupants to within survivable levels; prevent catastrophic injuries and fatalities resulting from contact with barriers, projections, and loose equipment; and limit the threat to occupant survivability posed by fire, drowning, exposure, entrapment and other factors, following the cessation of the crash impact sequence.

224 Australian Transport Safety Bureau, *Aviation Occurrence Statistics 2002 to 2011*, p.61.

3.75 Some ADF aircraft operate in a way that substantially increases the risk of severe crashes, and are considered to be operating in a challenging environment. Military aircraft may operate at high speeds and low altitudes, with reduced clearance from obstacles, and within a wider variety of physical operating environments and operational scenarios. Nonetheless, Defence informed the ANAO that ADF helicopter accident statistics are broadly comparable to the above civilian statistics, noting that civil accident data is skewed for helicopters due to the accidents of helicopters flown in challenging roles, such as cattle mustering and low flying scenic operations.

3.76 Australian S-70A-9 Black Hawk helicopters have experienced an accident rate of 3.167 per 100 000 flight hours. DMO applied this accident rate to the MRH90 fleet to extrapolate the estimated number of MRH90 aircraft accidents over the fleet's expected 25 year service life. DMO's analysis took into account the MRH90 fleet's expected flying rate of 224 airframe hours per year. Based on this analysis, DMO estimated that eight MRH90 aircraft will be involved in accidents. This reinforces the importance of MRH90 aircraft crashworthiness.

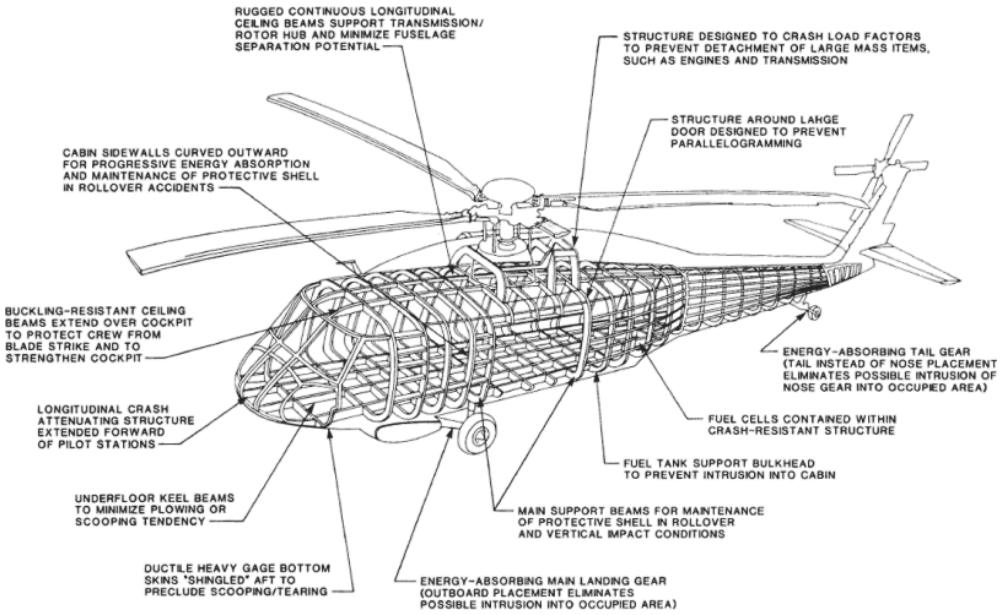
Military aircraft crashworthiness standard and guidance

3.77 The military standard for crashworthiness of helicopters is the US Department of Defence MIL-STD-1290A, *Military Standard for Light Fixed and Rotary Wing Aircraft Crash Resistance*, 26 September 1988.[225] Figure 3.8 provides a schematic picture of the design features associated with a MIL-STD-1290A crash resistant rotorcraft configuration.

3.78 MIL-STD-1290 places high demands on virtually all aspects of crash protection, particularly fuselage strength, seat strength and fuel system design. The standard recognises that the likely crash scenarios for some military aircraft will be more severe than the likely crash scenarios for most civilian aircraft, and therefore it imposes more demanding crash protection design requirements.

225 The original version of MIL-STD-1290 was published in January 1974.

Figure 3.8: Crash resistant features for rotorcraft – MIL-STD-1290



Source: Department of Defense, *Joint Service Specification Guide, Crew Systems, Crash Protection Handbook*, October 1998, p.13.

3.79 MIL-STD-1290A was inactive at the time of the development of the Phase 2 OCD and FPS, and Phase 2 contract signature. It was reinstated in January 2006[226], prior to the acquisition contract amendment relating to Phases 4 and 6. While the military standard was inactive at a key point in time during the development of the OCD and FPS, it remained a well known standard that had previously been in place for many years, and could have readily informed the development of crashworthiness requirements for the ADF's proposed multi-role helicopter.

226 During the early 1990s, it was argued in the US that the large number of military standards imposed unnecessary restrictions, increased cost to contractors, and impeded the incorporation of the latest technology. In June 1994, US Secretary of Defense William Perry issued a memorandum that prohibited the use of most military standards without a waiver, directing that performance specifications or non-government standards should be used instead. In December 1995, MIL-STD-1290A was cancelled without replacement.

In March 2005 the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics issued Policy Memorandum 05-3 – Defense Standardization Program. This memorandum referred to an October 2004 decision to remove the requirement to obtain a waiver in order to cite military specifications and standards in solicitations and contracts. The memorandum stated:

> We need to ensure that those in the acquisition and logistics communities have the flexibility to assess program requirements, make good decisions, and where appropriate, require conformance to military specifications and standards.

In January 2006, MIL-STD-1290A was reinstated without revision.

3.80 The Defence *Airworthiness Design Requirements Manual, 7001.054(AM1)* provides guidance on the application of airworthiness design requirements. The version of this manual current at the time of the Phases 2, 4 and 6 contract signature did not specify any standards for crashworthiness; instead it gave a brief overview of crashworthiness design principles. These principles could have been used as the basis for some high-level crashworthiness requirements in the OCD and FPS. The April 2012 version of the design requirements manual contains a more robust section on crashworthiness.

Crashworthiness requirements in the OCD and FPS

3.81 Table 3.4 shows that there were little by way of crashworthiness requirements included in the Phase 2 OCD and contracted FPS. This in part reflects the situation outlined above, that at the time the OCD and FPS were drafted, the US military standard was inactive and the ADF's *Airworthiness Design Requirements Manual* did not specify any standard for crashworthiness.

Table 3.4: Crashworthiness requirements in the OCD and FPS

Type of requirement	Is this included in the OCD?	Is this included in the FPS?
Ability to retain high mass items in a crash	No	No
Aircraft structure designed to absorb energy	Yes	No
Aircraft designed to prevent ploughing in the event of a crash	No	No
Troop seats are to be built to a military standard	All passenger seats must be crashworthy	Yes – troop seats are required to be certified according to MIL-S-85510 (AS), and restrain soldiers in Patrol Order.[227]
Pilot and co-pilot seats are to be built to a military standard	All crew seats must be crashworthy	'Crashworthy pilot/co-pilot seats' are listed in a table as part of the MRH90 aircraft configuration in the FPS.
Instructor jump seat behind pilots to be built to a military standard	All passenger seats must be crashworthy	No

227 Patrol Order consists of webbing, personal weapon and ammunition, which a standard infantry soldier has a requirement to wear at all times. The average weight used for a soldier in Patrol Order is 210 lb (95 kg). Webbing consists of pouches on a belt containing a large variety of equipment for a soldier. The webbing takes up a significant amount of space around a soldier's waist and will place restrictions on the minimum size of troop seats.

Type of requirement	Is this included in the OCD?	Is this included in the FPS?
When there are 9 soldiers in Marching Order for Airmobile Operations, their 90 lb (40.8 kg) packs must remain restrained in a crash.[228]	No	Yes
Landing gear designed to absorb energy in the event of a crash	No	No
Fuel tanks to be crashworthy according to a military standard	Does not specify crashworthiness to a military standard	Requirement states that 'The MRH shall have crashworthy internal fuel tanks.'
External fuel tanks shall be crashworthy	No	No

Source: Department of Defence, AIR 9000 Phase 2 OCD and FPS, and other Department of Defence documentation.

MRH90 aircraft design standard

3.82 The MRH90 aircraft is designed to the US Federal Aviation Administration's (FAA's) Part 29 standard (*FAR 29—Airworthiness Standard Transport Category Rotorcraft, Amendment 31*).[229] Section 562 of FAR 29 – *Emergency landing dynamic conditions* describes the protection that must be given to the occupants in the event that a rotorcraft has a crash landing.

3.83 The MRH90 is qualified[230] to a 'modified' MIL-STD-1290A in which the helicopter is assumed to land fairly level. The standard has been modified in the sense that the survivable impact velocities specified in MIL-STD-1290A were not adopted for the MRH90. Instead the MRH90 specification, which is based on a version of the NH90 TTH specification, contains reduced survivable impact velocities.

3.84 In April 2014, Defence informed the ANAO that:

228 The standard infantry soldier on extended operations has a requirement to carry Marching Order. Marching Order consists of Patrol Order equipment, personal weapon and field pack, with a nominal weight of 90 lb (40.8 kg).

229 Section 4.2 of the *MRH-90 Type Certification Plan*, Issue I, August 2009, states that:

> The MRH-90 will be compliant to the FAR 29 amendment 31 regulation. The comparison to the latest amendment was performed, that shows that amendment 31 is still guarantying [sic] a safe design. Moreover no fleet retrofit was asked for by FAA down to the gap between both amendments. Changes to FAR 29 introduced by amendment 31, are based on some of the proposals that were submitted to the FAA by the European Airworthiness Authorities.

230 'Qualified' means that the aircraft is built to, but not certified to, a standard. So while the intent to meet a standard may exist, there is not yet adequate assurance that it has been met.

Lack of 'certification' to a standard does not mean that the standard has not been met. The ADF's compliance finding activities are conducted to provide assurance that the standards defined for that particular design element have been met, or that any shortfalls against the standard have been assessed and treated (including risk retention where appropriate).

The partner NH90 nations had agreed to the NH90 TTH specification and the shortfalls against MIL-STD-1290A prior to Defence being involved in the project.

3.85 The NH90 has a fully composite fuselage, which has different energy absorption properties to that of metal fuselage designs. At the time of the audit, Defence had not received detailed design information relating to ADF unique structural modifications to the baseline NH90. This design information would provide visibility of important structural characteristics, limitations and capabilities of the MRH90 aircraft structure (see paragraphs 4.27 to 4.30). In April 2014, Defence informed the ANAO that the MRH90 aircraft structure has obtained France's DGA[231] qualification and certification from multiple European nations. Defence further informed the ANAO that France's DGA had qualified some ADF unique changes, although these are unlikely to be significant enough to affect the level of crash protection afforded by the structure.

3.86 In its response to an extract of the proposed audit report, Australian Aerospace commented that:

> As the Extract points out, the Defence Airworthiness Design Requirements Manual AAP 7001.054(AM1) did not specify a crashworthiness design standard at the time that Phase 2, 4 and 6 contracts were signed. Irrespective, the MRH90 provides a high level of survivability for occupants and is fully compliant with the requirements to which it was designed as specified by the NH90 Partner Nations in Europe. Australian Aerospace and NHI are working closely with Defence at this time to further improve occupant safety via introduction of enhanced cabin seating and cabin crew restraints which will further increase compliance of the aircraft with respect to the now current AAP 7001.054(AM1) requirements, while also considering a more contemporary military population from an anthropometric perspective and total weight, including combat equipment.

231 Direction générale de l'armement (DGA) is France's Defence Procurement Agency

MRH90 aircraft proposed modifications and waivers

3.87 Defence has identified MRH90 aircraft crash protection shortfalls against the 2009 *ADF Aircraft Crash Protection Policy*, and a range of modification options to address these shortfalls. In September 2012, the Chief of Army forwarded to the Defence Aviation Authority (the Chief of Air Force), a waiver request covering MRH90 aircraft crash protection design shortfalls, with respect to the *ADF Aircraft Crash Protection Policy*. Temporary waivers were requested until June 2017 in areas such as: evacuation—including ditching and underwater egress, crew and passenger retention, and retention of interior equipment. Permanent waivers were requested where treatment options were not currently cost-effective or no practical solution was identified. These included crew and passenger retention system strength, and post crash fire potential and rating.[232]

Conclusion

3.88 The primary Defence Capability Definition Documents (CDDs) are: Operational Concept Documents (OCDs), Function and Performance Specifications (FPSs), and Test Concept Documents (TCDs). These documents are developed during a project's requirements definition phase, and form part of the supporting documentation for the Second Pass capability proposal to government. They need to accurately reflect the user's expectations of the system.

3.89 AIR 9000 Phase 2 was a pilot project for the development of a set of CDDs under a revised Defence approach to the Capability Definition Phase of major projects. Defence recognised a lack of internal expertise in the development of CDDs at the time, and engaged a professional services provider to write the CDDs for Phase 2. However, there was still a need for Defence to verify that the delivered CDDs were of adequate quality. The Phase 2 OCD only partially followed the OCD guidance documents applicable at the time. The OCD describes the future multi-role helicopter capability, but not the functionality and performance required of the helicopters and their associated support system, for each proposed solution. As a consequence, the extent to which the MRH90 and the S-70M Black Hawk meet the specified operational concepts is unclear from the OCD. Further, there was scope for the

232 Within this context, the waivers are the discharge of an obligation to satisfy technical regulations.

FPS to be more specific, in order to reduce the risk of contractual disagreements during system design reviews and requirements verification and validation. While the Phase 2 FPS is large and detailed, it did not follow DMO's then FPS guidelines, nor did it include functional modelling or trace the functional and performance requirements that should flow from the OCD. The Phase 2 FPS was also utilised for AIR 9000 Phases 4 and 6, and demonstrated the same shortcomings at the time these phases received government approval in April 2006.

3.90 Many important MRH90 mission requirements were not included in the OCD and/or contract FPS; and the compliance or fitness for purpose of the MRH90 against many mission requirements has yet to be demonstrated, with some key requirements remaining subject to redesign work. A prominent example illustrating immaturity in aspects of the aircraft's design relates to the operation of the Self Defence Gun System (SGDS) and Fast Roping and Rappelling Device (FRRD). The FPS states that the MRH90 aircraft shall be able to be fitted with a Self Defence Gun Mount in each of the cabin doorways. However, the installation of door mounted guns interferes with a range of helicopter cabin workflow requirements. Troops need to move around the guns as they enter and leave the aircraft, the doors need to be open when the guns are in use, and the FRRD cannot be safely used in the same doorway as the gun. These and other issues have been partially addressed through changes to the MRH90 acquisition contract, and some of the design modifications are being implemented for Product Baseline 3 (PBL3) MRH90 aircraft. A key design change has been the development of an Enhanced MRH90 Armament System (EMAS). The EMAS reduces but does not eliminate the obstruction caused by the gun in the door, and the Army is therefore pursuing other options to improve the operation of the gun system and roping device. In a similar vein, there were no specific requirements in the OCD or FPS related to the width of troop seats, and as part of the Deed 2 settlement of a claim for Liquidated Damages and common law damages, Australian Aerospace is redesigning the seats so that they are wide enough.

3.91 The need to rectify these and other issues has delayed the planned introduction into operational service of the MRH90 aircraft. In March 2014, the Chief of Army approved a revised Acceptance Into Operational Service (AIOS) schedule due to deficiency rectification and delayed aircraft delivery. The Chief of Army also directed that further investigation of options be undertaken to achieve relevant OCD requirements, including the potential for changes to tactics, techniques and procedures, to inform a subsequent decision.

3.92 The AIR 9000 OCD and FPS outlined a range of marinisation requirements, including a rotor brake, manual folding blades, the ability to operate on Landing Platform Amphibious ships and corrosion protection. However, there were gaps in the specification of marinisation requirements related to: automatic folding blades; and cargo hook compatibility with a Navy rigid cargo strop. Trials of the MRH90 manual folding blades initially identified difficulties and risks in installing the blade pins. In April 2014, Defence informed the ANAO that manual blade fold speed and efficiency had improved with increasing flight deck team experience. Another aspect of embarked operations is the conduct of vertical replenishment. The MRH90 cargo hook was found to be incompatible for use with a rigid strop when embarked, which would impede the MRH90 from conducting vertical replenishment operations with US and other coalition ships that use the rigid strop as standard load rigging equipment. In April 2014, Defence informed the ANAO that an MRH90 cargo hook redesign to accommodate a rigid strop was underway, and that an alternate vertical replenishment configuration has been authorised.

3.93 It is also notable that the MRH90 aircraft are not being fitted with a recovery, securing and traversing system, which would enable helicopter operations in wide ranging sea states from the RAN's frigates and destroyers, consistent with the operating intent of the aircraft. In correspondence on this issue, Defence informed the ANAO in June 2014 that the MRH90 aircraft is replacing the Sea King aircraft in the Maritime Support Role, and the Sea King performed this mission effectively without a recovery assist, securing and traverse system.

3.94 Crashworthiness of helicopters is particularly important, because they operate at greater risk of fatal accidents, when compared to fixed-wing aircraft. The risks are further heightened for military helicopters that operate in a challenging environment. At the time of development of the Phase 2 OCD and FPS and contract signature, the US Department of Defense military standard for crashworthiness of helicopters (MIL-STD-1290A) was inactive. The 2004 version of the Defence Airworthiness Requirements Design Manual did not specify any standard for crashworthiness, and instead included a brief overview of crashworthiness design principles, which could have been used as the basis for some high-level crashworthiness requirements for the multi-role helicopter capability. However, there were significant gaps in the specification of crashworthiness requirements in the Phase 2 OCD and FPS. In terms of aircraft design, the MRH90 is qualified to a 'modified' MIL-STD-1290A, which

the NH90 partner nations had agreed to prior to Defence being involved in the project. Defence informed the ANAO that it is not aware of any aircraft which currently meets the full untailored requirements of MIL-STD-1290A[233], and expressed comfort with the overall crashworthiness design features of the MRH90. During the course of the program, Defence has identified modification options to improve MRH90 crashworthiness, and the Chief of Army has sought approval from the Defence Aviation Authority for a range of temporary and permanent waivers relating to MRH90 crash protection design shortfalls.

233 Defence further informed the ANAO that all aircraft (including the MRH90) are required to meet, in full, myriad military and civilian standards for both crash protection and other airworthiness requirements, and that this activity is the focus of Design Acceptance activities.

4. MRH90 Acceptance and Sustainment

This chapter examines the progress made toward the MRH90 aircraft being accepted into operational service, from the perspective of compliance with design acceptance requirements, and the verification and validation of contractual compliance. The chapter also examines the MRH90 aircraft operational availability and sustainment.

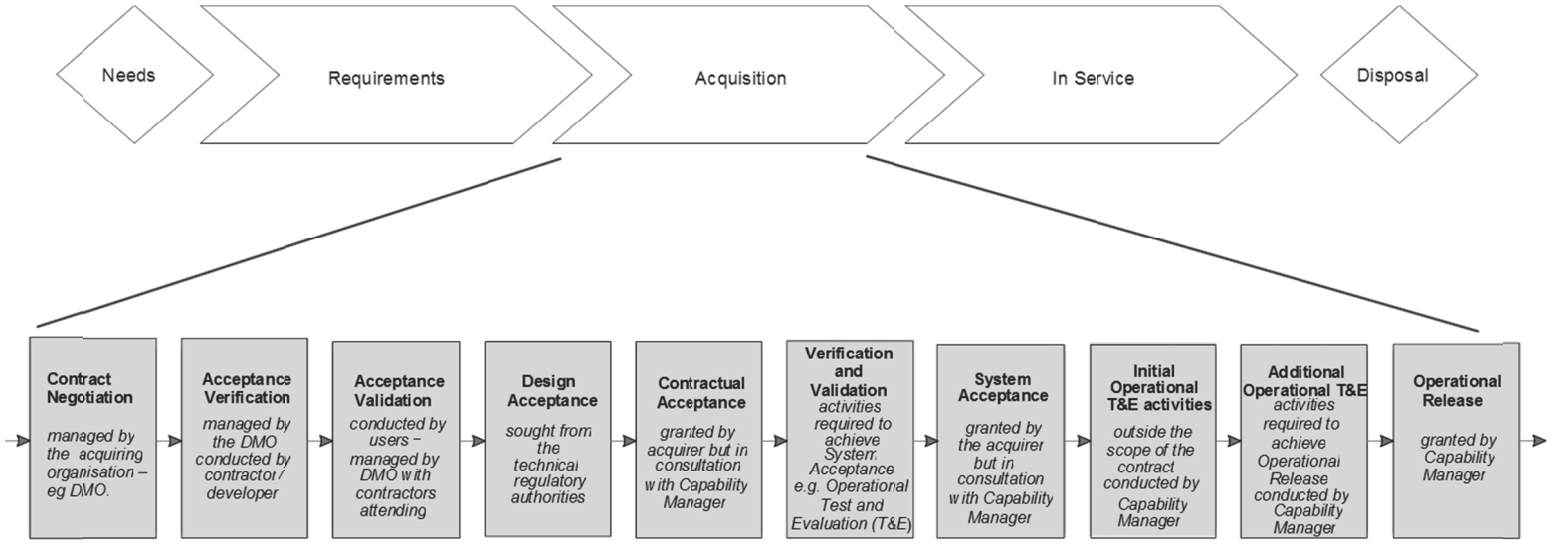
Introduction

4.1 The key activities and responsibilities leading to DMO System Acceptance are acknowledgment by the DMO project authority that an acquired system complies with contractual and Materiel Acquisition Agreement requirements, and that the system is ready to be transitioned to Operational Release. Operational Release is the acknowledgment by the relevant Capability Manager and Regulatory Authorities that the acquired system, complete with its support system, has proven effective and suitable for its intended role and that, in all respects, it is ready for Operational Service.

4.2 A critical point of agreement between the DMO and its contractors, and between the DMO, the Capability Manager and Regulatory Authorities, is to establish a test and evaluation program that verifies that products or systems offered for contractual acceptance comply with their contracted specifications. There needs to be proof that the specified end use of the system has been accomplished in its intended environment, and that sufficient sustainment arrangements are in place to enable the system to be accepted for Operational Release.

4.3 These key activities and responsibilities are outlined in Figure 4.1.

Figure 4.1: Activities and responsibilities during the system acquisition phase



Source: Defence Materiel Organisation, *Defence Verification and Validation Manual*, November 2008, p. 72.

Verification and validation of contractual compliance

4.4 DMO Project Office personnel are required to confirm that contractors offer for acceptance items that comply with contracted function and performance specifications, as well as other contractual requirements. To this end, during the design process, DMO personnel must monitor the interpretation and adherence to contracted requirements by the contractors. This is done to assist verification of the successful achievement of those requirements during the construction process[234], and also to validate that the intended end use of a product or system is accomplished in its intended environment.[235]

Managing compliance with requirements

4.5 Systems engineering standards and DMO system acquisition contracts involve the design and development of Mission Systems, and require contractors to produce a *Verification Cross Reference Matrix* (VRCM) that cross references the contracted requirements with the procedures by which compliance with those requirements are to be, or have been, verified.[236]

4.6 DMO Project Office personnel are required to review and, if it is acceptable, approve the VRCM, along with the underlying Acceptance Test Plans, Acceptance Test Procedures, and the eventual Acceptance Test Reports that yield the verification results. Project personnel are also required to witness

234 *Verification* is the confirmation by examination and provision of objective evidence [through test and evaluation procedures] that specified requirements to which a product or service, or aggregation of products and services, is built, coded, assembled and provided have been fulfilled. International Standards Organisation, ISO 9000:2006, *Quality Management System,* Fundamentals and Vocabulary. Defence Materiel Organisation, *DMO Acquisition and Sustainment Manual*, 2007, pp.74–75.

235 *Validation* is proof through evaluation of objective evidence that the specified intended end use of a product or system is accomplished in an intended environment. International Standards Organisation, ISO 9000:2006, *Quality Management System,* Fundamentals and Vocabulary.

DMO's verification and validation manual categorises verification and validation procedures into inspections, demonstrations, analysis, modeling and simulation, tests, system reviews, audits, defence trials, walkthroughs, experiments, red teaming, operational analysis and research and explosive ordnance proof. Defence Materiel Organisation, *Defence Materiel Verification and Validation Manual*, November 2008, pp.18–19 and 56–66.

236 VCRMs should provide complete traceability between each *Function and Performance Specification* and *Operational Concept Document* requirement, and derived requirement, and each corresponding test item, test procedure, and test report. Defence Materiel Organisation, *ASDEFCON (Strategic Materiel) Handbook*, March 2002, Part 3 Draft Statement of Work, Sect. 7.1.3. Since 2002, DMO has produced other versions of *ASDEFCON (SM)*, with the latest *ASDEFCON (SM) Handbook* being published in 2004.

acceptance tests conducted by the contractors.[237] Within the VRCM is a Contractor Statement of Compliance (CSOC) field. The DMO is required to make compliance findings against each of the contractor's compliance statements, in accordance with approved CSOC Review Procedures. In March 2014, the ANAO was informed by the MRH90 Program Office that it had used an estimated 92 400 man-hours making compliance findings with an estimated 26 300 remaining.

4.7 Table 4.1 provides the status of the MRH90 CSOC review process as at April 2014. It shows that some six and a half years after the planned In-Service Date (ISD) of 18 December 2007, contractor compliance with some 11 per cent of the MRH90 design requirements was yet to be accepted by DMO, or the requirements had been removed from the contract.

Table 4.1: Contractor Statement of Compliance, status as at April 2014

Category of requirements verification	Number of requirements in category	Verification status
Acceptable	494	Acceptable compliance demonstrated. Some of these requirements are the subject of Permanent or Temporary contractual waivers, granted via *Applications for Deviation* (known as Form SG2).
Under review	23	Compliance not yet fully assessed—CSOC or Application for Deviation under review.
CSOC rejected	22	CSOC found to be noncompliant. No Application for Deviation issued as Industry considers CSOC compliant.
Request for Deviation (Form SG2) rejected	1	CSOC compliance dependent on SG2 approval, which as at April 2014 had been rejected.
Not yet delivered	2	CSOC relates to capability not yet delivered.
Removed from contract	11	CSOC removed from the acquisition contract.

Source: Department of Defence, MRH90 Program Office.

Requirements non-conformance

4.8 Non-conformances are defined as failure of a supply to conform to the requirements of the acquisition contract, which may:

237 Defence Materiel Organisation, *Defence Materiel Verification and Validation Manual*, November 2008, p.74.

(a) be temporary or permanent;

(b) be approved or not approved; and

(c) arise from the design or production of the supply.

4.9 At as May 2013, the MRH90 Program Office had identified 35 requirements that the MRH90 design and construction had failed to achieve, for which non-conformance was accepted by the Commonwealth and waivers granted. These 35 requirements are the subject of the agreement DMO signed with Australian Aerospace on 9 May 2013 (Deed 2), which discharges Australian Aerospace and its contractors from all claims by the Commonwealth in relation to the requirements.

4.10 DMO agreed to grant waivers covering these 35 requirements as part of gaining agreement to changes in the sustainment contract, which aimed to achieve increased value for the money in MRH90 sustainment (see also paragraphs 1.50 to 1.52).[238] In April 2014, DMO informed the ANAO that there was appropriate engagement and consultation within Defence prior to reaching agreement to discharge the non-conformances, and that the stakeholders engaged or consulted included the Director General Aviation, the Chief of Army and the Chief of Navy. However, Defence subsequently informed the ANAO that the Navy has no evidence that consultation with the Chief of Navy took place.

Validation of MRH90 aircraft performance against the Statement of Operating Intent

4.11 Version 2.4 of the *MRH90 Statement of Operating Intent* (SOI) was developed for helicopters acquired under AIR 9000 Phase 2, and was approved by the ADF's Operational Airworthiness Authority on 25 May 2007. It describes the primary role of the MRH90 aircraft as Airmobile Operations, with secondary roles in battlefield support, support to Special Operations including Combat Search and Rescue, and Aeromedical Evacuation.

4.12 In 2012 Defence engaged Industry to compare the ADF's intended use of the MRH90 aircraft (including its operating environment), and the German

238 It was agreed that Australian Aerospace will have no further obligations or liabilities under the acquisition and sustainment contracts in relation to the rectification of the agreed non-conformances. However, for clarity, Australian Aerospace will continue to be required to manage any engineering, regulatory and certification consequences of the agreed non-conformances.

Army NH90 TTH Design Usage Spectrum. The comparison was based on the MRH90 SOI Version 2.4. The results of the comparison were reviewed and accepted by France's Defence Procurement Agency[239] and the DMO's MRH90 Program Office.

4.13 The ADF MRH90 aircraft configuration, intended role and usage environment was found to be less severe than the specified NH90 TTH Design Usage Spectrum, with some exceptions:

(a) MRH90 aircraft operations between 10 600 kg and 11 000 kg will require the application of an 11 tonne alternate gross weight procedure. This will consist of flight envelope limitations, and specific recording of flight hours and penalty factors against some component fatigue lives.

(b) The loads for landing during ship operations had not been tested on the NH90 TTH by the NATO Helicopter Management Agency (NAHEMA).[240] However, loads are more significant for maritime operations than for standard land-based operations, and thus penalty factors against some component fatigue lives are also required.

(c) Due to increased operations in higher temperatures in the ADF operating environment, MRH90 elastomeric lives may be reduced.[241]

(d) Specific MRH90 procedures are to be defined when the Environmental Control System and ventilation are not operational.

4.14 Version 2.4 of the MRH90 SOI was updated to Version 3.0 to include additional MRH90 roles. These include:

(a) up to 30 day deployments from the Landing Platform Amphibious (LPA) ships (HMAS *Manoora* and *Kanimbla*[242]), as part of the Phase 2 acquisition scope;

(b) an increased role in Airmobile support for Special Operations, as part of the Phase 4 acquisition scope; and

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239 Direction générale de l'armement (DGA).

240 The NATO Helicopter Management Agency (NAHEMA) is a subsidiary body of the North Atlantic Treaty Organisation (NATO), which manages the NH90 program on behalf of the 13 NAHEMA nations. These nations have placed orders for NH90 and NFH90 helicopters, and they include: Australia, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, New Zealand, Norway, Oman, Spain and Sweden.

241 An elastomer is a rubbery substance often used as seals, adhesives and molded flexible parts.

242 These ships were decommissioned in 2011.

(c) up to 6 month deployments from LPAs, and the future Auxiliary Oiler Replenisher (AOR) and Landing Helicopter Deck (LHD) vessels (HMAS *Canberra* and HMAS *Adelaide*), and support for operations from the RAN's air capable ships (Adelaide-class FFGs, ANZAC-class FFHs, and HMAS *Sirius*), as part of the Phase 6 acquisition scope.

4.15 Industry also compared the MRH90 SOI Version 3.0 and the NH90 TTH Design Usage Spectrum. This assessment found that the two usage spectrums are broadly similar. However, the intended usage outlined in the MRH90 SOI Version 3.0 was found to be more damaging during operations involving alternate gross weight and Nap-of-the-Earth flying, and some higher altitude profiles.

4.16 Australian Aerospace informed the ANAO that the MRH90 SOI Version 3.0 is not reflected in contractual arrangements, and that it is instead contracted to provide design approval certification for an MRH90 design baseline that is consistent with operational intentions stated in SOI Version 2.4. As a consequence, further costed work is required to certify the design baseline that is consistent with SOI Version 3.0.

4.17 At the time of the audit, there was an Airworthiness Issue Paper[243] that addressed concerns about MRH90 structural and mechanical fatigue. The planned MRH90 aircraft usage has led to reassessments of some MRH90 component service lives, including possible earlier fatigue induced damage than would be the case in operations within the NH90 TTH Design Usage Spectrum. The ADF's Director General Technical Airworthiness (DGTA) informed the responsible Airworthiness Board[244] that he had instigated a review of the MRH90 aircraft longer-term management strategy to ensure steps were taken that would avoid potentially crippling component retirement times, or undue resource impacts. The overall intent is to capture and manage fatigue–life limitations through cost-efficient and effective processes detailed in the approved MRH90 Aircraft Structural Integrity Management Plan.

243 Airworthiness Issue Papers are discussed from paragraph 4.22.

244 Defence Airworthiness Boards are responsible for providing independent review and for making recommendations on the airworthiness management of Defence aviation assets in service, the introduction into service of aviation assets and major modifications of these assets. Airworthiness Board members are retired star ranked officers from all three Services, with extensive operations and engineering experience in Defence aviation. Each Airworthiness Board consists of one operations and one engineering member.

Technical Airworthiness Regulations compliance

4.18 Airworthiness involves the management of aircraft design and maintenance under Technical Airworthiness Regulations, and an Operational Airworthiness component that covers all aspects of flight management, including safety.

4.19 The ADF's Technical Airworthiness Regulations set out the Australian Military Type Certificate (AMTC)[245] and Service Release[246] process. The purpose of this process is to assure the safety of ADF aircraft in all their intended roles.[247] At Type Certification, the aircraft or Aeronautical Product is deemed by the certifying authority to comply with regulations in respect of design and manufacture at that time. Type Certification recommendations are made by the responsible Airworthiness Board to the Defence Aviation Authority (the Chief of Air Force).[248] At this stage, DGTA must be satisfied that the aircraft's Design Acceptance has been completed in accordance with the Technical Airworthiness Regulations, and that all airworthiness issues have been satisfactorily resolved or are being managed through DGTA approved Issue Papers (see also paragraph 4.22).

4.20 At the planned In-Service Date of 18 December 2007, DMO had not completed 17 specified MRH90 Production Test and Evaluation procedures. Consequently, the first two MRH90 aircraft were accepted by DMO with a number of known and agreed deviations to contracted specifications, as annotated in each aircraft's *Supplies Acceptance Certificate* (known as Form SG1) or in *Applications for Deviation* (known as Form SG2). The ongoing delivery of

245 An AMTC is awarded to certify that the design of the aircraft is compliant with the approved Certification Basis Description, and incorporates all proposed management solutions to any departures from the approved Certification Basis Description. AMTC is therefore the military equivalent of the civil Type Certificate required for all aircraft registrations in Australia. An AMTC is awarded by the Defence Aviation Authority (the Chief of Air Force), on the recommendation of the responsible Airworthiness Board. It is the certification required before normal flight operations, with appropriate limitations, can commence.

246 Service Release is the process of permitting the actual in-service use of ADF aircraft. It requires that all engineering, logistics and operational issues are resolved, or alternatively approved processes are in place to resolve outstanding issues.

247 While the ADF is self-regulating with regard to airworthiness, it is implicit under the International Civil Aviation Organisation regulations, and Australia's *Civil Aviation Act 1988*, that the ADF Airworthiness Regulatory System should be no less rigorous than the civil system.

248 The Chief of Air Force is the Defence Aviation Authority, and in that role he is responsible for the authorisation, development, implementation and audit of a joint Airworthiness Regulatory System (covering the Navy, Army and Air Force), which includes ADF aircraft Type Certification and continuing airworthiness management.

MRH90 aircraft that did not comply with contracted specifications resulted in a 53 month delay in the achievement of AMTC and Service Release.

4.21 Table 4.2 lists the MRH90 Program's milestones leading to AMTC and Service Release. It also lists the 11 Special Flight Permits (SFPs)[249], issued by the Chief of Air Force, which authorised the scope of flying activity prior to AMTC and Service Release being granted. AMTC and Service Release are not issued until aircraft design issues and sustainment limitations identified during Special Flight Permit periods, and assessed by the responsible Airworthiness Board, are resolved to the satisfaction of the Defence Aviation Authority (the Chief of Air Force). The last cell in Table 4.2 shows that the MRH90 aircraft experienced a delay of 53 months before obtaining AMTC and Service Release in April 2013, rather than in December 2008 as originally planned.

Table 4.2: Milestones leading to MRH90 Australian Military Type Certificate and Service Release

Milestone	Date planned	Date achieved
MRH90 Preliminary Design Review	January 2006	November 2005
MRH90 Detailed Design Review	May 2006	March 2006
MRH90 Test Readiness Review	July 2006	December 2006
MRH90 Design Acceptance and Service Release Review	Not available	September 2007
MRH90 Product Baseline 1 (PBL1) design completed	December 2007	7 December 2007
Special Flight Permit (SFP) 001/2007 – The initial SFP enabled State Registered Flying Operations to commence in Australia. It permitted Visual Flight Rules/Visual Meteorological Conditions flight with an Original Equipment Manufacturer (OEM) trained Qualified Test Pilot or Qualified Flight Instructor acting as Pilot In Command.	October 2007	11 December 2007
Two MRH90 aircraft (A40-002 and A40-003) accepted and registered as State Aircraft	Not specified	14 December 2007
MRH90 In-Service Date (ISD)	December 2007	18 December 2007

249 Special Flight Permits authorise ADF and Contractor aircrew to operate the ADF aircraft to undertake an In-Service Date demonstration and production acceptance flights, in-country flight tests, and initial instructor training flights. There are 80 Contractor Statement of Compliances (CSOCs) which are critical to flight safety and need to be accepted to meet the scope of flying activity for the Special Flight Permits period.

Milestone	Date planned	Date achieved
SFP 003/2008 – A time extension of SFP 001/2007 that did not expand the scope detailed above.	Not planned—AMTC/ Service Release was scheduled to be granted in December 2008	23 June 2008
SFP 001/2009 – This SFP introduced Phases 2 and 3 of MRH90 operations. Phase 2 is Instrument Flight Rules flight and Phase 3 is flight training of Non-Type Qualified aircrew by ADF Aircrew.	Not planned	18 April 2009
SFP 004/2009 – This SFP was issued to enable the commencement of Phase 4 activities, which included MRH90 type conversion of Aircrewmen.	Not planned	10 August 2009
SFP 007/2009 – This SFP was issued to enable the carriage of passengers other than aircrew or MRH90 tradesmen. It also permitted ADF personnel, who in the course of their duties, have a legitimate requirement to fly in an MRH90 aircraft.	Not planned	23 February 2010
SFP 001/2011 – Expansion of SFP scope to cover initial Operational Test and Evaluation.	Not planned	20 February 2011
SFP 013/2011 MRH90 Product Baseline 3 (PBL 3) approved	Not planned	13 December 2011
SFP 013/2011 MRH90 PBL3 Instrument Flight Rules operations approved	Not planned	13 December 2011
SFP 013/2011 Ship operations, collective training and Operational Test and Evaluation approved	Not planned	14 June 2012
SFP 013/2011 Land-based Operational Test and Evaluation approved	Not planned	27 July 2012
SFP 013/2011 – Annual review of SFP and extension for a further 12 months	Not planned	07 December 2012
Australian Military Type Certification and Service Release	December 2008	17 April 2013

Source: Department of Defence.

MRH90 Airworthiness Issue Papers

4.22 The MRH90 fleet has been the subject of Airworthiness Issue Papers, which are used to ensure visibility of all airworthiness issues judged by the Project Office, DGTA or the Operational Airworthiness Authority as significant enough to warrant recording of their resolution in the Certification Basis

Description. Each Issue Paper enables all information relating to a particular airworthiness issue to be recorded in a single document.[250]

4.23 By November 2011, there were 25 MRH90 Airworthiness Issue Papers under consideration, and another six in draft form. The Airworthiness Board noted at the time that significant analysis and activity had been formally documented in the Issue Papers. It also considered that progressing many of the papers to closure prior to AMTC and Service Release could still be a significant task.

4.24 In November 2011, DGTA noted that other workload pressures would likely prevent DGTA staff from being able to assess many of the MRH90 Airworthiness Issue Papers prior to the meeting of the Airworthiness Board in the second quarter of 2012. Further, the MRH90 Design Acceptance Representative noted that clearance of Issue Papers was a significant risk to a second quarter 2012 AMTC and Service Release. The ADF's Operational Airworthiness Regulator also acknowledged that progressing to AMTC and Service Release with a number of limitations was undesirable.

4.25 By the time of the Airworthiness Board meeting in April 2013, 16 MRH90 Issue Papers had been closed and nine remained open. These nine were reported to generally relate to longer-term corrective actions and, with mitigations in place, did not preclude a recommendation for AMTC and Service Release.

4.26 The MRH90 aircraft achieved AMTC and Service Release on 17 April 2013. The aircraft appear in the ADF's State Aircraft register as the A40 MRH90 Taipan, with each aircraft having a unique tail number. At the same time, Service Release was granted with the following three limitations:

- use of the Heavy Stores Carrier and the External Aircraft Fuel Tank is prohibited;
- night formation flying is prohibited; and
- use of the Chaff and Flares Dispenser is prohibited.

250 The concept of an ADF Airworthiness Issue Paper was derived from the US Federal Aviation Administration's (FAA's) use of Issue Papers. The FAA suggests that Issue Papers '… provide a simple means for describing and tracking the resolution of significant technical, regulatory, and administrative issues that occur during the certification process [and] establishes a formal communication for dialogue of significant issues between the applicant and the FAA'. Australian Air Publication 7001.053(AM1) *Technical Airworthiness Management Manual*, October 2010, Annex H to Section 3 Chapter 12.

Structural Integrity Management

4.27 As part of the acquisition contract Australian Aerospace was required to provide an *Aircraft Structural Integrity Documentation Package* (ASIDP)[251] and a *Composite Materials Design Information Package* (CMDIP).[252] Under the contract, the draft ASIDP and CMDIP were to be delivered 20 days before the Test Readiness Review and the final packages 20 days before the Design Acceptance and Service Release Review.

4.28 Versions of the ASIDP and CMDIP were delivered by Australian Aerospace to the MRH Program Office in accordance with the above timeframe. However, these documents were rejected because Australian Aerospace declined to provide contractually compliant documents, due to Intellectual Property reasons.

4.29 The Deed 2 negotiations enabled the MRH Program Office to pursue these outstanding documents with Australian Aerospace. Under Deed 2 the contract had been amended so that Milestone 180 (acceptance of the 30th aircraft) includes approval of the ASIDP and CMDIP. At the time of this audit, the milestone date was 13 October 2014, with delivery of the ASIDP and CMDIP to occur 30 days prior to this. However, these documents are important inputs for earlier technical risk assessments and technical regulatory processes.[253]

4.30 Defence informed the ANAO that Structural Integrity can be adequately managed by engaging the Original Equipment Manufacturer without the need for the Commonwealth to hold a detailed *ASIDP*. This

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251 The *Aircraft Structural Integrity Documentation Package* (ASIDP) is a detailed summary of structural type design data that will be used by the Commonwealth to support the MRH90 aircraft once it is in aircraft service. It provides detailed design information relating to ADF unique structural modifications to the baseline NH90 aircraft. It also provides rapid visibility of important structural characteristics, limitations and capabilities of the aircraft. The ASIDP also documents the results of the Structural Verification Program, conducted in accordance with the *Structural Verification Plan* and the *Health and Usage Monitoring System Verification Plan*. The contractor must provide a sufficient level of detail to enable the Commonwealth to rapidly and easily determine and make decisions regarding the capabilities and limitations of the certified structural design of the MRH90 aircraft, including diagrams to facilitate understanding as necessary.

252 The *Composite Materials Design Information Package* (CMDIP) contains the design information and production build quality records of the composite materials and adhesively bonded applications in the MRH90. The CMDIP will be used to support the MRH Aircraft Structural Integrity Program (ASIP) as described in the ASIDP.

253 The basic NH90 structural design was largely complete by December 1995. It is therefore difficult to understand why these documents were not available in the early 2000s when AIR 9000 Phase 2 options were being considered. The documents were also not available for consideration in relation to Special Flight Permits or Service Release under an Australian Military Type Certificate.

process has involved the issuing of an Airworthiness Issue Paper (AWIP) and Technical Airworthiness Authority and Operational Airworthiness Authority endorsement of the paper.[254]

Fleet flight hours

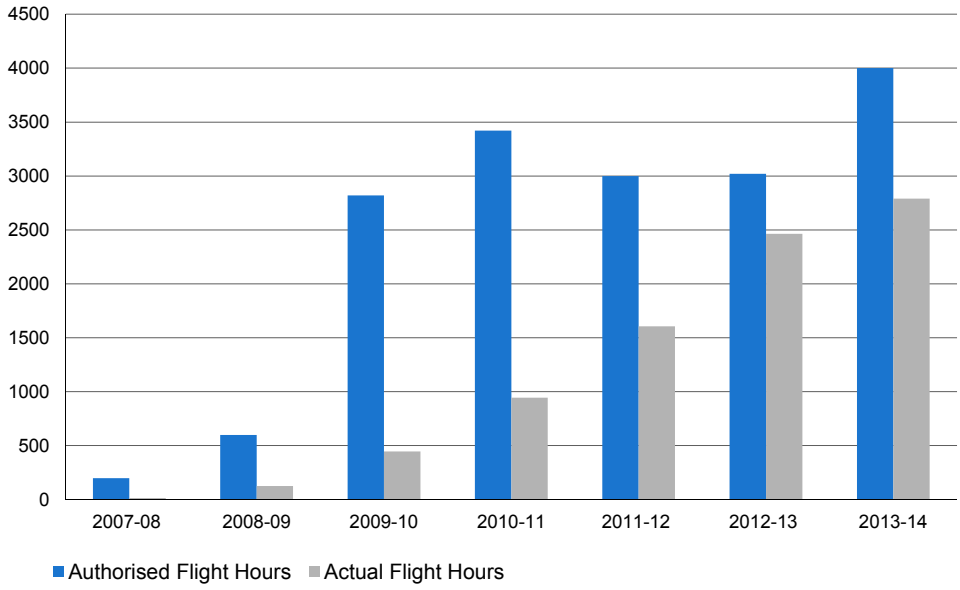
4.31 The system used by the ADF to allocate flight hours seeks to achieve agreed levels of military capability, to reduce resource costs to the minimum amount required to achieve those levels, and to ensure that aircraft reach their Planned Withdrawal Date. In determining authorised annual flight hour allocations, the ADF considers the required total flight hours, as well as the types of flying and the appropriate utilisation of capability development and sustainment resources.

4.32 The contracted number of flight hours for the mature MRH90 fleet of 47 aircraft is 10 300 hours per year, which is an average of 220 hours per aircraft per year, or 4.2 hours per week. The MRH90 sustainment system has been designed to surge above 10 300 hours per year (potentially to 12 500 hours) to support contingency operations, but this is not expected to be supportable on a sustained basis.

4.33 Figure 4.2 shows that, for the period July 2007 to April 2014, the MRH90 fleet's actual flight hours consistently fell short of Army and Navy authorised flight hours. The shortfall was a result of delays in the delivery of MRH90 aircraft, MRH90 aircraft being offered to DMO for acceptance when only partially compliant with their acceptance criteria, and a complex mix of sustainment shortfalls discussed later in this chapter.

254 MRH90 aircraft Airworthiness Issue Papers are discussed further in paragraphs 4.22 to 4.25.

Figure 4.2: Fleet flight hours, July 2007 to April 2014

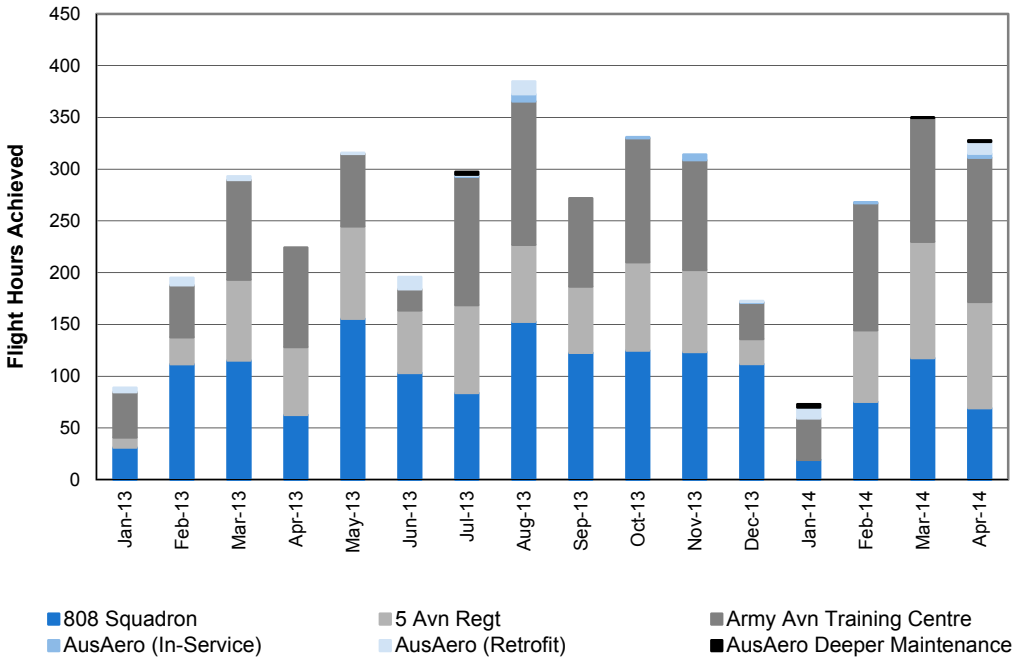


Source: Australian Aerospace, May 2014.

Note: The 2013–14 Actual Flight Hours is for the ten month period July to April 2014, whereas Authorised Flight Hours for 2013–14 is presented on a full financial year basis.

4.34 Figure 4.3 shows the flight hours achieved by the different groups operating the MRH90 fleet, between January 2013 and April 2014. The Australian Aerospace Brisbane amounts relate to contract test flights conducted as part of post-production, upgrades and Deeper Maintenance handovers. The Army Aviation Training Centre amounts are entered into the ADF's aircraft management system by Australian Aerospace, and they show the amount of MRH90 aircraft flying time used for pilot and crew training at the training centre.

Figure 4.3: Fleet flight hours per month, January 2013 to April 2014



Source: Australian Aerospace, May 2014.

4.35 A consequence of the reduced MRH90 flight hours, and the withdrawal from service of the RAN's six Sea Kings in December 2011, has been the need for Navy to use its anti-submarine S-70B-2 Seahawk helicopters in utility helicopter roles. On these occasions, the Seahawk helicopters have not been available to conduct crew training exercises aligned to their core military role. The reduced flight hours of the MRH90 aircraft have also constrained Navy helicopter pilot flight training, as well as Navy's ability to develop the MRH90 capability to the extent necessary to achieve the Maritime Support Operational Capability milestones. Navy's criteria for these milestones include having an MRH90 aircraft deployed at sea. At the time of the audit, the first of three Maritime Support milestones was scheduled to be achieved in April 2014, which is 45 months later than the original plan.

4.36 In response to the reduced MRH90 aircraft flight hours, the Army has retained its 34 S-70A-9 Black Hawk helicopters in operational service longer than originally planned. The Army Black Hawk fleet withdrawal from service was to commence in January 2011 and be completed by December 2013. In April 2014, Defence informed the ANAO that the Black Hawk fleet's withdrawal from service commenced in January 2014 and is now scheduled to

be completed by June 2018. Defence further informed the ANAO that the budgeted cost of this Black Hawk fleet service life extension is $311 million.

4.37 The reduced MRH90 aircraft flight hours has also constrained Army helicopter pilot flight training and contributed to delays in the achievement of the Army's MRH90 Operational Capability milestones.

4.38 In April 2014, the Chief of Army redefined the first Operational Capability milestone for the Army MRH90 aircraft to a limited capability subset involving a low-threat environment and no combat capability. This redefined milestone is scheduled to be achieved in July 2014, 39 months later than the original Operational Capability plan, with a second Operational Capability milestone covering Army's first Airmobile capability (a high-threat combat capability) now scheduled for September 2014, 41 months later than the original Operational Capability plan.

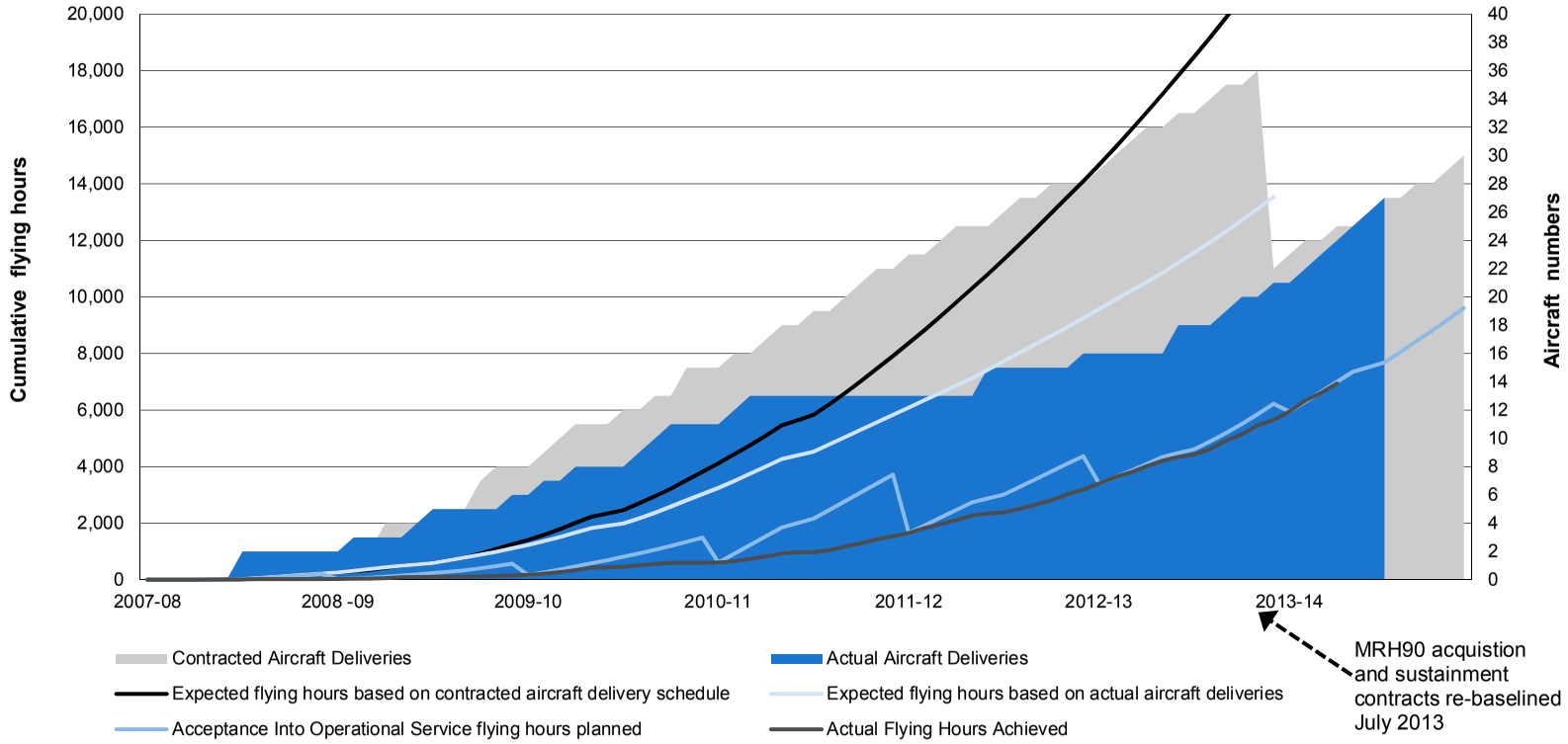
Planning Acceptance into Operational Service

4.39 The '*Capability realisation plan for acceptance into operational service of multirole helicopters*', titled Plan Pegasus, was first developed in 2003. Its objectives are to:

- plan the effective Acceptance Into Operational Service (AIOS), through-life support and capability management of the MRH90 systems;
- identify Army and Navy responsibilities for AIOS of the MRH90 aircraft;
- guide development of the Airmobile Operations and Maritime Support Helicopter capabilities, including consolidation of the amphibious aviation capability for both combined arms and joint forces, and the provision of focused aviation support to Special Operations; and
- inform the planning for ADF operational capability levels and the associated withdrawal of the Black Hawk and Sea King systems.

4.40 Figure 4.4 shows that the Army MRH90 fleet's actual flight hours have been falling below the number of hours planned for AIOS purposes. Since 2003, planned AIOS flight hours have been reduced annually in line with the trend in actual flight hours achievable, due to immaturity in the MRH90 design and support system.

Figure 4.4: Defence flight hour planning



Source: Department of Defence, Director Air Capability Management – Army.

Sustainment arrangements

4.41 DMO Systems Program Offices (SPOs) generally oversee sustainment activities for specialist military equipment. The SPOs manage the delivery of products and services through a variety of outsourced commercial contracts. In general terms, SPOs are responsible for:

- ensuring acquisition and logistics program integrity in terms of consistency with performance specifications, coherence with infrastructure planning and with other programs, and conformance with corporate, technical and specialist standards;
- ensuring deliveries of new products or services meet requirements in terms of contracted performance, cost and schedule;
- managing risks to the program's successful outcome;
- initiating management interventions wherever gaps in the program are identified or issues arise; and
- reporting progress of the program at regular intervals to the program's sponsor, Governance Board and DMO Senior Executives.

4.42 DMO has overarching responsibility for establishing the sustainment arrangements needed for the ADF to operate the MRH90 fleet. The sustainment arrangements adopted by DMO involve a long-term contract with Australian Aerospace, which was extended by two years in July 2013 and now has an end date of July 2019.[255]

4.43 Australian Aerospace has been engaged under the MRH90 sustainment contract to undertake the majority of maintenance and logistics support management tasks that are normally the responsibility of a DMO SPO. The responsibilities of Australian Aerospace include management of sustainment activities, fleet maintenance planning, engineering services, supply support services and maintenance services. Under the sustainment arrangements, Defence personnel in DMO's MRH90 Logistics Management Unit (LMU)[256] in Brisbane retain responsibility for governance of outcomes, are responsible for

255 The sustainment contract was also extended to align with the end of the current Tiger Armed Reconnaissance Helicopter (ARH) sustainment contract, with the intention to negotiate a single more efficient and effective contract for ongoing support to both the ARH and MRH.

256 At the time of the audit, the MRH90 LMU was merging with the ARH LMU to form the Reconnaissance and Mobility SPO.

MRH90 design acceptance, and verify and approve the payment of sustainment contract invoices received from Australian Aerospace. These personnel monitor the overall serviceability and configuration status of the MRH90 fleet.

4.44 This outsourced SPO model was intended to create efficiencies in the delivery of SPO services to Navy and Army, and to significantly reduce the number of military and public service employees engaged in the support of the MRH90 fleet. Within the arrangement, Australian Aerospace is required to act on behalf of the Commonwealth, including fulfilling the role of Authorised Engineering Organisation (AEO) and Approved Maintenance Organisation (AMO)[257], managing the logistics supply chain and sub-contractors, and identifying opportunities to improve MRH90 fleet performance and reduce its cost of ownership.

4.45 The sustainment arrangements for Tiger Armed Reconnaissance Helicopters (ARH) also involve the outsourcing of core SPO functions to Australian Aerospace. However, Defence Senior Commanders have raised concerns about the impact of the outsourced arrangements on sustainment services for both the ARH and MRH90 fleets. In August 2010, Commander 16th Aviation Brigade informed the Chief of Army that: there was not a sound logistics support arrangement for the ARH and MRH fleets; Defence had outsourced some core business with corresponding loss of control; and this had resulted in underperforming Repair Part/Repairable Item supply chains and prolonged delays in engineering solutions, which adversely affected flying rate of effort. Commander 16th Aviation Brigade also noted that the sub-contracting of functions by Australian Aerospace had created a complex and unreliable matrix of acquisition and sustainment support.

4.46 Australian Aerospace provides day-to-day logistics support services to DMO, as well as the Army and Navy units that operate MRH90 aircraft. It is also responsible for ensuring that demands placed by MRH90 Operational Maintenance personnel for Repairable Items and Breakdown Spares[258] are

257 As indicated in paragraph 1.12, two other maintenance organisations have been formally accredited by DGTA as AMOs for the MRH90 aircraft: Army's 5th Aviation Regiment in Townsville; and Navy's 808 Squadron in Nowra.

258 Repairable Items are all of those items whose resupply normally centres on maintenance processes formally authorised by the ADF to be carried out at authorised venues. Breakdown Spares are sometimes referred to as Non-Repairable Items or Consumables.

satisfied within priority timeframes.[259] Australian Aerospace is also contracted to provide a logistics support performance measurement system, to systematically gather statistics on the support of all significant MRH90 subsystems, such as engines, hydraulics and structures. The system seeks to identify logistics support performance trends and to predict future performance outcomes.

4.47 Australian Aerospace is a wholly owned subsidiary of Eurocopter[260] and so is responsible to its parent company to meet financial objectives and represent the interests of the parent company in Australia. Australian Aerospace is therefore under contract to deliver efficient and effective support to Defence while also having responsibility to its parent company, to maintain profitability and represent the interests of the parent. The experience of the MRH90 Program to date, including the high cost of sustaining the aircraft[261], highlights the potential for tensions to arise in the pursuit of these differing objectives. It also highlights the primary importance of a robust performance measurement regime to drive value for money and provide sufficient oversight of outsourced arrangements.

Sustainment contract amendments

4.48 DMO and Australian Aerospace negotiated amendments to the MRH90 sustainment contract through Deed 2, which took effect on 1 July 2013. These amendments seek to strengthen the sustainment performance management regime, by incorporating new performance measures, financial incentives and remedies into the contract, which are aimed at reducing the MRH90 total cost of ownership throughout the Life-of-Type, and increasing the number of serviceable MRH90 aircraft. Under the amendments, Australian Aerospace is required to develop a Remediation Plan that addresses contract underperformance in both the delivery and sustainment of the MRH90 aircraft. At the time of the audit, the Remediation Plan was yet to be completed by Australian Aerospace and approved by DMO. The Remediation Plan is to contain financial remedies to address unsatisfactory performance against the plan.

259 Spares demands are deemed to be satisfied if deliveries are made within specified priority durations, which are typically 24 hours, 5 days, 10 days or 48 days.

260 Now Airbus Helicopters.

261 MRH90 fleet sustainment costs are discussed from paragraph 4.75.

4.49 The revised performance management regime has introduced financial incentives to improve MRH90 aircraft serviceability rates. The regime involves a Repair By the Hour Sustainment Scheme, whereby Australian Aerospace will be paid a minimum monthly floor price, regardless of the number of hours flown by the MRH90 fleet, and a fixed amount per MRH90 aircraft flight hour. The price paid covers the cost of all Breakdown Spares and Repairable Items, except for the engines.

4.50 The performance management regime also involves a Quarterly Performance Management Fee based on a number of Key Performance Indicators (KPIs), which the Commonwealth has unilateral measurement rights over to avoid disputes relating to the measurement techniques. The primary KPI for MRH90 capability is the number of serviceable MRH90 aircraft, which is defined as aircraft (including applicable Role Equipment) that:

(a) are able to be flown on the day of measurement with all such systems (including applicable Role Equipment) as are necessary to enable the planned mission to be accomplished; or

(b) if no missions are planned for that aircraft on that day, then whether an aircraft is serviceable, and that will be determined by the Commonwealth in its discretion.

4.51 In April 2014, Defence informed the ANAO that:

> The new sustainment contract has significant remedies and a pricing structure that results in improved sustainment services and reduced payments. The old contract was uncapped and was not linked to performance. …
>
> Repair By the Hour Sustainment (RBHS) payment provisions mean that for every hour not flown under the contracted level of flying the Commonwealth does not have to pay. At the end of the third quarter post the Deed 2 effective date, the level of RBHS funds not expended was $9.6M less than the contracted level of funding.
>
> Additionally, because of under-performance against the contract KPIs, the contractor has forfeited $1.5M in the first three quarters. Also, because the contractor has under-performed in their administrative responsibilities (mostly related to planning and scheduling), the contractor has forfeited an additional $1.5M in the first three quarters. Further, the Commonwealth is receiving the benefits of additional services not covered by the old sustainment contract including but not limited to: improved technical data access (including on-site [Eurocopter] engineer), improved access to financial information,

implementation of additional Deeper Maintenance Services, and implementation of a continuous improvement program (including two additional efficiency managers).

4.52 The contract amendments included an obligation that Australian Aerospace will supply products and services at the NAHEMA[262] pricing plus nine per cent for spare parts and 12 per cent for other material purchases. The other countries that benefit from this pricing arrangement are Germany, France, Italy, Netherlands, Belgium and Portugal.

4.53 As previously discussed, the sustainment contract amendments are a part of DMO's decision to settle a claim for Liquidated Damages and common law damages with Australian Aerospace. The two-year extension to the MRH90 sustainment contract, together with other sustainment contract provisions gained through the Deed 2 negotiations, will cost the Commonwealth A$526.528 million, which is programmed for payment between July 2017 and June 2020.

4.54 The analysis in the remainder of this chapter draws upon a sample of data sets used to manage MRH90 fleet sustainment. It should be noted that the pre-July 2013 data shown in the following figures was used by DMO, amongst other things, as the basis for negotiating the amendments to the sustainment contract. In April 2014, Defence informed the ANAO that it will take at least a year and possibly longer, for the post-July 2013 sustainment data to show an improving trend.

Aircraft maintenance and serviceability

4.55 MRH90 aircraft are provided with two levels of maintenance, known as Deeper Maintenance and Operational Maintenance. The primary aim of Deeper Maintenance is to make aircraft available to be made fully serviceable by Operational Maintenance personnel. Deeper Maintenance involves structural inspections and repairs, and the overhaul, repair, calibration, testing and alignment of Repairable Items and aircraft systems. It includes the conduct of scheduled and unscheduled maintenance, and repairs unable to be conducted by Operational Maintenance personnel. For example, maintenance activities requiring the use of specialised facilities, test and repair equipment,

262 Refer to footnote 240.

and the availability of personnel with specialised engineering and technical skills.

4.56 The primary aim of Operational Maintenance is to make aircraft fully serviceable to the level of their achieved Operational Capability. Operational Maintenance tasks are predominantly carried out on the flight lines[263], but may involve the limited use of workshop facilities. Operational Maintenance includes servicing and fault diagnosis, and aircraft condition inspections and defect repairs via Repairable Item replacement.

MRH90 unavailable, available and serviceable aircraft

4.57 All aircraft undergoing Deeper Maintenance are classified as unavailable. When an aircraft has been released from Deeper Maintenance into operational service, it is classified as being 'available' to be made 'serviceable' by Army or Navy's Operational Maintenance units. Serviceable aircraft are those aircraft signed-off by the AMO's Senior Maintenance Manager delegate as being serviceable for flying operations.

4.58 Some serviceable aircraft may include aircraft authorised for release for flying operations through the Carried Forward Unserviceability (CFU) process. This process allows operational availability demands to be satisfied and maintenance efficiency to be increased by postponing some maintenance activity, provided that technical and operational airworthiness is maintained. For the period September to November 2013, the number of MRH90 CFUs issued at Army's 5th Aviation Regiment averaged 14 CFUs per aircraft. The high number of CFUs is a consequence of supply chain issues, including delays in the supply of maintenance related technical advice.

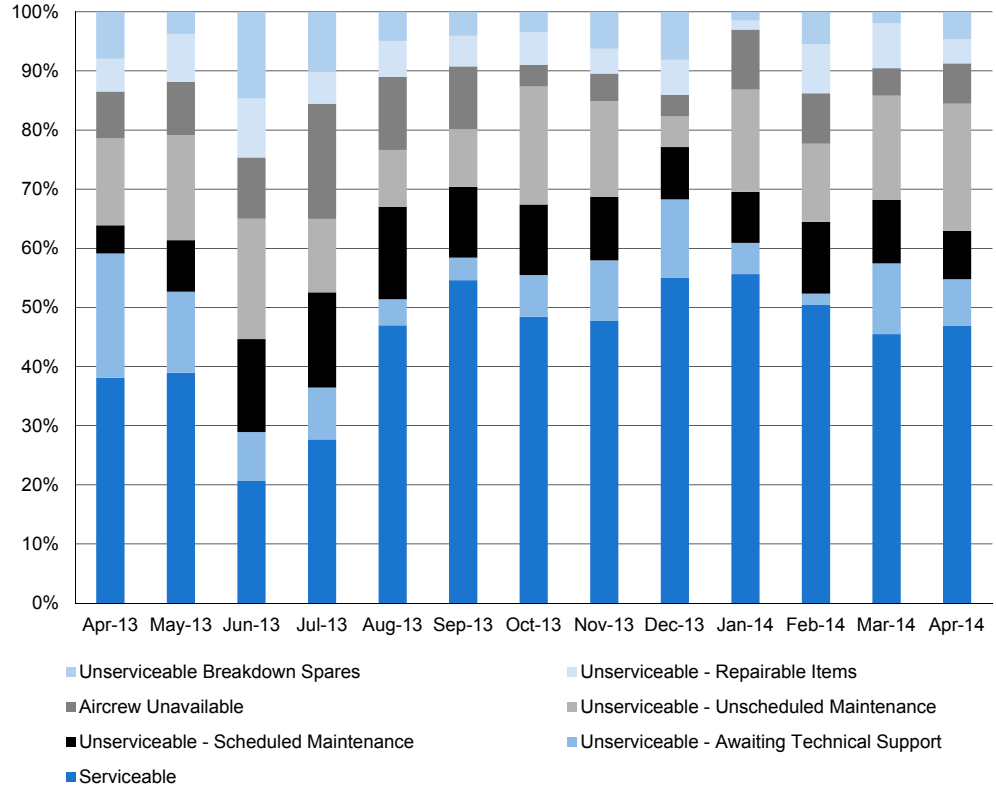
4.59 In April 2014, Defence informed the ANAO that:

> The number of CFUs is reducing, down to 12 CFUs per aircraft in April 14 from 14 CFUs per aircraft in November 13. The number of CFUs under management is related to developing maturity in the logistics support arrangements (engineering supply and technical services) and, as alluded to in the report the objective of achieving high availability and efficiency in maintenance with a small fleet as the MRH90 is introduced to service. The number of CFUs is not considered excessive from an airworthiness (safety) perspective.

263 A flight line is an area of an airfield or airport on which aircraft, especially military aircraft, are parked and serviced.

4.60 Figure 4.5 shows the percentage of time the MRH90 aircraft were serviceable and unserviceable, during the period April 2013 to April 2014. For that period, the average percentage of aircraft serviceable in the MRH90 fleet was 47.6 per cent.[264] The sustainment contract's performance target for serviceable MRH90 aircraft is 65 per cent.

Figure 4.5: Percentage of serviceable MRH90 aircraft, and reasons for unserviceability, April 2013 to April 2014



Source: Australian Aerospace, May 2014.

4.61 MRH90 aircraft may be unserviceable for one of the following reasons:

- *Aircraft awaiting engineering advice* (technical support). These aircraft require engineering determinations regarding serviceability issues such as CFUs or responses to Engineering Advice Requests.[265] Defence

264 The worldwide serviceability of the NH90 was 38 per cent, averaged over the year to November 2013.
265 Engineering Advice Requests are also known as Technical Information Requests.

informed the ANAO that improvements in the *MRH90 Interactive Electronic Technical Manual* provided to Operational Maintenance personnel are expected to result in reduced numbers of Engineering Advice Requests. Further, it is anticipated that Australian Aerospace's ability to fully resolve Engineering Advice Requests will be supported by the formation of Integrated Product Teams accountable for timely responses, and that this will lead to reductions in unserviceable aircraft rates. Aircraft awaiting engineering advice contributed 7.3 per cent on average toward MRH90 aircraft unserviceability during the three months to the end of April 2104.

- *Aircraft Missing Parts*. These aircraft are awaiting Repairable Item or Breakdown Spare replacements. The duration that they remain unserviceable is a function of stores Demand Satisfaction Rate (DSRs). The DSR is the 'number of demands satisfied in full on time as a percentage of total demands submitted, weighted by reference to priority of demand'.[266] At the time of the audit, the DSR for MRH90 Repairable Item and Breakdown Spares was averaging around 80 per cent, compared to the greater than 90 per cent target within the Australian Aerospace sustainment contract. Missing parts contributed 10.6 per cent on average toward MRH90 aircraft unserviceability during the three months to the end of April 2014.
- *Scheduled Maintenance* includes maintenance activities specified within the platform's Technical Maintenance Plan to be conducted by Operational or Deeper Maintenance personnel. The first MRH90 Deeper Maintenance service was conducted by Australian Aerospace between July and October 2013. Of the 3041 separated maintenance actions (arisings) carried out by 5th Aviation Regiment personnel during the three months to the end of November 2013, 9.7 per cent (295) were scheduled maintenance actions. Scheduled maintenance contributed 10.4 per cent on average toward MRH90 aircraft unserviceability during the three months to the end of April 2014.
- *Unscheduled Maintenance* is any unexpected unserviceability revealed in the course of a flight, or during a scheduled maintenance activity. Of the 3041 separated maintenance actions carried out by 5th Aviation

266 See footnote 259.

Regiment personnel during the three months to the end of November 2013, 90.3 per cent (2746) were unscheduled maintenance actions. Unscheduled maintenance contributed 17.5 per cent on average toward the MRH90 aircraft unserviceability during the three months to the end of April 2014.

Aircraft reliability and maintainability

4.62 The promise of high-levels of aircraft reliability and maintainability was a key consideration during the AIR 9000 Phases 2, 4 and 6 source selection processes. In February 2003, the then Minister for Defence was advised by Eurocopter that the:

> NH90 is designed to exploit new-generation technologies to drastically reduce Life Cycle Costs and enhance reliability – typical figures are 2.5 MMH/FH [Maintenance Man–Hours per Flight Hour], as compared to Tiger (4 MMH/FH or 10+ MMH/FH for Black Hawk; [and]
>
> Mission reliability is validated to 97.5%.

4.63 Australian Aerospace reflected similar information in its May 2004 tender proposal for Phases 2 and 4, including the following reliability and maintainability measures:

(a) 2.6 maintenance man–hours per flight hour for Operational Level (on-aircraft) maintenance;

(b) 95 per cent of on-aircraft defects rectified within 120 minutes;

(c) 97.5 per cent of missions can be successfully completed; and

(d) Safety Inspection (covering an airworthiness period of 15 flight hours or 14 days) can be completed in 20 minutes with three personnel or 30 minutes with two personnel.

4.64 These reliability and maintenance performance measures were not incorporated into the MRH90 sustainment contract. Defence informed the ANAO that the Eurocopter and Australian Aerospace maintenance man-hours per flight hour estimates 'were not and are not accepted on face value', and that 'the ADF and industry did not base their planning for maintenance on these figures alone'. Australian Aerospace has noted that:

(a) the 2.6 maintenance man–hours per flight hour figure is for scheduled maintenance only, and does not include before flight, after flight and other related maintenance;

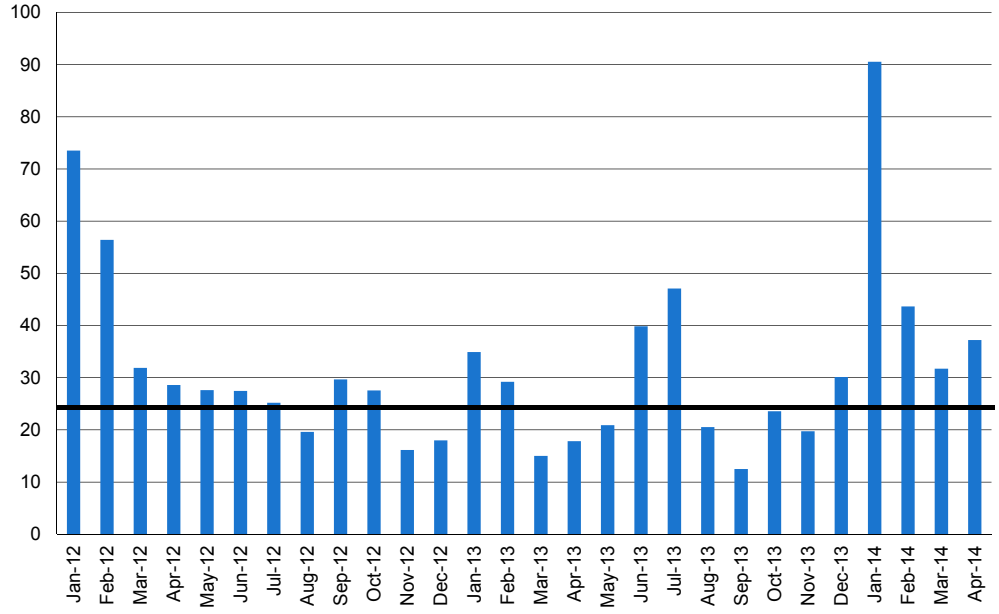
(b) the figure does not include Deeper Maintenance;

(c) the figure is described as 'dry', that is, the maintenance staff do not look at any publications to inform their work and do not perform any before or after maintenance administration, the aircraft is prepared for maintenance, and the figure also does not include supervision time or independent inspections; and

(d) the figure assumes that nothing is found incorrect or requiring further inspection, or no faults are found.

4.65 Figure 4.6 shows the MRH90 fleet's reliability in terms of the number of faults found per 100 MRH90 airframe flight hours. The sustainment contract target is 24 or less faults per 100 flight hours. In the 28 months up to and including April 2014, the MRH90 reliability rate exceeded 24 faults per 100 flight hours on 18 occasions.

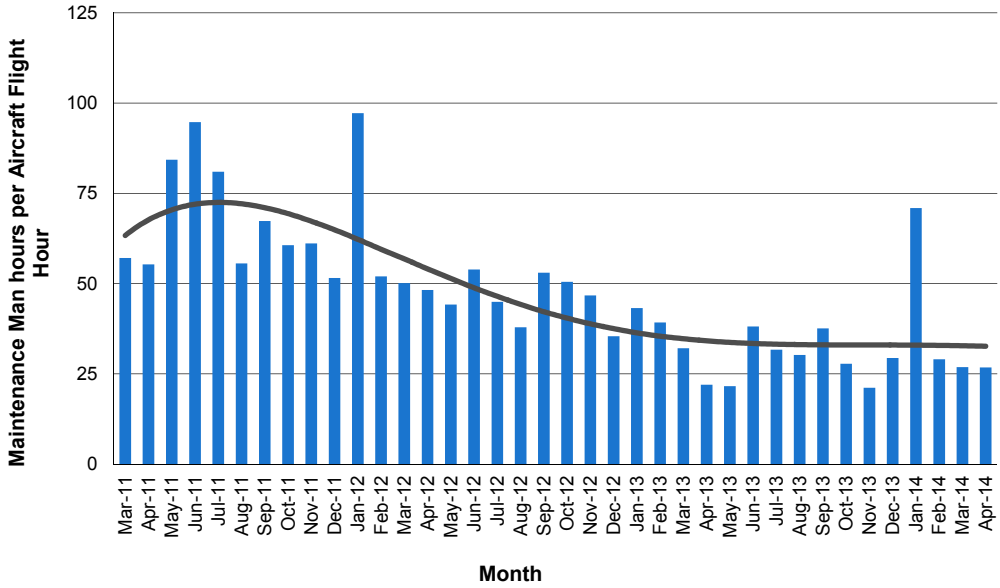
Figure 4.6: MRH90 reliability – faults found per 100 flight hours, January 2012 to April 2014



Source: Australian Aerospace, May 2014

4.66 Figure 4.7 shows the MRH90 fleet's Operational Level maintenance man–hour per flight hour, which by April 2014 was 27 hours per flight hour, down from a peak of 97 in January 2012.

Figure 4.7: MRH90 fleet Operational Level maintenance man-hour per flight hour, March 2011 to April 2014

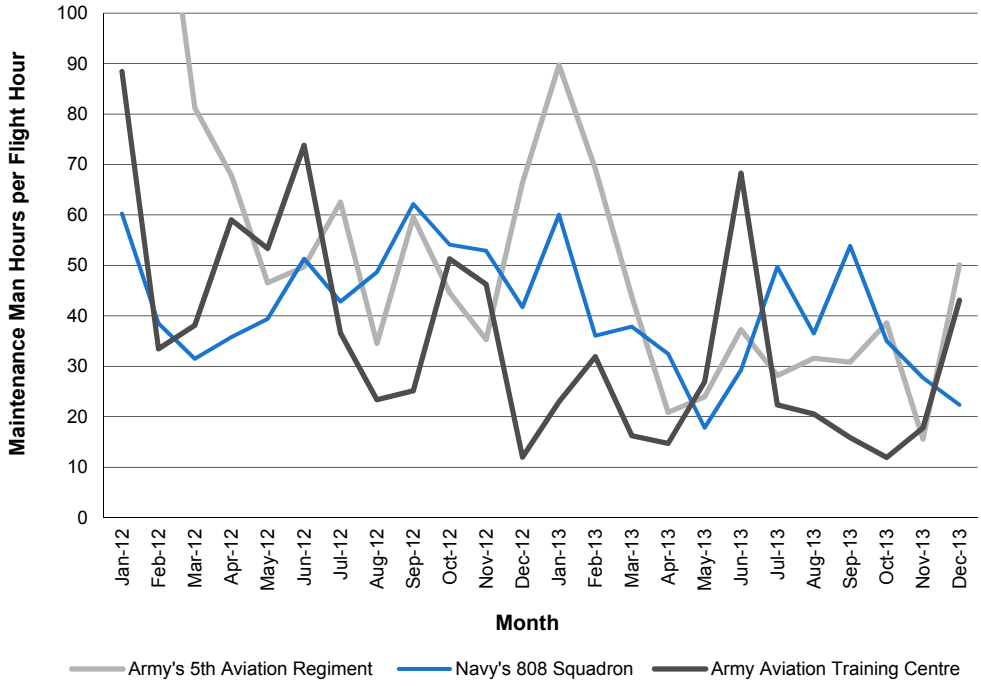


Source: Department of Defence, Reconnaissance and Mobility Systems Program Office, May 2014.

Note: The black trend line was calculated from the monthly data.

4.67 Figure 4.8 generally shows the Army Aviation Training Centre to be the fleet leader in reducing maintenance time on the MRH90 aircraft on a flight hour basis. This maintenance is carried out under the MRH90 sustainment contract by Australian Aerospace. The overall trend is identical to that shown in Figure 4.7, which is an overall decline in maintenance man–hours per flight hour, across the three maintenance venues.

Figure 4.8: MRH90 fleet Operational Level maintenance man-hour per flight hour of each fleet, January 2012 to December 2013



Source: Department of Defence, Reconnaissance and Mobility Systems Program Office, January 2014

4.68 Defence's November 2011 *MRH90 Technical Maintenance Plan* lists around three times the servicings considered necessary by Australian Aerospace in 2004.[267] Consequently, there is more than double the amount of scheduled maintenance being performed on each MRH90 aircraft than originally considered necessary by Australian Aerospace. However, increases in servicing efficiency have occurred with each update of the *MRH90 Interactive Electronic Technical Manual* made available to MRH90 Operational Level maintenance personnel, and as personnel have gained experience working with the MRH90 aircraft. As previously shown in Figure 4.7, Operational Level maintenance has declined in recent years from a peak of 97 hours in January 2012 to 27 maintenance man–hours per flight hour in April 2014.

267 The *MRH90 Technical Maintenance Plan* lists servicing required to occur after the following flight hours: 1, 3, 6, 7, 9, 50, 55, 100, 114, 150, 165, 171, 200, 300, 330, 337, 600, 649, 660, 720, 900; as well as 1 year, 2 year and other calendar-based servicing. Australian Air Publication 7210.023-7(AM1) *MRH90 Technical Maintenance Plan,* November 2011.

Spares support

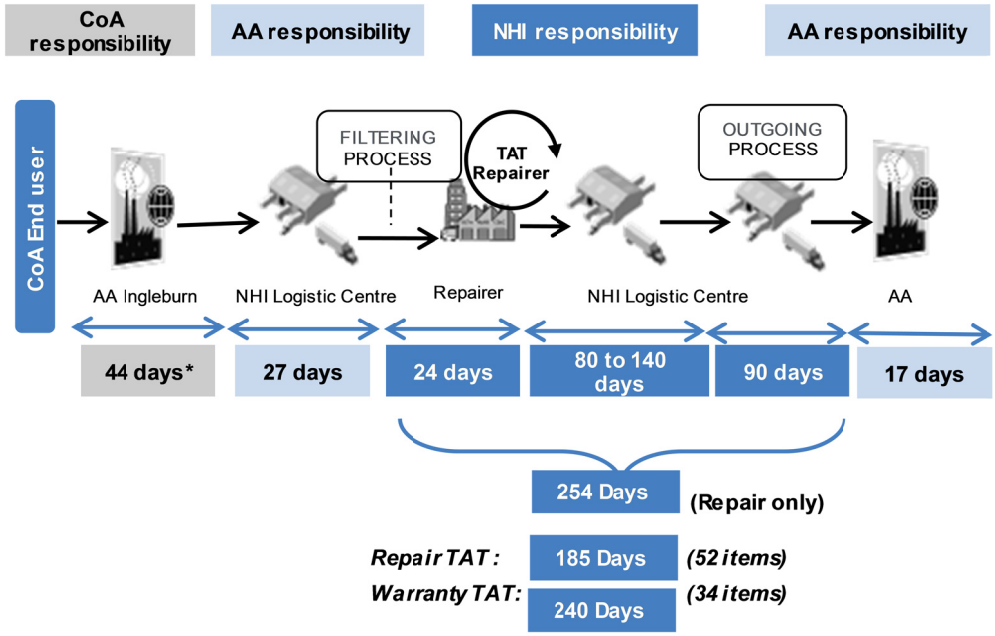
4.69 DMO has established initial stocks of Repairable Items[268] and Breakdown Spares (otherwise known as consumable spares), which are used by Operational and Deeper Level maintenance personnel to repair unserviceable MRH90 aircraft. MRH90 spares ordered under Phase 2 were intended to support the first two years of MRH90 aircraft operations. Additional spares were to be purchased in four tranches, with the last two tranches proposed for 2008 and 2011. The intention was to allow the actual quantities purchased to be determined by an accurate analysis of the operations of the Australian and worldwide fleets, and the ability of Australian repair venues to undertake the work. In May 2006, it was intended that the MRH90 acquisition contract would include a 'not to exceed' estimate for the value of these spares.

4.70 In May 2006, Australian Aerospace's proposal included $120 million for repair of Commonwealth owned Repairable Items, with the costs for these repairs based on European repair venues. Subsequent contract negotiations focused on arrangements for Australian Aerospace to deliver detailed business cases for the repatriation of these repairs to Australian venues, with an expectation that this would deliver savings in the number of items to be purchased, the time taken to repair and the cost of repair. The Australian venues were to be established through the Australian Industry Commitment program outlined in paragraphs 4.84 to 4.90. However, repatriation of Commonwealth owned Repairable Item repairs to Australian venues has not occurred to the extent required to reduce the cost and duration of repairs.

4.71 Unserviceable Repairable Items are returned to Australian Aerospace's warehouse for distribution to Repairable Items repair centres. Once repaired, these items are returned to Australian Aerospace's warehouse to replenish spares stockholdings. Figure 4.9 outlines the MRH90 Repairable Item pipeline and durations, as at October 2010.

268 Repairable Items are all of those items whose resupply normally centres on maintenance processes formally authorised by the ADF to be carried out at authorised venues. Australian Defence Force, *ADF aviation maintenance management manual (Book 2 of 2)*, Australian Air Publication 7001.059, 18 May 2011, Glossary.

Figure 4.9: Repairable Item pipeline and durations, October 2010

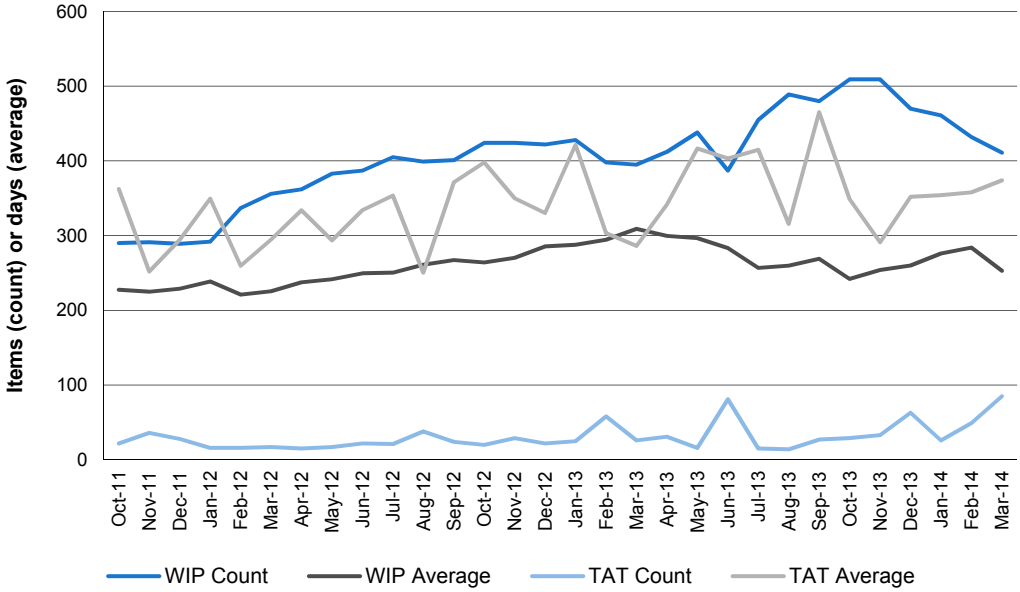


Source: *MRH Support Improvement Plan*, Brisbane, 13 October 2010, p.24.
TAT = Repairable Item Turn Around Time; AA = Australian Aerospace; CoA = Commonwealth of Australia

4.72 During MRH90 sustainment contract negotiations in May 2006, logistics support analysis was conducted to determine the economic quantity of MRH90 Repairable Item spares holdings. To assist this analysis, Australian Aerospace provided the Commonwealth with direct access to its Basis of Provisioning and spares modelling. The economic quantity of Repairable Item spares holdings was based on an estimated repair time of less than 200 days.

4.73 Figure 4.10 shows that efforts to reduce the Repairable Item Turn Around Time had not been effective until November 2013. The number of Repairable Items in the repair pipeline, referred to as the Work In Progress (WIP) Count, had increased from 290 in October 2011 to 509 in November 2013. However since then, the number of Reparable Items entering the repair pipeline was less than the number being repaired and placed back into stores inventory. That resulted in the backlog of Repairable Items undergoing repairs being reduced from 509 in November 2013 to 411 in March 2014. On the other hand, the time taken to repair Repairable Items, shown as Turn Around Time (TAT) Average, has not yet shown any appreciable improvement.

Figure 4.10: MRH90 Repairable Items—Work In Progress and repair Turn Around Time, October 2011 to March 2014



WIP Count: Work in Progress Count is the number of items in the repair pipeline that month.
TAT Count: Turn Around Time Count is the number of items returned that month.

WIP Average: Work in Progress Average is the average number of days in the pipeline that month.
TAT Average: Turn Around Time Average is the average number of days for the items returned

Source: Department of Defence, Reconnaissance and Mobility Systems Program Office, April 2014.

4.74 Figure 4.10 also indicates that the planned repatriation of Commonwealth owned Repairable Items to Australian venues has not been successful. The lengthy MRH90 Repairable Item process shown in Figure 4.9 has remained in place since the sustainment contract commenced in 2008. The Repairable Item Turn Around Time Average has continued to exceed original estimates, which casts doubt on the accuracy of the spares inventory economic quantity analysis used to determine MRH90 spares stock holdings. As the number of MRH90 aircraft placed into service increases, there will need to be a significant reduction in the repair Turn Around Time Average to prevent exhaustion of spares holdings due to increased demands. Nonetheless, one of the outcomes of Deed 2 is that Australian Aerospace has warranted that Defence has bought enough spares to support 10 600 flying hours per year. If more spares are required, Australian Aerospace would be required to satisfy this warranty.

Fleet sustainment costs

4.75 In June 2004, 40 MRH90 aircraft were proposed under a combined Phases 2 and 4, and Defence observed that the cost of the sustainment contract was estimated as follows:

> Australian Aerospace priced the support contract for the mature system at $48.9 million annually, whereas the [Defence] LCC [Life Cycle Cost] analysis estimated this at $85.2 million per annum. While these prices may not be measuring the same thing, the disparity clearly indicates the potential cost pressures associated with incomplete data and/or depth of supporting information from Australian Aerospace.

4.76 By 2009–10, when 15 MRH90 aircraft had been delivered, the cost of sustaining the MRH90 aircraft accepted by DMO already exceeded the $85 million cost estimated using Life Cycle Cost analysis in 2004, even though the Life Cycle Cost analysis was based on 40 aircraft having been delivered. This was a consequence of Defence basing its sustainment contract cost estimations on incomplete or immature logistics support analysis data obtained from Australian Aerospace.

4.77 By May 2011, DMO found the MRH90 spares to be significantly more expensive than equivalent spares purchased for the Black Hawk helicopters through US Government Foreign Military Sales (FMS). An extreme example is an MRH90 plastic plug, which costs $2.18 through FMS, and cost $753.30 when acquired from Australian Aerospace. Similar price mark-ups occurred for the ARH Tiger aircraft, for which a wheel locking pin cost €5783.63 when a similar pin for Black Hawk aircraft cost A$9.67. The ANAO requested Defence advice on the result of audits or cost investigations carried out to assess the extent of such price differentials. Defence informed the ANAO in April 2014 that 'no specific audits or cost investigations that include the cost of role equipment had been undertaken'.

4.78 In April 2012, on average each of the 15 in service MRH90 aircraft was costing approximately $51 200 per hour of flying, which Defence calculated to be 5.5 times more expensive than an ADF Black Hawk aircraft. At the same time, the cost of supporting the 15 MRH90 aircraft was more expensive than supporting the ADF's 34 Black Hawk aircraft.

4.79 During 2012, DMO was unable to accurately determine the sustainment contract costs of Repairable Item repair and overhaul. Other MRH90 sustainment cost drivers such as software support, engine maintenance and

obsolescence management were similarly not yet well understood by DMO. However, DMO endeavoured to accurately capture and model the anticipated cost of ownership for the 47 MRH90 aircraft capability over the planned life of type. That modelling indicated a mature state cost of ownership of between $240 million and $360 million per annum (October 2012 prices). On that basis, the annual cost of sustaining each MRH90 aircraft ranges from $5.1 million to $7.7 million.

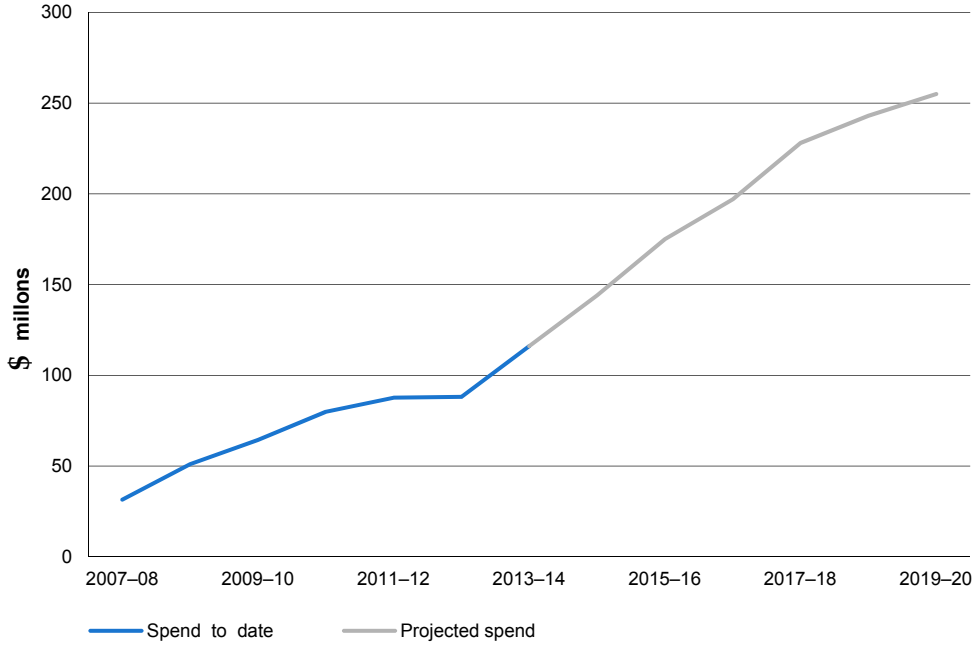
4.80 In November 2012, DMO expected average MRH90 sustainment costs would reduce as the more reliable mature configuration (PBL 3) aircraft entered service and flying rates improved. Nevertheless, DMO projections at the time suggested that the MRH90 aircraft would most likely still be twice as expensive to operate as the ADF's Black Hawk aircraft.[269]

4.81 Figure 4.11 shows the sustainment cost of the MRH90 fleet since 2007–08, as well as Defence's cost estimates for sustaining the MRH90 fleet (in out-turned dollars) until 2019–20. These estimates are calculated based on MRH90 flight hours agreed with Army and Navy.[270] Over 95 per cent of these costs are attributed to MRH90 In-Service Support fees payable to Australian Aerospace and other contractors. The figure includes the full range of engineering and support services provided by Australian Aerospace.

269 The budgeted cost of sustaining 34 Black Hawk aircraft was estimated to be $77 million for the year 2013–2014. *Portfolio Budget Statements 2013–2014, Budget related Paper No.1.4A, Defence Portfolio*, Commonwealth of Australia, 2013, p.176. This equates to an average of $2.265 million per aircraft per year to sustain, or less than half the average cost of sustaining an MRH90, as reported in the *2013–2014 Portfolio Budget Statements*.

270 Defence informed the ANAO that it expected that any flight hour reductions would result in lower sustainment costs.

Figure 4.11: MRH90 sustainment contract expenditure and cost estimates.



Source: Department of Defence, May 2014

Note: Figures for 2007–13 are in then-year terms, and estimated provisions from 2014–20 are in out-turned dollar terms.[271]

4.82 The estimated annual cost of sustaining the MRH90 fleet rises from $116 million in 2013–14, when 27 MRH90 aircraft had been accepted from Australian Aerospace, to $255 million in 2019–20 for the full complement of 47 MRH90 aircraft, which are due to be accepted from Australian Aerospace by July 2017.

4.83 On the basis of sustainment costs increasing by a conservative three per cent per year, it is likely that the total contracted services cost of sustaining the 47 MRH90 aircraft in their current configuration until their Planned Withdrawal Date of 2040, will be approximately $8.730 billion.

271 Then-year dollars are based on the cost of labour and materials and currency exchange rates at the time the expenditure occurred. Out-turned dollars include the estimated effects of labour and materials variations and currency exchange rate movements.

Australian Industry Commitment objectives

4.84 The importance of Australian Industry Commitment (AIC) objectives was highlighted by the then Government during the 2004 AIR 9000 Phases 2 and 4 ODRP. At the time, the then Minister for Defence directed that there should be a high level of Australian industry involvement in the MRH90 program in areas of greatest importance, while containing cost and schedule within Defence Capability Plan limits.

4.85 In 2004 Australian Aerospace informed Defence that access to the NH90 Global Supply Chain would allow the Australian industry network to reach the critical size that would guarantee long-term sustainability. That access was to include the following items being sourced from Australia for the world market:

- NH90 tail rotor blades production and support;
- NH90 major composite structures production and support;
- engine support;
- NH90 and Auxiliary Power Unit electrical harnesses production and support;
- avionics and defence electronic equipment production and support; and
- mechanical parts production.

4.86 By May 2006, the Australian Aerospace AIC offer included: Australian assembly of 42 MRH90 aircraft; an Australian indigenous software support capability; Australian industry participation in the NH90 Global Supply Chain for composite parts manufacture, engine assembly and repair; and repair of Electronic Warfare Self Protection equipment, and main and tail rotor blades. Defence was also pursuing with Australian Aerospace additional Australian industry opportunities in the areas of gearbox testing and overhaul, and Deeper Level Maintenance of Commonwealth owned Repairable Items.

4.87 In 2006, the MRH90 acquisition contract for Phases 2, 4 and 6 contained an AIC program, developed around the following themes:

(a) *Platform theme*, which outlined the proposed actions to develop Australian capability to support the MRH90 aircraft and other platforms. This theme included some dynamic components, such as rotor blades, and those activities and components that are not specifically covered by another theme;

(b) *Engines, Gearboxes and Transmissions theme*, which outlined the proposed actions to extend Australian capability to support the MRH90 aircraft and other engines, gearboxes and transmissions, as well as to acquire or manufacture materials and components;

(c) *Special to Purpose Systems theme*, which outlined the proposed actions to develop Australian capability to install, support and develop the MRH90 aircraft mission and weapons systems and to maintain compatibility with existing or new external-to-MRH90 communications and weapon systems;

(d) *Training theme*, which outlined proposed actions to develop Australian capability to provide both engineering and flying training support and services; and

(e) *Management theme*, which included overall management activities associated with the delivery of the Australian Industry Plan.

4.88 These themes were also factored into the MRH90 sustainment contract signed in June 2006, which set out the following AIC objectives for AIR 9000 Phases 2, 4, and 6:

(a) generate and sustain, on a commercial basis, critical industry capabilities which aid the self-reliance of the ADF; and

(b) maximise the involvement of Australian industry in the development of the broader Australian Aerospace and Electronic Systems Sectors as a competitive, globally integrated and flexible environment supportive of critical capabilities and economic growth.

4.89 In June 2006, the AIR 9000 Phases 2, 4 and 6 sustainment contract identified AIC activities and Strategic Industry Development Activities (SIDA) with a total value of $457.4 million and $152.7 million respectively (both January 2004 prices). These included:

- Integrated Logistics Support Management and administration services local content $66.7 million;
- Engineering Support Services local content $45.2 million;
- Operational and Deeper Level Maintenance of equipment installed on the MRH90 aircraft, local content $43.4 million; and
- Software Support and Maintenance local content $38.2 million.

4.90 The MRH90 sustainment contact also identified the following AIC critical activities (contracted cost in January 2004 prices):

- establishment of a Main Gear Box (Helicopter Transmission System) repair and overall capability including the establishment of a Multipurpose Test Bench, at a cost of $101.7 million apportioned to Strategic Industry Development Activity and an additional $12.7 million in local content[272];
- establishment of a Rolls Royce Turbomeca 322 Deeper Level Maintenance capability at a cost of $6.4 million;
- establishment of a Main Structure Composite Repair capability at a cost of $1.7 million; and
- equipment listed in the MRH90 sustainment contract as candidates for Deeper Maintenance to be conducted in Australia:
  - Forward Looking Infra-Red (FLIR) sensor equipment;
  - Plant Management Computer (PMC);
  - Radar Altimeter equipment, MRH90 Autonomous Navigation System (ANAS);
  - Flight Control Computer (FCC);
  - Threat Warning Equipment (TWE) Central Processor Unit;
  - Aircraft Safety Equipment;
  - Hydraulic Equipment;
  - Auxiliary Power Unit (APU) Deeper Maintenance; and
  - Main and Tail Rotor Blade Deeper Maintenance.

MRH90 Program investment in Australian industry

4.91 During acquisition contract negotiations in May 2006, Defence advised its Minister that:

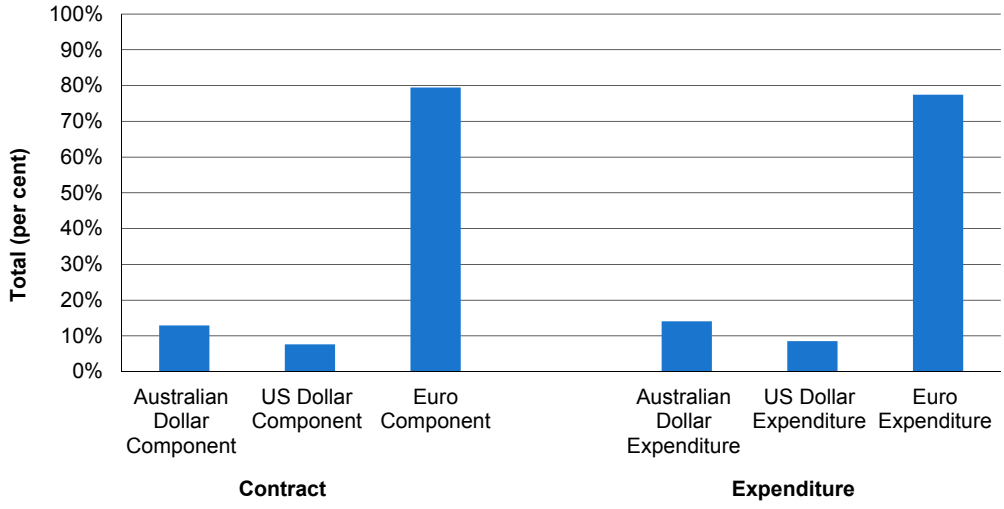
> Under Phase 2 it was agreed that the Overarching AIC Target (OAT) is equivalent in value to 37% of the total Contract value. This figure has been agreed as the minimum for the combined Phases 2, 4 and 6 and thus should represent a $1.1 bn investment in Australian industry.

272 AgustaWestland was expected to seek funding under the Skilling Australia's Defence Industry (SADI) Program to train personnel for this capability. Defence's SADI was established in 2005 to increase the quality and quantity of skilled personnel available to the Defence industry sector. The SADI Program provides funding to companies and industry associations for training and/or skilling activities in trade, technical or professional skills sets where that training is linked to a Defence capability.

4.92 Defence informed the ANAO that it validates AIC activities under the acquisition and sustainment contracts by examining invoices and accounting documentation. However, Defence has not assessed the value of the AIC activities actually delivered.

4.93 In the absence of any other measures or assessment of the implementation of AIC activities, the ANAO sought to gauge the indicative value of AIC activities. The ANAO examined total expenditure amounts in terms of the three currencies contained in the acquisition and sustainment contracts. Figure 4.12 shows, by currency in percentage terms, the AIR 9000 Phases 2, 4 and 6 acquisition contract value at the contract base date (4 January 2004 exchange rates). It also shows contract expenditure as at March 2014 by currency, in percentage terms. Based on expenditure to date, the proportion of Euro expenditure is 2 per cent less than the acquisition contract proportion, and the proportion of Australian and US Dollar expenditure is 1 per cent higher than the acquisition contract proportion. It should be noted that the Australian Dollar proportion in the acquisition contract (13 per cent) differs significantly from the 37 per cent AIC target.

Figure 4.12: AIR 9000 Phases 2, 4 and 6 acquisition contract and expenditure, by currency, in percentage terms, as at March 2014



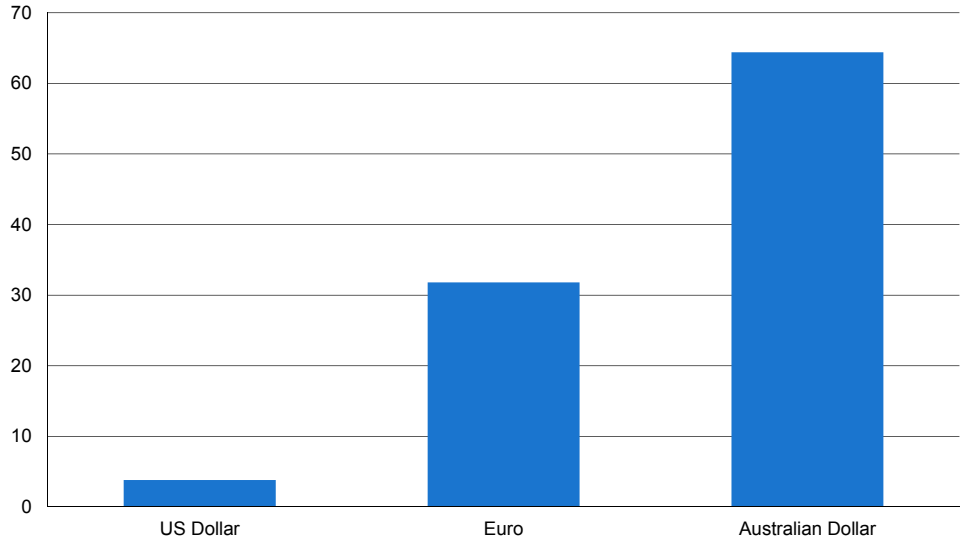
Source: Department of Defence, MRH90 Program Office.

4.94 On 11 March 2014, total MRH90 acquisition contract expenditure was $2.016 billion, and $0.283 billion or 14 per cent of that amount was in

Australian Dollars. This level of Australian dollar expenditure indicates that the $1.1 billion AIC expenditure target is unlikely be achieved.

4.95 Figure 4.13 shows the sustainment contract expenditure since 2008 by currency, in percentage terms. The overall sustainment expenditure totalled $431.267 million, and $266.109 million of this amount (62 per cent) was expended using Australian Dollars.

Figure 4.13: AIR 9000 Phases 2, 4 and 6 sustainment contract expenditure, by currency, in percentage terms, as at March 2014



Source: ANAO analysis of Defence records.

4.96 The ANAO requested Defence advice on the extent of the shortfall in AIC activities, and the measures being taken to address this shortfall. In April 2014, Defence informed the ANAO that:

> Under Deed 2, Industry and the Commonwealth agreed to resolve a dispute related to the valorisation/validation of the AIC Program. Australian Aerospace agreed to implement a Local Industry Plan (LIP) and incorporate it as part of the Sustainment Contract. The LIP will retain all activities currently being performed in Australia under the original AIC Plan and provide an additional 40 Local Industry Activities. The LIP will be supported by agreed Validation Indicators and a Liquidated Damages regime.

4.97 In June 2014, DMO further informed the ANAO that the scope of the revised Local Industry Plan encompasses a range of activities including aircraft

production, component manufacture and the conduct of maintenance, and that it has worked with Australian Aerospace to provide greater definition of the industry activity capability outcomes against which it can conduct verification audits. DMO also advised that it has agreed to an extended schedule to implement the revised Local Industry Plan offered by Australian Aerospace to allow commercial matters between Australian Aerospace and industry partners to be refined and agreed, whilst retaining an environment of competitive tension in which to conduct those commercial discussions.

4.98 Nevertheless as at June 2014, the revised Local Industry Plan had not yet been finalised, some 12 months after Deed 2 took effect.

Conclusion

4.99 Systems engineering standards and DMO system acquisition contracts involve the design and development of Mission Systems, and require contractors to produce a *Verification Cross Reference Matrix* (VRCM) that cross references the contracted requirements with the procedures by which compliance with those requirements are to be, or have been, verified. DMO Project Office personnel make compliance findings against each of the contractor's compliance statements. As at April 2014, six and a half years after the In-Service Date (ISD) of December 2007, DMO had accepted Australian Aerospace's compliance statements for 494 out of 553 requirements (89 per cent). Further, as at May 2013, the MRH90 Program Office had identified 35 acquisition contract requirements that the MRH design and construction had failed to achieved, relating to a broad range of design issues, including embarking and egress of troops, ballistic vulnerability and external sling load operations. These non-conformances were accepted by the Commonwealth and waivers granted as part of the Deed 2 negotiations in order to increase the value for money of sustainment arrangements through contract changes. Defence informed the ANAO that as at April 2014, there remained another 32 temporary and four permanent design deviations not accepted by the Commonwealth. In June 2014, Defence further informed the ANAO that the number of permanent design deviations for the MRH90 aircraft is not unusual.

4.100 The ADF's Technical Airworthiness Regulations set out the Australian Military Type Certificate (AMTC) and Service Release process. The AMTC and Service Release are issued after aircraft design issues and sustainment limitations identified during Special Flight Permit periods, and assessed by

Airworthiness Boards, are resolved to the satisfaction of the Defence Aviation Authority. As a consequence of the ongoing delivery of MRH90 aircraft that did not comply with contracted specifications, the Chief of Air Force, in his role of Defence Aviation Authority, issued a series of unplanned Special Flight Permits, which authorised the scope of flying activity prior to AMTC and Service Release being granted. By the time of the Airworthiness Board meeting in April 2013, 16 MRH90 Airworthiness Issue Papers had been closed and nine remained open. These nine were reported to generally relate to longer-term corrective actions and, with mitigations in place, did not preclude a recommendation for AMTC and Service Release. The MRH90 aircraft achieved AMTC and Service Release in April 2013. The 53 month delay in obtaining AMTC and Service Release required the aircraft to be operated under Special Flight Permits for longer than originally anticipated, and with more incremental variations to the Special Flight Permits than originally anticipated. At the same time, Service Release was granted subject to three limitations, including prohibition of the use of the Heavy Stores Carrier and the External Aircraft Fuel Tank, and prohibition of night formation flying. Defence expects that these aircraft limitations will be temporary.

4.101 Australian Aerospace has been engaged under the sustainment contract to undertake the majority of management tasks that are normally the responsibility of a DMO Systems Program Office (SPO). This outsourced SPO model was intended to create efficiencies in the delivery of SPO services to Navy and Army, and to significantly reduce the number of military and public service employees engaged in the support of the MRH90 fleet. Within this arrangement, Australian Aerospace is required to act on behalf of the Commonwealth, including fulfilling the role of Authorised Engineering Organisation (AEO) and Approved Maintenance Organisation (AMO), managing the logistics supply chain and sub-contractors, and identifying opportunities to improve MRH90 fleet performance and reduce its cost of ownership. Commonwealth personnel in the MRH90 Logistics Management Unit retain responsibility for design acceptance and governance of outcomes, and for verifying and approving the payment of sustainment contract invoices received from Australian Aerospace.

4.102 Australian Aerospace is a wholly owned subsidiary of Eurocopter and so is responsible to its parent company to meet financial objectives and represent the interests of the parent company in Australia. Australian Aerospace is therefore under contract to deliver efficient and effective support to Defence while also having responsibility to its parent company, to maintain

profitability and represent the interests of the parent. The experience of the MRH90 Program to date, including the high cost of sustaining the aircraft, highlights the potential for tensions to arise in the pursuit of these differing objectives. It also highlights the primary importance of an appropriate performance measurement regime to drive value for money and provide sufficient oversight of outsourced arrangements.

4.103 The sustainment contract for the first 12 MRH90 aircraft was signed on 29 July 2005. It was amended on 20 June 2006 to include the additional 34 MRH90 aircraft, and amended again in March 2012 and July 2013 to include agreements reached with Australian Aerospace as part of the Deed negotiations. The pre-2012 contract provisions were found to be largely ineffective, as they were based on the premise that the number of fully developed (mature) MRH90 aircraft delivered through the MRH90 acquisition contract would be sufficient to achieve value for money via performance incentives and other incentives within the contract. Until June 2013, DMO was unable to apply the sustainment contract's performance management regime, as there were insufficient MRH90 aircraft placed into operational service to trigger that regime. Furthermore, other sustainment issues affected the availability of the delivered MRH90 aircraft and further brought into question the value for money and cost-effectiveness of MRH90 sustainment expenditure.

4.104 DMO and Australian Aerospace negotiated amendments to the MRH90 sustainment contract, which took effect on 1 July 2013 and are scheduled to expire on 19 December 2019. These amendments seek to improve MRH90 sustainment outcomes by reducing the total cost of ownership throughout the Life-of-Type, and increasing the number of serviceable MRH90 aircraft. The amendments establish a new performance management regime, which involves: financial incentives to improve MRH90 serviceability rates[273]; and a Quarterly Performance Management Fee based on a number of Key Performance Indicators (KPIs). The sustainment contract amendments are a part of DMO's decision to settle a claim for Liquidated Damages and common law damages, in return for improvements to MRH90 aircraft affordability and serviceability.

273 That regime focuses on a Repair By the Hour Sustainment (RBHS) Scheme whereby Australian Aerospace will be paid a minimum monthly floor price, regardless of the number of hours flown by the MRH90 fleet, and a fixed amount per MRH90 flight hour. The price paid covers the cost of all Breakdown Spares and Repairable Items.

4.105 The contracted number of flight hours for the mature MRH90 fleet of 47 aircraft is 10 300 hours per year, which is an average of 220 hours per aircraft per year, or 4.2 hours per week. For the period July 2007 to April 2014, the MRH90 fleet's actual flight hours consistently fell short of Army and Navy authorised flight hours. The shortfall was a result of the MRH90 aircraft being offered to DMO for acceptance when only partially compliant with their acceptance criteria, as well as a complex mix of sustainment shortfalls. A consequence of the reduced MRH90 flight hours, and the withdrawal from service of the RAN's six Sea Kings in December 2011, has been the need for Navy to use its anti-submarine S-70B-2 Seahawk helicopters in utility helicopter roles. The reduced flight hours of the MRH90 aircraft have also constrained Navy helicopter pilot flight training, as well as Navy's ability to develop the MRH90 capability to the extent necessary to achieve the maritime Operational Capability milestones. The reduced MRH90 flight hours have resulted in the Army retaining its 34 S-70A-9 Black Hawk helicopters in operational service longer than planned. The reduced MRH90 flight hours have also reduced Army helicopter pilot flight training, and the ability to achieve the Army's first Operational Capability milestone for the MRH90 aircraft.

4.106 DMO, Navy and Army records indicate that MRH90 fleet reliability and maintainability has fallen significantly short of expectations. In the 28 months up to and including April 2014, the MRH90 reliability rate exceeded the sustainment contract target of 24 faults or less per 100 flight hours on 18 occasions. Further, the MRH90 fleet's Operational Level maintenance man-hour per flight hour was averaging 27 hours per flight hour by April 2014, down from a peak of 97 hours in January 2012. Notwithstanding the decline, Operational Level maintenance man hour per flight hour remains high, particularly when compared to advice provided by Eurocopter to the Minister for Defence in February 2003 that the NH90 was designed to exploit new-generation technologies to drastically reduce Life Cycle Costs and enhance reliability. In April 2014, Defence informed the ANAO that it would take at least a year before the impact of the July 2013 sustainment contract revisions on aircraft reliability, maintainability and sustainment costs becomes apparent.

4.107 During the AIR 9000 Phases 2 and 4 ODRP in 2004, the Minister for Defence directed that there should be a high level of Australian industry involvement in the MRH90 program in areas of greatest importance, while containing cost and schedule within Defence Capability Plan limits. Defence

advised its Minister when negotiating the acquisition contract in May 2006 that an overarching Australian Industry Commitment target of 37 per cent translated to a $1.1 billion investment in Australian industry for the combined Phases 2, 4 and 6. The approved MRH90 acquisition and sustainment contracts for Phases 2, 4 and 6 contained an Australian Industry Commitment program, which was developed around themes and objectives. Defence informed the ANAO that it validates this program's activities under the acquisition and sustainment contracts by examining invoices and accounting documentation. However, Defence had not measured or assessed the value of the Australian industry capability activities actually delivered. Further, following on from Deed 2, Defence and Australian Aerospace are negotiating a new Local Industry Plan, which will include milestones and performance measures.

Ian McPhee

Auditor-General

Canberra ACT

25 June 2014

Appendices

Appendix 1: Agency and Company Responses

Australian Government
Department of Defence

Mr Dennis Richardson
Secretary

General David Hurley, AC, DSC
Chief of the Defence Force

SEC/OUT/2014/172
CDF/OUT/2014/551

Dr Tom Ioannou
Group Executive Director
Performance Audit Services Group
Australian National Audit Office
PO Box 707
Canberra ACT 6203

Dear Dr Ioannou

ANAO Section 19 (Draft) Audit Report for Acquisition of MRH-90 Helicopter Capability – AIR 9000 Phases 2, 4 and 6

Thank you for the opportunity to review and comment on the Section 19 (Draft) Audit Report for the Acquisition of MRH-90 Helicopter Capability – AIR 9000 Phases 2, 4 and 6 provided to Defence on 12 May 2014. The Defence response is contained at Attachments A and B.

Defence welcomes the report and notes that the section19 does not contain recommendations. Nonetheless, the draft report includes key lessons learned in the areas of project definition and tender evaluation, capability requirements, and acceptance and sustainment.

Defence acknowledges that there is scope to realise further improvements in the MRH-90 capability and anticipates continued maturity to the sustainment arrangements with associated benefits to cost of ownership. Defence is committed to managing the complexities of its mission and appreciates the regular reviews undertaken by the ANAO.

Yours sincerely

Dennis Richardson
Secretary

D.J. HURLEY, AC, DSC
General
Chief of the Defence Force

***Attachments*:**
1. Defence response to acquisition of MRh90 Helicopter Capability – Air 9000 Phases 2, 4 and 6 Issues Papers, Additional Information and Proposed Amendments.
2. Defence response to MRH90 Helicopter Capability – Air 9000 phases 2, 4 and 6 Issues Papers, and Requests for Information.

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AUSTRALIAN AEROSPACE

Dr Tom Ioannou
Australian National Audit Office
GPO Box 707
Canberra ACT 2601

10th June 2014

Ref: MRHPMO-OUT-00039337-14CCR
Program Ref: Acquisition

Dear Tom

AUSTRALIAN AEROSPACE COMMENTS ON EXTRACT OF ANAO AUDIT REPORT – ACQUISITION OF THE MULTI-ROLE HELICOPTER CAPABILITY (AIR9000 PHASES 2, 4 & 6)

Reference:

A. Your Letter 3415179 dated 12 May 2014

1. Thank you for the opportunity provided at reference A to make formal comment on the extract of your report on the Department of Defence's Acquisition of the MRH90 aircraft. This letter is the formal response by Australian Aerospace to the content of the Extract of the Report.

2. The Extract points to the maturity of the design of the helicopter as a contributing factor to the delayed introduction into service in Australia. The design of the TTH variant of the NH90 has undergone considerable development since first introduced to Australia and Australian Aerospace is confident that this development will continue, providing greater system reliability and reduced maintenance workload as we move forward. Over 500 NH90 helicopters have been ordered in the world and this will create a strong user base which will drive cost of ownership improvements for the life of type of the aircraft.

3. Australian Industry capability is judged in the Extract by an indicative measure of the amount of capital acquisition expenditure in Australian currency. In the view of Australian Aerospace this overly simplifies the detailed planning and preparation required to make Australian Companies capable of repairing complex equipments from the MRH90. A number of very successful capabilities have been established in Australia including a complete main engine capability with Safran Turbomeca Australasia in Sydney. As a result of Deed 2, a much more specific and binding Local Industry Plan (LIP) has been established which makes Australian Aerospace responsible for establishing a number of capabilities including; avionic black boxes, the main gearbox and the Forward Looking Infrared Radar (FLIR). Negotiations over these opportunities are well advanced and will

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be introduced in line with the Commonwealth agreed schedule for LIP implementation. This will see the level of Australian Industry involvement in the MRH90 Program rise as the capability matures and the equipments are sent to the local venues for repair.

4. **Cabin Improvements**. The Extract raises the issues that are being addressed with a number of role equipments like the troop seats, the Self Defence Gun position and the Fast Roping and Rappelling Device (FRRD). Due to the specific requirements of Australia for a number of these types of systems it has now become evident that the designs that were created in Europe before the aircraft had seen any operational service were not well focussed on the end user requirement. Australian Aerospace is now working very closely with all Australian stakeholders to ensure that any redesigned equipments take full cognisance of the operational requirements of all Australian users of the aircraft. Therefore, we are confident that the new systems that have been agreed to be provided following Deed 2, will meet the operational requirements of the ADF.

5. **Marinisation**. Inevitably in the design of a helicopter compromises need to be made to ensure that the basic weight of the aircraft does not increase to the point where the operational range or lift capacity falls below the users requirements. For a multi role helicopter it would not be common to fit automatic blade folding and deck recovery systems because they would be rarely used but add considerable weight for all operations. The MRH90 has very good handling qualities when operated to ships but does not feature some of the equipments which are found on dedicated maritime helicopters. With regards to corrosion protection, Australian Aerospace has developed, in conjunction with the Australian Navy, local protective procedures to be applied prior to and when embarked. Australian Aerospace has undertaken deeper maintenance on four MRH90 aircraft to date, including aircraft that have seen significant embarked operations, and corrosion on these aircraft has been minor and consistent with expectations for aircraft of this type.

6. **Crashworthiness**. The Extract highlights that the MRH90 is qualified to a modified MIL-STD-1290A and suggests that the crashworthiness of the aircraft is less than required by the ADF. As the Extract points out, the Defence Airworthiness Design Requirements Manual AAP 7001.054(AM1) did not specify a crashworthiness design standard at the time that Phase 2, 4 and 6 contracts were signed. Irrespective, the MRH90 provides a high level of survivability for occupants and is fully compliant with the requirements to which it was designed as specified by the NH90 Partner Nations in Europe. Australian Aerospace and NHI are working closely with Defence at this time to further improve occupant safety via introduction of enhanced cabin seating and cabin crew restraints which will further increase compliance of the aircraft with respect to the now current AAP 7001.054(AM1) requirements, while also considering a more contemporary military population from an anthropometric perspective and total weight, including combat equipment.

7. **Flight Hours and Sustainment Support**. The Extract clearly shows that the flight hour expectations of the Navy and Army have not been met in the initial years of MRH90 operations in Australia. The early versions of the aircraft (PBL1&2) were less reliable than the PBL3 variant which is now predominant in the fleet. This combined with a poor ability of Industry to support spares and repairable item demands in the early years contributed significantly to the low flight hour achievement. Australian Aerospace is of the view that the mature configuration of the MRH90 is capable of meeting the flight hour expectations of the ADF and that in recent times this is being demonstrated. As the Extract points out, significant changes to the MRH90 sustainment construct were agreed through Deed 2 and

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these arrangements are now showing very positive trends in Demand Satisfaction Rates and flight hours achieved. It is acknowledged that the Repair By the Hour Services (RBHS) payment provisions are having a positive impact on the way that the sustainment of the MRH90 is focussed and delivered. Industry is strongly motivated to resolving support and reliability issues quickly and fully and this is having a positive effect on the KPIs which have been implemented through Deed 2. The other consequence of the RBHS is that Defence is no longer concerned about the pricing of individual components and repairs because all of these costs have been wrapped up in the new arrangement. This gives Defence a comprehensive view of support cost and allows for a predictable budget to support the aircraft. It also means that the spares pricing errors that the Audit noted are no longer a concern to the Commonwealth because they are costs to Industry in providing the overall RBHS.

8. It is acknowledged that introduction of the MRH90 has been protracted for the reasons discussed in the Extract but Australian Aerospace is of the view that the aircraft is now gaining strong pilot support as a capable and safe aircraft by virtue of its modern avionics and advanced performance and flight characteristics. Australian Aerospace and its NHI Partner are committed to working with Defence on improvements to the cabin and related role equipments which will make the MRH90 a potent battlefield capability for the Australian Army and Royal Australian Navy in the future.

9. Australian Aerospace thanks the ANAO for the opportunity to comment on the Extract of the Report in the MRH90 Program and requests that you consider including this letter as an appendix to your final report. The AusAero point of contact for this matter is Charles (Jock) Crocombe, Email Charles.Crocombe@ausaero.com.au.

Yours sincerely

Jens Goennemann
CEO Australian Aerospace

Charles Crocombe
VP Governmental Helicopters

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Ref: ANAO 02/14

3rd June 2014

Stuart Turnbull
Executive Director
Performance Audit Services Group
Australian National Audit Office
GPO Box 707
Canberra, ACT, 2601

Subject: **Acquisition of the Multi-Role Helicopter – AIR 9000 Phases 2, 4 and 6.**

Ref: ANAO Ref 3454768 – AIR 9000 Phases 2, 4 and 6

Dear STUART,

We have reviewed the extract papers provided by the ANAO and are satisfied that the information is factually correct.

Sikorsky would like to take the opportunity to express its disappointment in not being selected as the preferred provider of the multi role aircraft and support solution. The delivery and service performance that Sikorsky has provided to the US Army with the UH-60M Black Hawk aircraft demonstrates to the Commonwealth that the UH-60M should have been the chosen platform and would have delivered to our commitments.

Sikorsky understands that this will not change decisions in the past, but hopes that the audit will provide improvements in the selection process for future contracts. Whilst disappointed in not being chosen for this contract, Sikorsky remains committed in supporting the Commonwealth for any current and future requirements.

Please do not hesitate in contacting me (07) 3632 7000 if you require any further details to assist with considering this request.

Yours sincerely,

David Stilianos
General Manager

Page 1 of 1

Appendix 2: ADF Helicopter Strategic Master Plan

1. At the time the *ADF Helicopter Strategic Master Plan* was developed in the early 2000s there were nine helicopter types in, or entering, ADF service. The Kiowa, Black Hawk, Chinook, Iroquois, Seahawk, Squirrel and Sea King helicopters were in service, and the Tiger and Sea Sprite helicopters were under acquisition. While the Master Plan stated that as few as three helicopter types might not be practical, it considered that there would be efficiencies[274] in rationalising the nine helicopter types into three fundamental classes of platform:

- Group 1 – Multi-Role Helicopter (MRH):
  - Group 1A – Airmobile and medium lift utility; and
  - Group 1B – maritime warfare[275];
- Group 2 – The Tiger Armed Reconnaissance Helicopter (ARH), this aircraft was already in the process of being acquired; and
- Group 3 – Heavy Lift Utility, Chinook.

2. Analysis conducted by DSTO for the Master Plan, Issue 1, also identified that:

- the helicopter force required marinisation;
- increased internal volume and lift capacity was needed;
- external lift capacity would increase in importance;
- high density altitude operations would predominate; and
- improvement in human factors was required.

3. *ADF Helicopter Strategic Master Plan*, Issue 2, endorsed the requirement for a separate training helicopter that could also be used for light utility tasking and so added a fourth group of helicopters.

4. The current ADF Helicopter roadmap adds a fifth helicopter type, the naval attack helicopter, the MH-60R 'Romeo'. This recognises that the

274 Reducing the number of helicopter types would potentially realise synergies and efficiencies across personnel, tools, spares, training and facilities.

275 Group 1A and 1B imply that two different helicopters are needed that might be based on the same family of design such as the NH90 Troop Transport Helicopter (TTH) for 1A and the NH90 NATO Frigate Helicopter (NFH) for 1B, or the Sikorsky Black Hawk S70M for 1A and the Seahawk 'Romeo' for 1B.

'Airmobile and medium utility lift' helicopter is not suitable for providing anti-surface and anti-submarine maritime warfare.

5. At the time of this audit, the number of helicopter types in service had reduced from seven to six and the number of acquisitions had increased from two to four.[276] While this will ultimately lead to five aircraft types in service, Defence is currently managing the acquisition or sustainment of ten helicopter types, which is one more than when the Master Plan was first written a decade ago.

Implementation of Lessons Learned

6. Five key lessons learned were recorded in the ADF Helicopter Strategic Master Plan:

(a) Strategic Guidance should be defined through documents such as the Capability Systems Life Cycle Management Guide. Capability requirements must be clearly defined in order for the Acquisition Phase of a project to fulfil the capability requirement. Systems Engineering and endorsed Project Management Methodologies should be applied during the Requirements Definition Phase of a project utilising subject matter experts that are skilled in these disciplines.

(b) Project interfaces should be identified during the Concept Definition Phase and developed during the Requirements Phase. Wide Integrated Project Team consultation and coordination should occur to ensure interface and schedule requirements are identified and any associated project risks are appropriately mitigated.

(c) Capability Systems and Defence Material Organisation staff should be appropriately trained and qualified personnel. The ADF would benefit by 'specialising' rather that 'generalising' with career streams to ensure that the requisite corporate knowledge achieves optimum capability, cost-effectiveness and schedule requirements. This is particularly relevant to specialised areas such as Communications, Computers and Aviation.

276 The Sea King and the Iroquois were retired; the Sea Sprite acquisition was cancelled; the ARH Tiger is entering service; the MRH90, CH-47F Chinook and the MH-60R 'Romeos' are under acquisition and will replace the Black Hawk, CH-47D Chinook and the Seahawk 'Classic'; and the Helicopter Aircrew Training System (HATS) is undergoing Tender Evaluation and will replace the Kiowa and Squirrel aircraft.

(d) In order for a System's through life support costs to be appropriately analysed, the Integrated Project Team must be adequately funded and staffed. Endorsed Life Cycle Cost (LCC) calculators may be required to achieve Defence Capability and Investment Committee endorsement; this may impact on a project's Schedule and Budget given the level of detail required and may also involve official solicitation from industry.

(e) Project contracts should have some means of redress for the department in the event that the contractor fails to achieve the objectives as specified; this is particularly relevant to performance or schedule shortfalls.

Appendix 3: Technical Issues Settled by the First Deed of Agreement (Deed 1)

1. Through Deed 1, DMO and Australian Aerospace agreed to settle a number of technical issues that had been in dispute for some time. The settlement of these issues was on the basis that it was difficult to determine the liability or responsibility of the parties due to uncertainty in the interpretation of a number of requirements in the Function and Performance Specification (FPS), the Operational Concept Document (OCD) and the Statement of Operating Intent (SOI).

2. The technical issues settled by Deed 1 are funded through a cost share arrangement. Australian Aerospace is addressing many of the issues utilising its own funding, on a without admission basis. Defence is responsible for funding to a value of $24.315 million under the cost share arrangement.

3. The issues settled under Deed 1 include:

(a) **Cabin Floors and Tie Down Points**. The cabin floors are susceptible to damage.

(b) **Foreign Object Damage to Engines**. This issue relates to the engines suffering unacceptable damage from foreign objects being sucked up by the rotor.

(c) **Reliability of Engines** (stagnation and compressor cracking). This issue relates to the engines suffering stagnation and cracking problems when they are restarted within three hours of shutting down.

(d) **Foreign Object Damage to Windscreens**. This issue involves windscreens suffering unacceptable levels of cracking from foreign objects.

(e) **Inertial Reference System (IRS)** alignment at sea and improved reliability. This issue involves the IRS for the helicopters not operating correctly when the aircraft are at sea.

(f) **Helo-Ship Interface (HSI).** This relates to the aircraft "not being fully qualified" for operation on RAN vessels.

(g) **Instrumented Flight Rules (IFR).** This relates to the aircraft not meeting IFR in Australia.

(h) **Chaff and Flare Dispenser (CFD).** This relates to Australian Aerospace being late on satisfying qualification requirements for the CFD capability.

(i) **Helmet Mounted Sight Display (HMSD) Configuration**. This issue relates to the poor performance of the HMSD.

(j) **Retrofit of Mission Software Support Centre (MSSC) to Product Baseline 3 Configuration.** This will enable the MSSC to operate in combination with the Mission System Aircraft in Product Baseline 3 configuration.

4. Under Deed 1, the parties also agreed that:

- the MRH90 aircraft is intended to be a battlefield helicopter and is required to be able to operate in a range of battlefield environments (as set out in the FPS, OCD and SOI); and
- in accordance with Deed 1 and Contracts, Australian Aerospace will develop remedies to defects so as to enable the MRH90 aircraft to operate as a battlefield helicopter and in order to achieve acceptable performance of the MRH90 aircraft in Australian environments.

Appendix 4: Lead Capability Manager Assessment of MRH90 Issues, Risks and Constraints

1. The Chief of Army's 2013–14 assessment of the sustainment of the MRH90 aircraft identified the following issues, risks and constraints[277]:

Issues

- Immaturity of the MRH90 fleet significantly compromises effective and efficient support, management and operation of MRH90. Notable impacts on introduction include:
- Non-readiness of key operational systems (cargo hook, guns, Electronic Warfare Self Protection, fast roping and rappelling) are preventing capability development.
- Inability to conduct all aspects of training courses, due to operating restrictions, certification delays or lack of systems, has led to a large gap training liability.
- Inconsistent generation of aircraft flight hours, which hampers efficient planning and conduct of training and testing activities.
- The need to return aircraft (four at any time, for up to a year each) for major retrofit work reduces operationally available aircraft and complicates fleet management.
- Configuration and compatibility issues with the different aircraft types restrict fleet allocation, increase Operational Airworthiness and support management workloads, and complicate employment of related systems (e.g. mission management system, simulators).
- The need to allocate significantly more technical support manpower (per flight hour) than for the Black Hawk aircraft is likely to increase the impact on Black Hawk operations during transition.
- The continuing need to conduct a wide range of Verification and Validation activities on problematic or deficient aircraft systems.
- Extended concurrent operation of both the Black Hawk and MRH90 fleets, due to immaturity and delays with MRH90 aircraft are creating

277 MRH90 Materiel Sustainment Agreement – Army Module E to CA48, 2013–14, July 2013.

significant problems for funding of Army aviation. The inability to fund both platforms through transition is likely to require compromises to levels of capability.

Risks

- The extant contract has very limited Intellectual Property rights afforded to the Commonwealth of Australia and therefore there is no ability to compete work in the market.
- There will be continued pressure to constrain aviation costs. Potential incapacity to fund additional sustainment costs may lead to direct reductions in levels of capability.
- Reduced ability to influence software configuration may impact future operational effectiveness. Long-term sustainment may become more difficult if MRH90 specific software elements are not able to be kept aligned with core NH90 software.
- Lower-than planned aircraft availability would compromise MRH90 aircraft introduction and capability dates.

Constraints

- The tight contracting and restricted competition environment of the MRH90 capability severely limits the ability of the Capability Manager to make short to medium term changes in levels of MRH90 aircraft operations or support; either to realise efficiencies or savings, or to increase operations cost-effectively. Deed 2 is seen as means to mitigate this constraint. The extant MRH90 sustainment contract contains no effective remedies for contractor under-performance.

Appendix 5: Recommendations in the 2005–06 Armed Reconnaissance Helicopter Audit Report

1. ANAO Audit Report No. 36, 2005-06, *Management of Tiger Armed Reconnaissance Helicopter Project – Air 87*, contained the following five recommendations, which were all agreed by Defence and DMO:

> The ANAO recommends that, for future complex and strategic, high value capital acquisition projects, the Defence Materiel Organisation ensures that one of the key outcomes following tender evaluations is a formal report of the deliberations and decision of the Tender Evaluation Board, in forming its recommendation in favour of the preferred tenderer.
>
> The ANAO recommends that, the Defence Materiel Organisation undertakes periodic audits of all Intellectual Property holdings associated with the Tiger ARH aircraft and systems, with the aim of ensuring Contractor, and Sub-Contractor Intellectual Property is being maintained as required by contractual requirements.
>
> The ANAO recommends that, prior to accepting aircraft against specified capability, technical and operational airworthiness standards, the Defence Materiel Organisation completes the required testing activities, unless there is a demonstrable case for not doing so.
>
> The ANAO recommends that, Project Authorities liaise and consult closely with Capability Managers in Defence prior to finalising product acceptance, where significant operational capability issues exist.
>
> The ANAO recommends that, the Defence Materiel Organisation incorporates into final contract documentation unambiguous specifications, including required configurations for airborne weapon systems, so that the impact on the platform is fully understood.

Appendix 6: Prices of Role Equipment

1. Table A.3 lists the price of MRH90 role equipment, in June 2005 price and exchange rates.

Table A.1: Prices of role equipment

Role and Mission Equipment	Unit Price (Euros)
Sand Filter with its Servicing Cowlings (Removable Parts)	218 295
External Auxiliary Fuel Tank	206 780
Ice Protection System (Removable Parts)	184 730
3rd AC Generator for De-Icing Kit (Removable Part)	25 235
Cargo Hook (Replacement Parts)	980
Primary Rescue Hoist (Replacement Parts)	980
Winchman Ministick Control	40 099
Reinforced Heavy Store Carrier with Release Unit (set of 2) (Removable Parts)	385 924
Fast Rope System (Removable Parts) (4 beams per set)	208 250
Emergency Flotation System (Removable Parts)	186 200
Integrated Helmet Including Basic Helmet (set of 2)	529 722
Sniper Bar (1 set of 2)	25 084
2 Pintle Machine Gun Installation Support, for door with adaptation when External Fuel Tanks Fitted (for MAG 58)	119 250
3rd Crew Seat	12 821
Piloting FLIR (Removable Parts)	261 741
Cabin Armour Protection (Removable Parts for floor) including Rear Ramp Armour Protection (Removable Parts incl. lateral side)	211 354
Cockpit Armour Protection (Removable Parts including lateral side)	107 582
Cabin Armour Protection (Removable Parts for lateral side)	95 605
Weather Radar (Removable Parts)	75 379
Stretchers Supports (not including troop seats) (set of 3 stretchers)	30 380
Loadmaster Seat Inertia Reel	30 295
Personal Life Raft AERAZUR Type 16	22 797
ICS Microphone Switch for MAG 58 Pintle (retrofit)	51 978
Rotor Tip Light (retrofit)	5204
406 Litter Storage (retrofit)	88 311
Staggered MAG 58 Machine Gun Mounts	59 617
Loadmaster Seat Inertia Reel	30 295

Source: Department of Defence, *Project AIR 9000 Troop Lift Helicopter Contract (Acquisition) CAPO C338444* June 2005, Attachment B, Annex A, Price Schedule.

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