The Senate

Foreign Affairs, Defence and Trade References Committee

Use of unmanned air, maritime and land platforms by the Australian Defence Force

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Foreign Affairs, Defence and Trade Committee
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600
Australia

Phone: + 61 2 6277 3535
Fax: + 61 2 6277 5818
Email: fadt.sen@aph.gov.au
Internet: http://www.aph.gov.au/senate_fadt

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Committee Membership

Senator Alex Gallacher, **Chair**	ALP, SA
Senator Chris Back, **Deputy Chair**	LP, WA
Senator Sam Dastyari	ALP, NSW
Senator David Fawcett	LP, SA
Senator Scott Ludlam	AG, WA
Senator Anne McEwen	ALP, SA

Participating members who contributed to the inquiry

Senator the Hon Joseph Ludwig	ALP, QLD
Senator Peter Whish-Wilson	AG, TAS

Secretariat

Mr David Sullivan, Committee Secretary
Mr Owen Griffiths, Principal Research Officer
Ms Casey Mazzarella, Senior Research Officer
Ms Kimberley Balaga, Research Officer
Ms Lauren Waugh, Research Officer
Dr Ruth Edwards, Administrative Officer

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Abbreviations

A2/AD	anti-access/area-denial
ACUO	Australian Certified UAV Operators Inc.
ADF	Australian Defence Force
AFP	Australian Federal Police
ASPI	Australian Strategic Policy Institute
ASW	anti-submarine warfare
CASA	Civil Aviation Safety Authority
CCW	UN Convention on Certain Conventional Weapons
CMSL	Centre for Military and Security Law
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCP	Defence Capability Plan
DSTO	Defence Science and Technology Organisation
HALE	high altitude long endurance
ICAO	International Civil Aviation Organisation
ICRC	International Committee of the Red Cross
IHL	international humanitarian law
ISR or ISTAR	intelligence, surveillance, target acquisition and reconnaissance
LOAC	law of armed conflict
MALE	medium altitude long endurance
MTCR	Missile Technology Control Regime
NT	Northern Territory
PED	processing, exploitation and dissemination
PREMT	Programme on the Regulation of Emerging Military Technology
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RPA	remotely piloted aircraft
UAV	unmanned aerial vehicle
UAS	unmanned aerial system
UCAV	unmanned combat air vehicle

UGV	unmanned ground vehicles
UK	United Kingdom
US	United States
USV	unmanned surface vehicle
UUV	unmanned underwater vehicle

Recommendations

Recommendation 1

8.6 The committee recommends that the Department of Defence strengthen its public communications in relation to military unmanned platforms.

Recommendation 2

8.11 The committee recommends that the Australian Defence Force acquire armed unmanned platforms when the capability requirement exists and the Australian Government make a policy statement regarding their use. This policy statement will:

- **affirm that armed unmanned platforms will be used in accordance with international law;**
- **commit that armed unmanned platforms will only be operated by the Australian Defence Force personnel; and**
- **include appropriate transparency measures governing the use of armed unmanned platforms.**

Recommendation 3

8.14 The committee recommends that the Australian Defence Force notify the Australian Government of measures taken to address any identified gaps training and dissemination programs regarding the law of armed conflict and international humanitarian law when armed unmanned platforms are acquired.

Recommendation 4

8.20 The committee recommends the Australian Government:

- **increase funding for innovation in the relation to unmanned platforms; and**
- **establish a Defence Unmanned Platforms Centre as a cooperative research centre in the area of military unmanned platforms.**

Recommendation 5

8.24 The committee recommends that strategic engagement with the Australian unmanned platform industry be addressed in the forthcoming Defence Industry Policy Statement.

Recommendation 6

8.27 The committee recommends that the Australian Government:

- **consider establishing additional support facilities for the Triton in the Northern Territory; and**
- **review the future deployment and support needs of Australian Defence Force unmanned platforms in the Australia's north.**

Recommendation 7

8.33 The committee recommends that the Australian Government support international efforts to establish a regulatory regime for autonomous weapons systems, including those associated with unmanned platforms.

Recommendation 8

8.34 The committee recommends that following the release of the Defence White Paper 2015 the Australian Defence Force review the adequacy of its existing policies in relation to autonomous weapons systems.

Recommendation 9

8.37 The committee recommends that Defence, the Civil Aviation Safety Authority and Airservices Australia increase their cooperation to facilitate the safe use of unmanned platforms in Australian airspace.

Chapter 1

Introduction

Referral

1.1 On 28 October 2014, the Senate referred an inquiry into the potential use of unmanned platforms by the Australian Defence Force (ADF) to the Foreign Affairs, Defence and Trade References Committee for inquiry and report by 25 June 2015.[1]

1.2 The terms of reference for the inquiry are as follows:

> The potential use by the Australian Defence Force of unmanned air, maritime and land platforms, with particular reference to:
>
> (a) their role in intelligence, reconnaissance and surveillance operations, including in support of border security, civil emergencies and regional cooperation;
>
> (b) their cost- and combat-effectiveness in relation to conventional military platforms;
>
> (c) the Government's force structure review and defence capability plan;
>
> (d) challenges, opportunities and risks associated with their deployment;
>
> (e) domestic and international legal, ethical and policy considerations;
>
> (f) research and development capabilities and Australia's industrial expertise;
>
> (g) transport, health and air safety implications; and
>
> (h) other related matters.

Conduct of inquiry

1.3 The committee advertised the inquiry on its website and in *The Australian* newspaper. The committee also wrote to individuals and organisations likely to have an interest in the inquiry inviting them to make written submissions. The committee has received 25 submissions to the inquiry, two of which were accepted as confidential. The Civil Aviation Safety Authority (CASA) and the RAND Corporation also provided the committee with additional information.[2] Public submissions are listed at Appendix 1. The committee held public hearings for the inquiry on 14 April 2015, 4 May 2015 and 13 May 2015 at Parliament House in Canberra. A list of hearings and witnesses who appeared before the committee is at Appendix 2.

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1 *Journals of the Senate*, 28 October 2014, p. 1629.

2 Lynn Davis et al, 'Armed and Dangerous?: UAVs and US Security', *RAND Corporation Report*, 2014; CASA, 'Remotely Piloted Aircraft Systems', *Information paper*, 2015.

1.4 All public submissions, additional information received, public hearing transcripts and answers to questions on notice are available via the committee's website: www.aph.gov.au/senate_fadt.

Policy context

1.5 The previous Defence White Paper in 2013 considered that the 'importance of unmanned air, maritime and land platforms to future ADF operations and the future force needs further investigation'. It stated:

> These platforms, particularly unmanned aircraft, are proliferating not only among national defence forces around the world, but also civil organisations and non-state actors. With stealth and the ability to loiter for extended periods, these systems have advantages for intelligence, surveillance and reconnaissance, including in support of Australia's border security needs. Armed unmanned systems will be available in greater variety and sophistication in years to come.[3]

Defence White Paper 2015 and Force Structure Review

1.6 On 4 April 2014, the Prime Minister and the then Minister for Defence, announced that the Department of Defence (Defence) would produce a new Defence White Paper to be released in mid-2015. The Defence White Paper 2015 website outlines:

> A fully-costed Force Structure Review will underpin the White Paper. The Force Structure Review will assess Defence's future capability needs and propose a force structure that addresses Australia's defence objectives within an agreed allocation of funding…
>
> Following the release of the 2015 Defence White Paper, Defence will publish a 10-year Defence Capability Plan and a Defence Industry Policy Statement to provide defence industry with greater certainty about the Government's key priorities and timeframes.[4]

1.7 The Defence Capability Plan (DCP) is intended to provide industry with guidance regarding Defence's capability development priorities and contain major capital equipment acquisition proposals planned for Government consideration. The last public version of the DCP was released in 2012.[5]

1.8 The Defence submission noted that the 'Force Structure Review (FSR) will consider the utility and cost benefit of unmanned systems within the ADF, particularly where the opportunity exists to improve operational effectiveness and reduce personnel risk in the land, maritime and air environments':

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3 Department of Defence, *Defence White Paper 2013*, p. 19.

4 Department of Defence, '2015 Defence White Paper', available at http://www.defence.gov.au/Whitepaper/default.asp (accessed 6 April 2015).

5 Department of Defence, *Defence Capability Plan 2012*, p. 1.

> The FSR will continue to focus on the capability benefits, and will develop a number of options for Government consideration that include unmanned systems integrated into the force, but it will not specifically include or exclude any system depending on whether it is manned or not. The FSR is still developing the Preferred Future Force and it would be premature to provide details as to what may or may not be under consideration at this point.[6]

House of Representatives committee report on privacy and safety

1.9 In July 2014, the House of Representatives Standing Committee on Social Policy and Legal Affairs tabled the report from its inquiry into unmanned aerial vehicles (UAVs) and the regulation of air safety and privacy. The committee recommended additional consultation in the development of air regulation and that the Australian government consider introducing legislation to provide protections against privacy-invasive technologies such as UAVs.[7]

First Principles Review

1.10 On 1 April 2015, the Minister for Defence released the First Principles Review (FPR). The Minister noted that the government had agreed or agreed-in-principle to 75 of the 76 recommendations made by the FPR. In particular, the FPR recommended that the Defence Materiel Organisation be disbanded and its core responsibilities transferred to a new Capability Acquisition and Sustainment Group within the Department. However, the government did not agree to the recommendation relating to the Defence Science and Technology Organisation (DSTO) becoming part of the new Capability and Acquisition Group 'at this time'.[8]

Structure of the report

1.11 The remainder of the report is structured as follows:

> Chapter 2 provides a brief background to the use of unmanned platforms, including current use by the ADF;
>
> Chapter 3 examines the effectiveness of unmanned platforms as military assets;
>
> Chapter 4 considers some of the defence policy issues arising from the use of unmanned platforms by the ADF;
>
> Chapter 5 looks at certain legal issues arising from ADF use of unmanned platforms;

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6 *Submission 23*, pp 10-11.

7 Standing Committee on Social Policy and Legal Affairs, *Eyes in the sky*, July 2014.

8 The Hon Kevin Andrews MP, Minister for Defence, 'First Principles Review of Defence', *Media release*, 1 April 2015.

Chapter 6 considers Australian research and industry engagement issues as well as acquisition and procurement issues;

Chapter 7 considers the airspace regulatory issues raised during the inquiry; and

Chapter 8 contains the committee's view and recommendations.

Acknowledgements

1.12 The committee thanks all those contributed to the inquiry by making submissions, providing additional information and appearing to give evidence at hearings.

Chapter 2

Background

Introduction

2.1 This chapter will provide a background to the inquiry including the increasing use of military unmanned platforms, use of unmanned aerial vehicles (UAVs) by the United States (US), the proliferation of UAV capability and ADF use of unmanned platforms.

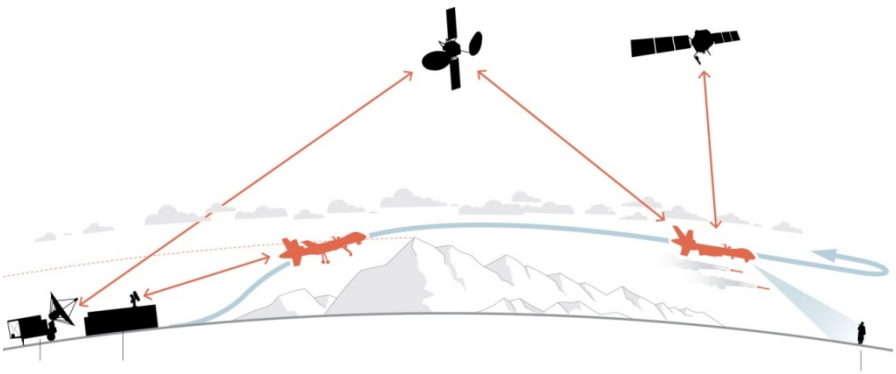
Terminology

2.2 While popularly referred to as 'drones', unmanned platforms are an area of defence technology rich in acronyms and abbreviations. The range of terminology has been increased by a differing focus on the unmanned vehicle/unit itself and the associated systems of communication and control. In particular, the numbers and categories of UAV (also referred to as remotely piloted aircraft (RPA) or unmanned aircraft systems (UAS)) have soared in recent years. For convenience, the term 'unmanned platform' has been used in the committee's report to refer to all complex remotely operated devices and their associated communication and control systems.

Unmanned platforms

2.3 Unmanned platforms often have a number of common characteristics. These include the structure of the platform itself, the external control system (such as a ground control station), the communications system which links to the control system, and the payload (which could include sensors or munitions). Automated functions are also often incorporated such as waypoint navigation via GPS.

Figure 2.1. Visualisation of UAV communications.[1]



1 Extracted from Alberto Cuadra and Criag Whitlock, 'How drones are controlled', *The Washington Post*, 20 June 2014.

2.4 There are differing views on the first uses of unmanned platforms in a military context.[2] Notably, in the 1950s, the Australian Government Aircraft Factory produced advanced 'target drones' (the GAF Jindivik) as part of an agreement with the United Kingdom (UK) for guided missile testing. The Defence submission observed that the popular term 'drone' may originate from the striped painted fuselage of aerial targets.[3] However, the first modern use of unmanned platforms is frequently identified as the US use of the Ryan Fire Fly and Lightning Bug (Teledyne, US) high altitude unmanned jets over South East Asia and North Vietnam in the early 1960s.[4] These were target drones designs adapted for long range surveillance over conflict zones.

UAV use by the United States

2.5 Since 2001, the US has attacked hundreds of targets in Afghanistan, Northwest Pakistan, Yemen and Somali using armed medium altitude long endurance (MALE) UAVs as part of counter-terrorism operations.[5] Some of these operations have been criticised by human rights groups and others in relation to their legality and the number of civilian casualties associated with these attacks. For example, the Programme on the Regulation of Emerging Military Technology (PREMT) submission notes that the 'rather extensive armed UAV programme of the US has proven to be highly controversial, engendering significant public debate in the US and provoking widespread discontent in the countries in which the aircraft operate'.[6] Statements by US President Barack Obama on 23 May 2013, at the National Defense University in Washington, have been reported as signalling a shift policy to reducing the number of armed UAV strikes conducted by the US.[7]

Proliferation of UAV capability

2.6 Australia, and many other developed countries, are partners to a number of defence technology export regimes which can cover certain unmanned platforms. For example, the Missile Technology Control Regime (MTCR) is an informal and voluntary association of 34 nations which seeks to coordinate national export licensing efforts aimed at discouraging the proliferation of unmanned delivery systems capable of carrying weapons of mass destructions. Other countries such as Israel,

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2 For example, Brendan Gogarty and Isabel Robinson, 'Unmanned vehicles: A (rebooted) history, background and current state of the art, *Journal of Law, Information and Science*, Volume 21(2), 2011/12, p. 3.

3 *Submission 23*, p. 7.

4 For example, Mr Brian Weston, *Submission 4*, p. 1.

5 For example, Chris Woods, 'The Story of America's Very First Drone Strike', *The Atlantic*, 30 May 2015.

6 *Submission 22*, p. 3.

7 White House, 'Remarks by the President at the National Defense University', *Speeches and Remarks*, 23 May 2013, available at https://www.whitehouse.gov/the-press-office/2013/05/23/remarks-president-national-defense-university (accessed 10 April 2015).

India and China have indicated they will abide by the rules of these defence export control regimes to varying degrees.

2.7 Nonetheless, advanced unmanned platforms (many capable of being armed) appear to be proliferating. In the US, there has been internal debate about the appropriate defence export controls on military UAVs.[8] US sales of armed UAVs have been limited to the United Kingdom (UK), although other countries have purchased large unmanned systems. On 17 February 2015, the US State Department announced a 'new policy, governing the international sale, transfer and subsequent use of US-origin military UAS' as part of a 'policy review which includes plans to work with other countries to shape international standards for the sale, transfer, and subsequent use of military UAS'. It noted:

> The new policy also maintains the United States' long-standing commitments under the Missile Technology Control Regime (MTCR), which subjects transfers of military and commercial systems that cross the threshold of MTCR Category I (i.e., UAS that are capable of a range of at least 300 kilometers and are capable of carrying a payload of at least 500 kilograms) to a "strong presumption of denial" for export but also permits such exports on "rare occasions" that are well justified in terms of the nonproliferation and export control factors specified in the MTCR Guidelines.[9]

2.8 Under the new policy, the US will require recipients to agree to principles guiding the proper use of US-origin military UASs:

> Recipients are to use these systems in accordance with international law, including international humanitarian law and international human rights law, as applicable;
>
> Armed and other advanced UAS are to be used in operations involving the use of force only when there is a lawful basis for use of force under international law, such as national self-defense;
>
> Recipients are not to use military UAS to conduct unlawful surveillance or use unlawful force against their domestic populations; and
>
> As appropriate, recipients shall provide UAS operators technical and doctrinal training on the use of these systems to reduce the risk of unintended injury or damage.[10]

2.9 The development of cheaper UAVs suitable for intelligence, surveillance and reconnaissance (ISR) has meant they have become available to almost all modern

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8 For example, Jessica Schulberg 'Why is the US so stingy with its drones. It's costing us', *New Republic*, 2 July 2014.

9 US Department of State, 'US Export Policy for Military Unmanned Aerial Systems', *Fact sheet*, 17 February 2015.

10 US Department of State, 'US Export Policy for Military Unmanned Aerial Systems', *Fact sheet*, 17 February 2015.

militaries at the lower end of capability. Although the US, UK and Israel are the main users of armed UAVs, other countries such as Russia, China, Iran, India, South Korea and Taiwan, for example, have begun to develop increasingly sophisticated unmanned platform capabilities. Other countries, including Pakistan, Turkey, Saudi Arabia and the United Arab Emirates (UAE) have announced their intention to acquire them.[11] Northrop Grumman commented:

> In a global context, use of unmanned systems continues to grow at a rapid pace – the last decade seeing an exponential increase especially in UAS, primarily performing ISR missions, and with increasing use in command and control, communications relay, battlespace awareness, force protection, ordnance delivery and logistics.[12]

2.10 A Council of Foreign Relations report in 2014 on armed UAVs noted:

> According to industry estimates, international interest in armed drones has grown in the wake of Iraq and Afghanistan. The drone market is expected to grow from [US]$5.2 billion in 2013 to [US]$8.35 billion by 2018. While drones are still a relatively small portion of the overall defense market, the segment with the "biggest potential" is the demand for medium-altitude long-endurance (MALE) drones, such as the Predator and Reaper.[13]

2.11 Increasingly, UAVs have been perceived as an important sovereign capability. For example, in May 2015, Italy, Germany and France announced an agreement to commence a MALE UAV development program. The German Defence Minister, Ursula von der Leyen, was reported as commenting:

> The goal of the Euro-drone is that we can decide by ourselves in Europe on what we use it, where we deploy the Euro-drone and how we use it… This makes us, the Europeans, independent.[14]

2.12 A recent report to the US Congress on military and security developments in China has indicated that it was 'advancing its development and employment of UAVs':

> Some estimates indicate China plans to produce upwards of 41,800 land and sea-based unmanned systems, worth about [US]$10.5 billion, between 2014 and 2023. During 2013, China began incorporating its UAVs into military exercises and conducted ISR over the East China Sea...In 2013, China unveiled details of four UAVs under development—the Xianglong,

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11 Micah Zenko and Sarah Kreps, Council of Foreign Relations, *Limiting Armed Drone Proliferation*, Council Special Report No. 69, June 2014, p. 5.

12 *Submission 12*, p. 2.

13 Micah Zenko and Sarah Kreps, Council of Foreign Relations, Limiting Armed Drone Proliferation, Council Special Report No. 69, June 2014, p. 7.

14 Tom Kingston and Pierre Tran, 'European Ministers to study MALE UAV program', *Defence News*, 19 May 2015.

Yilong, Sky Saber, and Lijian—the last three of which are designed to carry precision-strike capable weapons.[15]

Stealth, combat and autonomy

2.13 Research and development in relation to large military UAVs appears to have moved from focusing on platforms intended to operate in non-contested airspace to platforms designed to operate in contested or denied airspace. The focus on these types of unmanned platforms is arguably driven by advances in the anti-access/area denial (A2/AD) capabilities of other countries. A2/AD capabilities include anti-aircraft and anti-ship missile systems which could potentially prevent aircraft and carrier fleets from approaching strategically significant areas.

2.14 Some of these new unmanned platforms rely on low-observability, high manoeuvrability, hypersonic flight and increased levels of autonomy from remote operators. For example, the Taranis Unmanned Combat Air Vehicle (UCAV) (UK Ministry of Defence/BAE Systems) demonstrator incorporates stealth technology and is designed for long range missions. The Taranis is described as having 'full autonomy' elements.[16] Similarly, the US Navy X-47B demonstrator (Northrop Grumman, US) is another stealth-focussed UCAV platform designed to be launched from an aircraft carrier. This is one design of the US Navy's Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) program. As currently envisioned UCLASS UAVs will have 'deterministic autonomy' within pre-set parameters such as decisions on when to conduct aerial refuelling.[17] China is also reportedly developing stealth-focused UAVs.[18]

Figure 2.2 Taranis UCAV demonstrator[19]

15 US Department of Defence, *Annual report to Congress: Military and Security Developments Involving the People's Republic of China*, May 2015, p. 36.

16 BAE Systems, 'About Taranis', available at http://www.baesystems.com/enhancedarticle/BAES_157659/taranis-unmanned (accessed 23 June 2015).

17 Marina Malenic, 'Surveillance or Strike?', *IHS Jane's Defence Weekly*, Issue 22, Vol 52, 3 June 2015, p. 31.

18 US Department of Defence, *Annual report to Congress: Military and Security Developments Involving the People's Republic of China*, May 2015, p. 36.

19 From Matthew Grimson and Mark Corcoran, 'Taranis drone: Britain's $336m supersonic unmanned aircraft launched over Woomera', *ABC News*, 7 February 2014.

2.15 The line between unmanned platforms and guided munitions is also being blurred. For example, the Harop (IAI, Israel) is a long range 'loitering munition', controlled in-flight by a remote operator, designed to detect and attack air defence radar systems by self-destructing into them. Similarly, the Switchblade (AeroVironment, US) is an expendable small UAV equipped with an explosive warhead which has been used by US Marines in Afghanistan.

Counter-UAV research focus

2.16 As unmanned platforms have proliferated as a component of military arsenals around the world, research has increasingly focused on developing effective counter-UAV technologies. Some commentators have highlighted that small low-cost civilian 'drones' are already being utilised by non-State actors. For example, on 17 March 2015, US Central Command noted an airstrike by US and Coalition forces destroyed 'an [Islamic State] remotely piloted aircraft' for the first time in Iraq.[20] The RAND Corporation's report on UAVs commented:

> The availability of this technology means it is likely that states hostile to the United States will acquire it in the foreseeable future. They could use it for suppression of internal enemies, or to support ground combat units, the way the United States uses it today. This is not an insurmountable threat to U.S. operations, but the United States is not yet prepared to deal with it. Current U.S. doctrine for short-range air defense is primarily concerned with defeating attacking helicopters with missiles. The United States may have to develop new defensive systems as the threat from small UAVs emerges.[21]

2.17 Similarly, the Sir Richard Williams Foundation has recently argued that 'defensive capabilities must also be developed in case such systems are used against Australia and Australian forces'.[22]

2.18 In the US, there have been a number of recent developments in counter-UAV research. Last year, the US Navy demonstrated a ship-mounted directed energy weapon system, including against a UAV target.[23] The US Joint Integrated Air and Missile Defense Organization has arranged a counter-UAV demonstrator event focused on adapting existing and new air defence capabilities to UAV threats.[24] The

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20 US Central Command, 'March 18: Military Airstrikes Continue Against ISIL in Syria and Iraq', *Operation Inherent Resolve News Release*, 18 March 2015.

21 Lynn Davis et al, 'Armed and Dangerous?: UAVs and US Security', RAND Corporation Report, 2014, p. 4.

22 Sir Richard Williams Foundation, 'Protecting Australia with UAS', Special Report, February 2014, p. 9.

23 Matthew Peach, ' US Navy ship-mounted 30kW laser weapon tested in Persian Gulf', *Optics*, 10 December 2014, available at http://optics.org/news/5/12/18 (accessed 10 April 2014).

24 Joshua Stewart, 'Modified UAVs raise concerns for infantry', *Marine Corps Times*, 2 August 2014.

US Army last year issued a 'request for information' on counter unmanned aerial system capabilities. It observed:

> US FORCES will be increasingly threatened by reconnaissance and armed Unmanned Aerial Vehicles (UAVs) in the near and far future. These threats can be employed against all echelons of US FORCES. These threats do or may employ a variety of sensors and operate at a variety of tactical levels. These levels include micro sized to large UAVs and operate with varying altitude and speed.[25]

Increasing development of ground, surface and undersea vehicles

2.19 Research and development in relation to unmanned platforms is also extending to unmanned ground vehicles (UGVs), unmanned surface vehicles (USV) and unmanned undersea vehicles (UUVs). This is illustrated by a number of projects including:

- the US Defense Advanced Research Projects Agency (DARPA) has funded the development of the Legged Squad Support System, a quadruped robot which can be controlled by voice command and is designed to function as a packhorse for troops;
- the Guardium (IAI/Elbit, Israel) is a four-wheel medium size surveillance UGV Force equipped with cameras, sensors and a loud speaker used by the Israeli Defence for border patrol duties;
- the Protector (Rafael, Israel) is a USV based on a rigid-hulled inflatable boat which can be armed. The Protector has been deployed by the Israeli Defence Force and Republic of Singapore Navy; and
- the Remus (Kongberg, Norway) is a UUV remotely operated from a laptop which has been used for mine clearance.[26]

Figure 2.3 Guardium UGV[27]

25 US Department of Army, *Request for Information: Counter Unmanned Aerial System Capability*, 20 February 2014, available at https://www.fbo.gov/index?s=opportunity&mode=form&id=94d4624458cac9978a69abc1ff6ccbd3&tab=core&_cview=0 (accessed 19 March 2015).

26 *Submission 1*, Gary Martinic, 'Unmanned Maritime Surveillance and Weapons Systems', *Journal of the Australian Naval Institute*, p. 88.

27 From G-Nius Unmanned Ground Systems, 'Guardium MK 1', available at http://g-nius.co.il/unmanned-ground-systems/index.php (accessed 23 June 2015).

ADF use of unmanned platforms

2.20 The ADF has previously used unmanned platforms in a number of contexts. However, these utilisations have not involved the use of force. The Defence submission noted that '[a] number of Defence Capability Plan (DCP) projects and other projects are presently focused on unmanned capabilities; however, the DCP does not currently contain a project to procure an armed unmanned platform or system'.[28]

Unmanned Ground Vehicles

2.21 The Australian Army has used several UGVs mainly focused on explosive detection and removal. For example, the ADF has purchased and utilised Talon UGV in Afghanistan. This platform has been used for disposal of improvised explosive devices (IEDs), reconnaissance, the identification of hazardous material and combat engineering support. The Defence submission noted that 'Project Land 3025 is focused on investigating and procuring additional UGV or UAS to support explosive ordnance search and disposal'.[29]

Unmanned Surface Vehicles

2.22 Defence outlined that the 'Navy does operate unmanned surface (on water) vehicles (USV) in the Fleet training support role, where this capability is focused on the reduction of risks to personnel and the provision of increased training fidelity'. It described these USV capabilities as 'human-in-the-loop' controlled.[30]

Unmanned Undersea Vehicles

2.23 The Royal Australian Navy (RAN) Huon class mine hunters are equipped with Double Eagle (Saab, Sweden) tethered remote operating vehicles, primarily intended for the disposal of naval mines. The vehicle's payload can consist of scanning sonar, echo locations, or self-navigation systems and have an extendable manipulator arm which can be used to place a small explosive charge on a naval mine.

2.24 The Defence submission noted that Project SEA1778 'seeks to acquire autonomous underwater vehicles for mine detection and classification, expendable mine neutralisation systems for mine identification and disposal, and unmanned surface vehicles for towing the in-service influence minesweeping equipment'.[31] It also stated that 'autonomous underwater vehicle (AUV) systems have been used for experimentation in hydrographic survey and clearance diving tasks'.[32]

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28 *Submission 23*, p. 9.

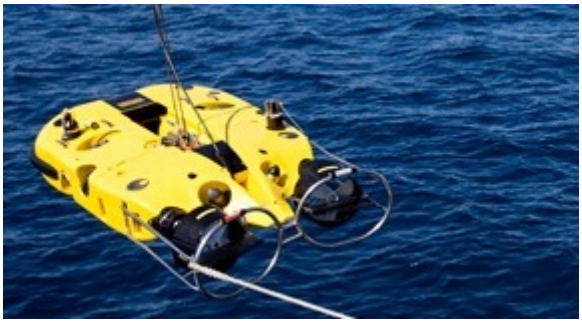
29 *Submission 23*, p. 10.

30 *Submission 23*, p. 9.

31 *Submission 23*, p. 10.

32 *Submission 23*, p. 9.

Figure 2.4 – Double Eagle UUV[33]



Unmanned Aerial Vehicles

Tactical UAV

2.25 The ADF has used tactical UAVs to support operations in Iraq and Afghanistan, in particular, the Skylark (Elbit Systems, Israel) and the RQ-11 Raven (AeroVironment, US). These are 'miniature' light weight short range UAVs which are launched by hand and usually equipped to provide 'over the horizon' ISR. The ADF has recently commenced training with the RQ-12 Wasp (AeroVironment, US).[34] The Defence submission noted the RAN is presently reviewing options for a small, tactical UAS to be employed in the provision of ISR for counter-piracy operations.[35]

Figure 2.5 Skylark UAV launch[36]

33 From DSTO, 'Mine Countermeasures and Hydrographic Operations', available at 23 June 2015, http://www.dsto.defence.gov.au/projects/mine-countermeasures-and-hydrographic-operations (accessed 23 June 2015).

34 Philip Smart, 'ADF trains on Wasp small UAS', *Australian Defence Magazine*, 22 June 2015.

35 *Submission 23*, p. 9.

36 From Tom Muir, 'The ADF's love affairs with tactical UAVs', *Australian Defence Magazine*, 19 March 2015.

Heron

2.26 The Royal Australian Air Force (RAAF) currently operates the Heron UAV (IAI, Israel) from RAAF Base Woomera for training purposes. Australia's Heron UAVs completed more than 27,000 mission hours in Afghanistan and provided high resolution ISR support to Australian forces and the International Security Assistance Force in southern Afghanistan. Australia's Heron detachment in Afghanistan flew its final mission for Operation SLIPPER from the Kandahar Air Field on 30 November 2014. The Defence submission noted:

> In October 2014, the former Minister for Defence announced that Air Force would be returning a limited Heron-1 capability to Australia following the end of its mission in December 2014. Australia will operate two Heron-1 platforms in Australia to support the integration of complex UAS into the Australian environment. The repatriation will also support the retention and development of tactics and procedures for overland ISR gained during four years of Heron operations in Afghanistan.[37]

Figure 2.6 – Heron UAV[38]

Shadow

2.27 The RQ-7 Shadow (AAI, US) tactical UAV has been used by the Australian Army 20th Surveillance and Target Acquisition Regiment for reconnaissance, surveillance, target acquisition and battle damage assessment. The Defence submission noted the Shadow had been 'employed extensively in Afghanistan, has been typically tasked in route reconnaissance, point reconnaissance and surveillance flights to monitor "pattern of life" activities using sensors such as electro-optic and infrared cameras. It stated that '[l]ike the United States Army, the Australian Army utilises its soldiers to operate the Shadow 200, which is different to the Australian Air Force, who employ qualified pilots to operate the Heron-I'.[39]

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37 *Submission 23*, p. 8.

38 From Mark Corcoran, 'The kill chain: Australia's drone war', ABC News, 27 June 2012, available at http://www.abc.net.au/news/2012-06-08/australias-drone-war-in-afghanistan/4058058 (accessed 23 June 2015).

39 *Submission 23*, p. 9.

2.28 The Defence submission outlined that the 'Joint Project (JP) 129 will continue to support and update the Shadow 200 UAS capability as used in operations in Afghanistan predominantly by ground forces' and 'the project will also seek to procure small tactical UAS capabilities to support tactical ISR'.[40]

Figure 2.7 – Shadow UAV launch[41]

Triton

2.29 On 13 March 2014, the Prime Minister committed the Australian Government to acquiring the MQ-4C Triton (Northrop Grumman, US) for use by the ADF. The Prime Minister's media release noted that '[t]he total number of Triton UAVs to be acquired and their introduction into service date will be further considered by Government in 2016, based on the Defence White Paper'.[42]The Tritons will be based at RAAF Base Edinburgh in South Australia and will operate from the runway alongside the manned P-8A Poseidon maritime surveillance aircraft when it enters RAAF service. The MQ-4C Triton will operate alongside the P-8A Poseidon to replace the current AP-3C Orion capability.

2.30 The Defence submission noted that the 'Triton is an unarmed UAS that is capable of High Altitude Long Endurance (HALE) flight, as well as being tactically agile to descend to medium altitudes as required' and will be fitted with radar, electronic support and electro-optic sensors.[43]

40 *Submission 23*, p. 10.

41 From Australian Army, 'Shadow 200', available at http://www.army.gov.au/Our-future/Projects/Aviation-projects/Shadow-200 (accessed 23 June 2015).

42 The Hon Tony Abbott MP, Prime Minister, 'Triton Unmanned Aerial Vehicles to Boost Maritime Surveillance Capabilities', *Media Release*, 13 March 2014.

43 *Submission 23*, p. 10.

Reaper training

2.31 The Defence submission stated:

> Air Force is considering a program to fund the embedding of ADF members into 'allied' UAS units. This activity will inform the ADF of the support and operational characteristics of complex UAS systems, as operated by our close allies, should the ADF seek to acquire similar systems in the future.[44]

2.32 On 23 February 2015, the Parliamentary Secretary to the Minister for Defence, the Hon Darren Chester MP, announced that the RAAF had commenced training aircrew and support staff on MQ-9 Reaper (General Atomics, US) operations in the United States. The media release stated 'the training program provides a cost effective method to increase the ADF's understanding of complex UAS operations and how this capability can be best used to protect Australian troops on future operations'.[45] At the April public hearing, Defence confirmed six RAAF personnel were undertaking Reaper training in the US.[46]

Figure 2.8 – US Reaper UAV[47]

44 *Submission 23*, p. 10.

45 The Hon Darren Chester MP, Parliamentary Secretary to the Minister for Defence, 'Air Force commences unmanned aerial system training in the United States', *Media Release*, 23 February 2015.

46 Air Vice-Marshal Gavin Davies, Defence, *Committee Hansard*, 14 April 2015, p. 48.

47 From US Air Force, 'MQ-9 Reaper', available at http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104470/mq-9-reaper.aspx (accessed 23 June 2015).

Chapter 3

Effectiveness

Introduction

3.1 This chapter will examine the effectiveness of unmanned platforms. This includes:

- the advantages of unmanned platforms;
- the cost-effectiveness of unmanned platforms;
- unmanned platforms in contested areas;
- the reliance of unmanned platforms on communications;
- the complementary role of unmanned platforms to manned platforms; and
- the reliability of unmanned platforms.

Advantages of unmanned platforms

3.2 A large number of submissions highlighted the technical advantages of unmanned platforms, particularly UAVs. Factors which were commonly listed included:

- risk reduction for pilots and assets;
- longer flight times and the ability to 'loiter' in target areas;
- larger geographic areas which can be covered for ISR;
- stealthy operation, lower observability profile, smaller size;
- lower cost of acquisition and operation than existing manned platforms including training, components and maintenance;
- flexible and reconfigurable payloads; and
- less demand on pilots/operators with the capacity to follow pre-programmed flight paths.

3.3 Defence characterised the ADF's adoption of unmanned platforms as occurring for the same reasons they had been taken up in the commercial sector—to reduce risks to personnel and to extend capabilities.[1] Several contributors summarised the advantages of unmanned platforms as being a preferred alternative for 'dull, dirty, dangerous' missions. For example Northrop Grumman explained:

> Dull missions might include lengthy intelligence, surveillance and reconnaissance (ISR) missions that involve prolonged periods of monitoring and observation. Dirty missions are those that might expose

1 *Submission 23*, pp. 5-6.

> personnel to hazards, such as when undertaking chemical, biological, and nuclear detection operations. Dangerous missions are those that might be conducted in lethal operational environments. Unmanned systems perform all of these missions with far less risk to the operating personnel.[2]

3.4 Defence highlighted that unmanned systems are often able to provide a capability not previously available to commanders:

> The persistent surveillance provided by UAS platforms such as the Shadow, Heron and (in future) Triton, is considered a force multiplier for forces being supported. The utility of smaller platforms is that they can provide small ground elements with an airborne surveillance asset not previously available. Due to the smaller size of unmanned systems they are more economical, and can typically fly longer without refuelling or the risk of pilot fatigue. The ability to supplement traditional air elements in a cost-effective manner is a principal advantage of the smaller unmanned systems.[3]

3.5 Persistence was repeatedly identified as the key advantage of unmanned platforms, particularly UAVs. For example, Mr Brian Weston observed that aerial persistence was previously only achievable 'by cycling multiple manned aircraft…rapidly running down fleet and crew availability in the process'.[4] Similarly, Mr Anthony Patterson from Cobham Aviation Services, stated:

> With a manned aircraft you are essentially limited, depending on the crewing arrangements, to somewhere between six and 12 hours, and you have to return to a base of operations to swap out the crew. The real benefit of unmanned systems in the space is the fact that they can stay airborne, depending on the altitudes you are operating at, for 20 to 40-plus hours.[5]

Cost effectiveness

3.6 A number of complexities were observed in relation to the cost effectiveness of unmanned platforms. Several submitters and witnesses emphasised the 'back-end' of unmanned platform systems needed to be considered as well as the 'front-end' of the platform itself. Defence commented:

> Notwithstanding that the direct per hour operating costs associated with unmanned systems may be cheaper than traditional manned platforms, the total cost of the capability must be considered. Unmanned systems still require 'human-in-the-loop' procedures for operations, maintenance, and, where relevant, ISR data exploitation and dissemination. For systems that are capable of operating 24 hours a day, 7 days a week, the manpower overhead for operating and data processing becomes significant. In the case

2 *Submission 12*, p. 2.

3 *Submission 23*, p. 12.

4 *Submission 4*, p. 3.

5 *Committee Hansard*, 4 May 2015, p. 2.

> of UAS, the simple metric of cost per flying hour is not an accurate reflection of the true cost of operations.[6]

3.7 However, Defence also observed that for UGVs and UUVs involved explosives neutralisation or naval mine detection 'the cost of the system can easily be mitigated against the potential price of a human life'.[7] Similarly, Air Vice-Marshal Gavin Davies made the point that 'economy' is not just measured in dollars but is also 'about the ability to conduct the mission':

> If you were to consider, in a maritime domain, the acquisition of Triton, we are able to reach areas in Australia's maritime approaches that we could get persistence in, to identify whatever the mission is of the day for further ranges—we can stay for longer, we can gather more data and then make an assessment beyond that. The range of Triton is considerable; it is an economy of its own.[8]

3.8 Northrop Grumman described the assertion that UAVs are cheaper to buy or operate as 'overly simplistic and misleading'. It argued that a shift in perspective was essential 'to ensure that Australian force structure reviews no longer simply focus on platforms, but systems'.[9] It argued the 'up front capital comparisons with manned aircraft are often misleading as they are rarely based on a credible comparable operational metric, such as "surveillance product per square km"; rather simply being based on the "cost per flight hour" a measure that often bears little relationship to the "cost per unit of operational capability". It noted:

> Operators of military aircraft systems may point out that a fleet of UAS requires a significant number of ground based operators to analyse the enormous amount of data collected by the systems, and to support missions spanning 24 hours or longer...[10]

3.9 The increased use of civilian contractors and non-specialist personnel to operate unmanned platforms was a related issue. It was noted during the inquiry that Australia had been slow in adopting a civilian contractor base for UAV support for forward deployed areas of operation. It was also argued that efficiencies were being missed through an operational model of one pilot per aircraft and aircraft maintenance undertaken by trade-qualified aircraft technicians. Potentially, multiple unmanned platforms could be controlled from one ground station with significant maintenance being undertaken by non-technical aviation personnel.

3.10 The extra ISR capabilities of unmanned platforms were perceived as creating additional demands on processing, exploiting and disseminating (PED) intelligence

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6 *Submission 23,* p. 12.

7 *Submission 23*, p. 12.

8 *Committee Hansard*, 14 April 2015, p. 42.

9 *Submission 12*, p. 7.

10 *Submission 12*, p. 5.

systems. Mr Weston noted that the raw data produced by UAVs 'is of little use unless it can be filtered, assessed, analysed and disseminated to where it is most needed. He noted 'raw ISR data is perishable, so unless the surveillance data can be transformed into a refined and deliverable intelligence product quickly, the full capabilities of ISR UAS will remain under-exploited'.[11] Dr Andrew Davies from Australian Strategic Policy Institute (ASPI) described the change in the volume of ISR as 'extraordinary'. He noted that other countries 'have struggled with analysing all of the data coming back from high-endurance drones' as their systems of imagery analysis and intelligence exploitation were set up for static imagery rather than streaming imagery which required a different skill set.[12]

3.11 Similarly, Northrop Grumman stated:

> [W]hile unmanned systems greatly enhance Australia's ISR capabilities, such enhancement is dependent on a capable and sophisticated processing, exploitation and dissemination (PED) capability. The risk is that "front end" platform investment without the "back end" investment in supporting data processing and analysis systems will do little to improve national capabilities. ISR data is perishable; it must be processed and analysed quickly, then speedily passed to decision makers and end users. That is the role of a PED capability – without a co-investment in PED to match the platform procurement, the risk is that the value of the overall capability is diminished.[13]

3.12 Air Vice-Marshal Gavin Davies acknowledged:

> [T]he operation of the vehicle is not where the manpower-intensive elements are. It is in how much data is collected, what you do with the data and how you disseminate it. It is sometimes called 'the back shops' because of what you do with it and the analysis. That is where you can have a reasonably large personnel bill and that is where we need to begin to understand where opportunities lie.

3.13 At the hearing, Rear Admiral Peter Quinn noted that all modern platforms coming into service, whether manned or unmanned, were gathering more data that required processing:

> Defence is aware of that challenge and it is working to make sure that it can get the most out of these new platforms and all of the data that they provide…It is a combination of getting the right people, the right training, the right systems and the right processes in place to fuse all of this information together. This is for the platforms which are coming into service, not necessarily all of the platforms we have now. We know we

11 *Submission 4*, p. 9.

12 *Committee Hansard*, 14 April 2015, p. 26.

13 *Submission 12*, p. 7.

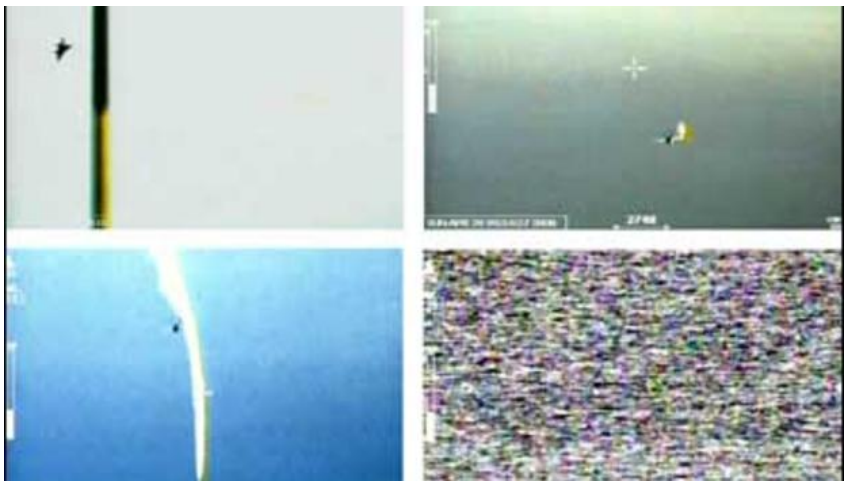
have a challenge; it is being addressed. We know that we will have to ramp up in that area.[14]

Contested airspace

3.14 While submissions were clear on the technical advantages of UAVs in uncontested airspace, there was less clarity in relation to their value in contested airspace. A number of examples were mentioned where UAVs had been ineffective in contested airspace. These included:

- in 1999, a number of US Predator UAVs were shot down during operations over the former Yugoslavia;
- in 2002, a US Predator UAV was shot down by an Iraqi aircraft;[15]
- in 2008, a number of Georgian surveillance UAVs were destroyed by air defence systems and manned aircraft;[16] and
- in 2011, Iranian forces captured a Lockheed Martin RQ-170 Sentinel, a stealth HALE UAV reportedly operated by the US Air Force for the Central Intelligence Agency.[17]

Figure 3.1 – Images from video feed of Georgian UAV[18]



14 *Committee Hansard*, 14 April 2015, p. 47.

15 *Submission 2*, Clinton Fernades, 'Welcome to the future: the use of drones in war', *Dissent*, Summer 2012/2013, p. 50.

16 For example, United Nations Observer Mission in Georgia, *Report of UNOMIG on the incident of 20 April involving the downing of a Georgian unmanned aerial vehicle over the zone of conflict*, 12 May 2008.

17 For example, Greg Jaffe and Thomas Erbrink, 'Iran says it downed US stealth drone; Pentagon acknowledges aircraft downing', *Washington Post*, 4 December 2011.

18 AAP, 'UN: Russian jet shot down Georgian drone', *CBS News*, 26 May 2008, available at: http://www.cbsnews.com/news/un-russian-jet-shot-down-georgian-drone/ (accessed 23 June 2015).

3.15 Dr Davies considered that '[in] a more contested environment in which the adversary has a sophisticated anti-air capability, something more capable than Reaper would be required'. He stated:

> For now, that would likely be a manned strike platform with support from electronic warfare and situational awareness platforms. In the future, there's likely to be higher performance (and almost certainly higher cost) unmanned options such as the stealthy Unmanned Combat Aerial Vehicles under development, such as the American X-47B and European Taranis...[19]

3.16 Others emphasised the potential advantages of UAVs in contested airspace. For example, Flight Officer Gary Martinic wrote:

> UAV designs of the future will likely be capable of 'hyper-manoeuvrability' (or extreme lateral acceleration), achieved through advances in avionics and the use of composite materials and stealthy airframes, which would give them considerably enhanced ability to avoid detection by radar. Contrarily, the extreme g-forces generated could not be withstood by a human pilot sitting at the controls. UAV designs of the future will also likely be more rugged, giving them enhanced levels of 'battle damage survivability' in situations of air-to-air combat.[20]

Communications and navigation

3.17 The reliance of unmanned platforms on communications with controllers and external guidance (such as GPS navigation) was highlighted during the inquiry.[21] UAVs may be vulnerable to a variety of communications and cyber threats.[22] For example, Dr Clinton Fernandes noted:

> For all the technical advances in endurance, sensors and firepower, the key vulnerability in drones remains the potential for interference and jamming of GPS signals. They can be overridden by more powerful signals from television towers, or spoofed so as to make them believe that they are somewhere other than where they actually are.[23]

3.18 Defence noted that 'reliable and predictable system operation is predicated on a reliable data link, and/or system automation'. Defence also observed that 'the data links that control unmanned systems and deliver ISR information back to the Commander in the battle-space are potentially prone to cyber attack and/or

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19 *Submission 13*, 'ADF and armed drones', p. 1.

20 *Submission 1*, Gary Martinic, 'Drones' or 'Smart' Unmanned Aerial Vehicles', *Australian Defence Force Journal*, Issue 189, 2012, pp 47-48.

21 For example, Dr Derek Rogers, *Committee Hansard*, 14 April 2015, p. 20.

22 For example, Kim Hartmann and Christoph Steup, 'The Vulnerability of UAVs to Cyber Attacks – An Approach to the Risk Assessment', *5th International Conference on Cyber Conflict*, 2013.

23 *Submission 2*, Clinton Fernades, 'Welcome to the future: the use of drones in war', *Dissent*, Summer 2012/2013, p. 50.

exploitation'.[24] Notably, one of the small projects being undertaken by the DSTO relates to how 'unmanned aircraft might cope in an environment where GPS navigation may be denied'.[25]

3.19 Cobham Aviation Services also emphasised:

> The challenge with [UAVs] are the communication links, as the sensors on board are able to collect a vast array of data that has to be passed to a ground station and/or troops on the ground in order to be able to become 'actionable intelligence'. Particularly where beyond line of sight operations are involved high bandwidth satellite datalinks are required.[26]

3.20 It was also noted during the inquiry that in order to appropriately control the use of force within the restraints of the relevant rules of engagement the communications infrastructure between unmanned platform and the operator must be robust. The problem of latency in the operation of remotely operated UAVs was also raised. Flying Officer Martinic explained:

> This is the time delay between when an operator sends a signal to a UAV and the time it takes to respond. While this would usually only be a matter of seconds (or micro-seconds), it is relevant to the argument as to the responsiveness of UAVs versus the reaction time of on-board pilots.[27]

Complementary role to manned platforms

3.21 There was a broad consensus during the inquiry that unmanned platforms were unlikely to replace manned platforms for the ADF in the medium term. Instead, a complementary model for unmanned platforms with overlapping capabilities was perceived the optimal mix. For example, Mr Weston described an emerging new force structure paradigm:

> [O]ne of complementary manned and unmanned air capabilities which exploit the advantages of both manned and unmanned air capabilities. Typically this means that an unmanned but persistent ISR capability might be combined with a manned airborne response capability to provide a more capable and flexible defence force.[28]

3.22 Northrop Grumman also described 'a new force structure paradigm' with 'manned aircraft and unmanned aerial systems working in a complementary fashion, to maximise overall operational effectiveness, and to minimise the risk to aircrew'. It noted that '[a]nalysis, combined with a significant amount of operational experience

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24 *Submission 23*, p. 14.

25 Dr Ken Anderson, DSTO, *Committee Hansard*, 14 April 2015, p. 44.

26 *Submission 14*, p. 4.

27 *Submission 1*, Gary Martinic, 'Drones' or 'Smart' Unmanned Aerial Vehicles', Australian Defence Force Journal, Issue 189, 2012, p. 51.

28 *Submission 4*, p. 3.

has proven that a "Hybrid Fleet" of manned and unmanned systems delivers a higher level of capability at significantly lower operating costs'.[29] Mr Ken Crowe, from Northrop Grumman, expanded on this complementary relationship between manned and unmanned platforms (such as between the unmanned Triton complementing the manned P-8A Poseidon aircraft).[30] He stated:

> The unmanned helicopter goes out and does the dull, dirty boring missions at three am—the comms relay missions, the ISR missions that nobody wants to do—in dangerous or boring situations. And that leaves and preserves the manned helicopter to respond and to keep to its core war fighting mission. By complementing the manned and the unmanned together, you extend the life of the manned helicopter, you reduce its utilisation down to its core functions and you off-load a lot of the intelligence, surveillance and reconnaissance onto the platform that is best suited for it. The skill sets are complementary. The same skill sets relating to interpretation of the battlefield and the interpretation of the sensor data that exist on the helicopter exist back in the ship, looking at the screens from the unmanned helicopter. The maintenance activities are more or less the same—they are both helicopters…[31]

Reliability of UAVs

3.23 There were differing views expressed on the reliability of unmanned platforms. Several contributors suggested that large scale military UAVs have experienced a higher failure rate than manned platforms leading to concerns about their use over civilian areas or interactions with civil aviation. For example, the Northern Territory Government observed:

> One of the ongoing issues associated with operating unmanned aerial platforms is the public perception of safety associated with the use of those systems. In particular, the general public have concerns with the likelihood of unmanned aerial platforms colliding with commercial or other military aircraft over populated areas.[32]

3.24 Similarly, PREMT highlighted that '[s]afety concerns are most severe when it comes to [UAVs], especially UAVs that are large enough and fly high enough to interfere with civil aviation'.[33] Dr Brendan Gogarty also commented:

> Drones experience much higher accident rates than manned vehicles (up to 100 times higher), but the reasons for this are more complex than simply technical. In fact they are more related to controller complacency and the

29 *Submission 12*, p. 5.

30 *Committee Hansard*, 14 April 2015, p. 18.

31 *Committee Hansard*, 14 April 2015, p. 18.

32 *Submission 9*, p. 8.

33 *Submission 22*, p. 2.

> reduced feedback that results from removing the pilot from the cockpit…as much as they related to technical faults.[34]

3.25 A recent *Washington Post* report highlighted the relatively high number of incidents involving US military UAVs. The common causes of incidents included:

- a limited ability to 'detect and avoid';
- pilot/operator error;
- persistent mechanical defects;
- unreliable communication links.[35]

3.26 Significant incidents included a US operated Shadow UAV colliding mid-air with a US Air Force C-130 cargo plane. Notably, in 2010, it was reported that an RAAF Heron crashed short of the airfield in Kandahar, Afghanistan and required costly repairs.[36] On 1 November 2010, ADF's Herons in Afghanistan were suspended from flying for 24 hours following 'a series of landing gear malfunctions'.[37]

3.27 Defence noted that the majority of large complex UAVs designed for combat operations were introduced into service 'with little consideration to peace time operations in civilian airspace'. It stated that the 'ADF continues to develop its unmanned capabilities responsibly' and considered that any transport, health and safety implications posed by the use of unmanned platforms are 'presently insignificant, given the scale of operations and maturity of these capabilities'.[38] At the April hearing, Air Vice-Marshal Davies highlighted the high number of flying hours of military UAVs and argued that '[t]he statistics are showing clearly that these are safe vehicles'.[39]

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34 *Submission 18*, p 2.

35 Craig Whitlock, 'When drones fall from the sky', *Washington Post*, 20 June 2014.

36 Ian McPhedran,'Defence in spy plane cover-up', *Daily Telegraph*, 10 September 2010.

37 Department of Defence, 'Heron Unmanned Aerial Vehicles Return to Flight Status after Temporary suspension of flying', *Media Release*, 3 November 2010.

38 *Submission 23*, p. 14.

39 *Committee Hansard*, 14 April 2015, p. 45.

Chapter 4

Defence policy issues

Introduction

4.1 This chapter will consider some of the defence policy issues arising from ADF use of unmanned platforms. These include:

- the suitability of unmanned platforms to Australia's defence and strategic circumstances;
- the effect of unmanned platforms on security stability;
- the deployment of unmanned platforms within Australia;
- perceptions and transparency of unmanned platforms;
- the use of unmanned platforms for emergency assistance and national support; and
- the issue of arming ADF unmanned platforms.

Suitability

4.2 The *Defence Issues Paper 2014* outlined some of the ways Australia's defence policy settings have adapted to changing strategic circumstances over the decades. It stated:

> Today, Australia's defence policies must deliver an ADF that can effectively protect Australia from direct attack, of whatever form, and is also able to secure and advance our interests. These include the protection of our trade routes and prevention of non-geographic threats, such as those from cyberspace, terrorism, transnational crime, people smuggling, and illegal fishing. Our Alliance with the United States remains integral to our defence and security arrangements and our changed strategic environment means that we now work more closely with a wider range of like-minded countries in our region.[1]

4.3 In this context, unmanned platforms were viewed as appropriate to Australia's defence and strategic circumstances. For example, Northrop Grumman considered 'Australia's geostrategic circumstances, particularly its expanse, its vast sea/air approaches, its export/trading economy and its proximity to Southeast Asia stress the importance of range, endurance, surveillance and intelligence; all attributes well-suited to the use of unmanned systems'.[2]

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1 Department of Defence, *Defence Issues Paper 2014*, p. 6.

2 *Submission 12*, p. 6.

4.4 Maritime unmanned platforms (UUV and USVs) were perceived as having particular relevance for Australia in the future. The importance of effective UUVs for mine counter measures was emphasised. The potential of USVs for mine sweeping, mine hunting and as a tool for anti-submarine warfare (ASW) was also highlighted. For example, Ms Rosalyn Turner from ASPI commented:

> UUVs might suit the [ADF] particularly well given our strategic context. With our vast maritime claim, long coastline to monitor and a vital interest in maintaining free and open sea lines of communication in our region, UUVs could foreseeably carry out key roles contributing to Australia's strategic interests. UUVs won't be replacing manned submarines anytime soon. But they're being considered as key complementary elements to address several operational challenges navies currently face.[3]

4.5 Northrop Grumman stated that undersea warfare was the most demanding and dangerous operational environment and argued it was 'one of the key domains where Australia needs to develop a decisive capability edge'. It stated '[a] replacement fleet for the Collins Class submarine would consume a huge proportion of Australia's Defence budget and the complementary contribution that UUVs can make to overall [undersea warfare] mission effectiveness needs to be established as an integral part of the force development process'.[4] Similarly, Dr Andrew Carr observed:

> The nature of Australia's largely maritime domain, 'air-sea gap' concerns and emergent maritime strategy speak to a need for underwater/surface unmanned systems. While maritime systems are currently far less developed than aerial systems, the technology is rapidly expanding. Such systems could help protect and expand the capacity of Australia's submarine and surface fleets, offer remote surveillance, static and mobile elements and enticingly— given the trend of regional arms purchases— offer promising new Anti-Submarine Warfare (ASW) options.[5]

Destabilising effect

4.6 The potential for unmanned platforms to destabilise security situations was seen as a key risk in their potential use. Dr Clinton Fernandes argued that as unmanned platforms improve in lethality and stealth 'one concern is that the political barriers to war may be lowered'.[6] Similarly, Dr Carr stated:

> One notable and under-discussed issue is that unmanned systems may face a lower strike threshold with countries more willing to shoot down unmanned platforms in contested territory. Clear discussion of the

3 Rosalyn Turner, 'The unmanned underwater future', *The Strategist*, 9 April 2014.

4 *Submission 12*, p. 3.

5 *Submission 19*, p. 2.

6 *Submission 2*, p. 4.

> acceptable norms regarding these systems will be vital, not only for Australian interests but as an issue to lead discussion on in our region.[7]

4.7 Dr Christian Emermark also noted that questions exist about 'the effect that the availability of drone technology has on political decisions to use force':

> One hypothesis worth testing is that the availability of remotely-controlled drones (as distinct from manned aircraft) lowers the threshold for deciding to go to war. The job of drone operators does not, unlike a combat infantryman, involve experiencing physical risk. Thus political leaders, having less cause to contemplate the prospect of deaths, injuries and grieving families, might accordingly feel less anxious about using force to solve political problems. And citizens, if not called upon to spill their own blood for a cause, might feel less inclined to 'dissuade leaders from foreign misadventures and ill-planned aggression'.[8]

4.8 Ms Turner observed that '[o]ne of the major concerns that surrounded the UK's acquisition of Reapers was that the platform might reduce the threshold for military intervention and the use of lethal force because of the lack of physical risk to personnel'. She stated that '[f]or some, that concern has been heightened by the widespread use of drone strikes by the US outside traditional battlefields'.[9] The Programme on the Regulation of Emerging Military Technology, (PREMT) at Melbourne Law School commented:

> As regards [unmanned platforms], there are well-founded concerns about an ever-expanding theatre of operations and the use of a technological capability that extends hostilities beyond what may otherwise have been feasible. In the long term, armed [unmanned platforms], the use of which entails little political risk for a government, may contribute to the spread of low-level conflicts globally and reduce the willingness of states to use judicial means to address security threats.[10]

Operation within Australia

4.9 It has been announced that the Triton UAVs will be based at RAAF Base Edinburgh in South Australia. However, the Northern Territory (NT) Government urged that consideration be given to the benefits of basing ADF UAVs in the NT. In particular, the NT Government proposed the Triton UAV fleet could be based, operated and maintained at RAAF Base Tindal.[11] It noted that Darwin is the current forward operating base for the P3 Orion maritime patrol aircraft. At the April hearing, Mr Stephen Mencshelyi from the NT Government elaborated:

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7 *Submission 19*, p. 3.

8 *Submission 5*, p. 5.

9 *Submission 13*, 'Lessons for the ADF from Britain's armed drone program', p. 1.

10 *Submission 22*, p. 6.

11 *Submission 9*, p. 2.

> The benefits include dramatic cost savings achieved through basing close to the area of operations, whereby eliminating the flying time from southern bases to reach their primary-operating environment. Savings in fuel, aircraft maintenance, airframe hours and manning also provide opportunities for additional cost savings and response times, particularly in response to humanitarian and natural disasters, and provide initial situational awareness and damage assessments rapidly. In addition to cost benefits there are capability benefits, with aircraft able to spend more time on tasks. The Northern Territory also offers the benefits of low air-traffic density and existing military and civil air-traffic interaction.[12]

Humanitarian emergencies and national support

4.10 Currently the ADF's manned platforms contribute to a variety of national support and emergency response operations such as disaster relief. In 2011, during Operation Queensland Flood Assist, all three services provided assets for tasks such as airlift support, search and rescue, aerial survey and the assessment of underwater hazards as part of the Australian Government's emergency response to flood affected areas of Queensland.[13] RAAF AP3C Orion aircraft and RAN patrol boats routinely contribute to efforts to manage civil maritime security as part of the interagency taskforce Border Protection Command.

4.11 Unmanned platforms were perceived by a number of submitters as providing additional opportunities for the ADF to conduct national support tasks such as assistance during emergencies. These included extreme weather monitoring, bushfire monitoring, damage assessments after civil emergencies, search and rescue, detection of illegal fishing and other border protection functions.[14] Mr Ken Crowe, from Northrop Grumman, highlighted that Australia's immediate region was prone to natural disasters and suggested that the response to those 'disasters can be aided by the application of unmanned technology'.[15] Mr Brian Weston also commented:

> With the emergence of UAS, there is considerable scope for UAS to play an increasing role in national support tasks where their persistence, surveillance capabilities and economy of operation are advantageous.[16]

4.12 When the then Minister of Defence, Senator the Hon David Johnston, announced that Australia would maintain a Heron capability he stated that 'while Defence resources are primarily used for national security purposes, if the Heron was available it could be used at the request of state governments for civilian roles, such as

12 *Committee Hansard*, 14 April 2015, p. 9.

13 Department of Defence, 'Operation Queensland Flood Assist', *Media release*, 5 February 2011.

14 NT Government, *Submission 9*, p. 5.

15 *Committee Hansard*, 14 April 2015, p. 17.

16 *Submission 4*, p. 13.

assistance during natural disasters'.[17] Defence noted that while the ADF's 'limited unmanned platform capabilities have been employed extensively and successfully in combat-support…[they] have not been employed in border security, civil emergency support or regional cooperation tasking in Australia or its region'.[18] However it also indicated that as the capabilities of unmanned platforms develop they 'could easily be extended to support domestic, regional and border protection operations'.[19] Air Vice-Marshal Gavin Davies predicted that 'the versatility of unmanned aerial vehicles will mean that they become a vital part of how emergency response is done around the world'.[20]

4.13 The Australian Red Cross outlined that there were a number of issues which have been identified by the international community as problematic in the use of military platforms (including unmanned platforms) deployed for humanitarian purposes. However, it considered that the Australian government has adopted a conservative approach to the use of military assets to assist with the delivery of humanitarian aid in an overseas context. It commented:

> It is worth noting that in natural disaster response in the Asia-Pacific region, affected States' militaries play a substantial role in disaster response and many governments look to their militaries to be a principal responder. In a natural disaster environment, military deployments to a disaster zone may follow government direction and provide rapid deployment of medical, logistics and engineering capabilities. Military assets (planes, helicopters or UAVs) may be used for immediate damage assessments and such use is increasing, for example in the Philippines following Typhoon Haiyan. In a domestic situation when responding to a natural disaster, the use of Australian military assets is considered supplementary to civilian responders when additional resources are required. Such use however, from experience, is thought to be uncontroversial.[21]

4.14 However, the Australian Red Cross also highlighted the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) advice which suggested that UAVs operated by the military should follow existing guidelines which require humanitarian organisations to ensure that:

- any humanitarian civil-military relationship or interaction does not impact principled humanitarian action [neutral, impartial, independent]; [and]
- the use of military assets in support of humanitarian operations is appropriate and in accordance with international guidelines, i.e. that

17 Senator the Hon David Johnston, Minister for Defence, 'Heron to be retained to keep Australia's unmanned aerial capability', *Media release*, 28 October 2014.

18 *Submission 23*, p. 3.

19 *Submission 23*, p. 13.

20 *Committee Hansard*, 14 April 2015, p. 45.

21 Australian Red Cross, *responses to questions on notice*, p. 6.

> military assets provide a unique capability, availability and timeliness not possessed by the humanitarian community (i.e. "last resort").[22]

4.15 The OCHA paper noted:

> In many cases, UAVs will clearly provide a "unique capability", particularly in areas where humanitarian access is restricted due to security or terrain. However, it is harder to show that the use of UAVs by military or peacekeeping actors will not impact humanitarian principles, because this depends on the perceptions of local communities and stakeholders, not the mission per se. Humanitarians will have to consider whether the military is a party to the conflict, and if association with them would impact the perceived or actual neutrality, impartiality and operational independence of the overall humanitarian effort.[23]

4.16 Other possible uses of ADF UAVs were raised. For example, the Australian Federal Police (AFP) argued that the use of 'UAVs in areas such as the Torres Straight and Northern Australia would provide significant opportunities to mitigate the AFP's current vulnerabilities in its covert surveillance operations'. It noted that the use of unmanned platforms by the ADF could provide opportunities 'to collaborate and share imagery information between various government agencies in the appropriate circumstances'. However, the AFP cautioned that a regulatory framework would need to be 'established for the effective exchange of imagery'.[24]

4.17 Despite these new opportunities for the use of UAVs, concerns were also expressed that the use of 'military-grade' unmanned platforms may not be an effective use of resources in non-military situations. For example, Cobham Aviation Services commented:

> [I]t needs to be noted that the use of high end military ISR capability, [UAVs] or manned, to deliver civil surveillance outcomes is a misuse of military capability and is provided at very high cost to government. This is because military platforms are designed, developed, crewed, trained for and operated for use in complex hostile conflict environments.[25]

Perceptions and transparency

4.18 The negative perception of unmanned platforms was identified as a key risk of their acquisition and deployment, particularly if they were armed.[26] Concerns were expressed that an ill-informed view was held by the general public in relation to unmanned platforms. Dr Andrew Davies from ASPI stated:

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22 Australian Red Cross, *responses to questions on notice*, p. 8.

23 UN Office for the Coordination of Humanitarian Affairs, *Unmanned Aerial Vehicles in Humanitarian Response*, Occasional Policy Paper, June 2014, p. 12.

24 *Submission 10*, p. 2.

25 *Submission 14*, p. 3.

26 For example, Australian Association for Unmanned Systems, *Submission 17*, p. 3.

> [B]ecause of the way that armed drones have entered the public consciousness as weapons in the unconventional part of the 'war on terror', they've the potential to draw opposition from the public and from neighbouring governments…So if Australia was to purchase Reapers or a similar system, there's the potential to cause alarm, among both Australians and our neighbours.[27]

4.19 Dr Davies suggested these concerns could be allayed by making clear public statements about the concept of operations for the UAVs and 'ensuring they are unambiguously and visibly under military control'.[28] Ms Turner, also from ASPI, argued that Australia could learn from the UK's experience in the acquisition and use of armed Reaper UAVs. In particular:

> The UK has made an effort to embrace transparency around its use of Reapers in military operations, most likely to allay speculation that it conducts covert strikes that have proven unpopular for the US. The UK has made data available on Reaper strikes and the Ministry of Defence (MoD) and British government have publicly answered questions about their use through formal inquiry…The MoD has also conducted a PR campaign by supporting media events intended to 'dispel some of the myths that surround the use of UAVs' and raise awareness of how it uses the technology.[29]

4.20 The Human Right Law Centre argued that there was an 'accountability vacuum' in relation to the use of military UAVs. It noted that '[d]espite the ongoing calls by the United Nations and other bodies, and various promises by governments, there continues to be a lack of transparency surrounding drone use'. The Human Rights Law Centre noted:

> In the United Kingdom, the Royal Air Force is accountable to Parliament through the Ministry of Defence, which allows for some transparency. The Ministry does not, however, comment publicly on the use of remotely piloted aircraft in connection with special operations. Under some of its operating procedures, every remotely piloted aircraft weapons discharge is internally reviewed and a mission report, including video footage and communications reports, prepared and reviewed. Where there is an indication of civilian casualties, the incident is referred to a body whose personnel are independent of the chain of command involved in the strike.[30]

4.21 Defence also highlighted 'perception management' as a potential risk in the use of unmanned platforms. It noted that '[p]oor perceptions created by illegal or uncertified civilian use of unmanned platforms within the domestic community in particular, has the potential to generate an incorrect perception of the systems used by

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27 *Submission 13*, 'ADF and armed drones', p. 1.

28 *Submission 13*, 'ADF and armed drones', p. 2.

29 *Submission 13*, 'Lessons for the ADF from Britain's armed drone program', pp. 1-2.

30 *Submission 16*, p. 9.

the military'.[31] Defence stated it had been 'engaged with Royal Air Force (RAF) regarding their experience with the introduction into service of the REAPER platform'. It noted that the 'ADF does not currently report on operations' but that changes to reporting practices may be considered 'should the ADF procure armed [UAVs]'.[32]

Personnel issues

4.22 The number of personnel required to operate and maintain unmanned platforms was frequently raised as one of the criteria to judge their value. For example, Mr Anthony Patterson, from Cobham Aviation Services, considered the reference to 'unmanned' was inappropriate as the 'employment level, or the relative number of people required to operate [a] system for the same unit of surveillance outcome, is about the same between manned aircraft and unmanned aircraft'.[33]

4.23 The Heron UAV used by the ADF in Afghanistan utilised a small team to operate it from a ground control station. This team could involve an air vehicle operator (pilot), an ISR officer, a payload operator and an electronic warfare operator as well as other specialist technicians or linguists.[34] Air Vice-Marshal Gavin Davies suggested to the committee that the impression that 'it takes fewer people to operate remotely piloted aircraft' may be overstated. He stated that the 'Air Force is of the view that our acquisition of Triton as part of the long-term maritime capability will, basically, be replacing a P3 squadron with a Triton squadron, in terms of people'.[35]

4.24 Defence acknowledged that '[r]ecruiting and retaining sufficient numbers of qualified personnel to operate and support emerging unmanned platform capabilities that can operate 24/7, such as the Triton, will be a challenge for the ADF in managing its workforce'. It noted it was 'currently planning the required personnel support structures to do this with specific consideration being undertaken under the Force Structure Review'.[36] Defence also identified that policy consideration was required in areas such as 'personnel management, training/competency requirements and medical standards for [UAV] operators'.[37]

4.25 Having sufficient personnel to operate, maintain and analyse the ISR material produced by unmanned platforms was highlighted as a significant issue. For example, Ms Rosalyn Turner from ASPI noted that, since acquiring armed Reapers from the US in 2007, the United Kingdom (UK) has extensively deployed them:

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31 *Submission 23*, pp 13-14.

32 Department of Defence, response to questions on notice no. 3, p. 1.

33 *Committee Hansard*, 4 May 2015, p. 2.

34 Royal Australian Air Force, 'Heron: looking to the future', *Air Force*, 29 January 2015, p. 5.

35 *Committee Hansard*, 14 April 2015, p. 42.

36 *Submission 23*, p. 13.

37 *Submission 23*, p. 14.

> One of the issues arising from such a high operational tempo has been maintaining capacity to resource the platforms. The UK's Select Committee on Defence highlighted a lack of UAV operators and imagery analysts as a key challenge shortly after the Reapers began operations. (The US Air Force (USAF) has also struggled in this regard)…
>
> It's hard to predict whether an Australian fleet would see as much action, and it would of course depend on the number and type of operations to which the ADF was committed. Nevertheless it's been reported that there's currently a shortage of drones available to confront the challenges in Iraq and Syria, which suggests they'll remain a sought-after capability for some time. If the ADF decides to acquire these platforms, it'd be well placed to start the process of recruiting and training personnel early to head off challenges faced by the RAF and USAF.[38]

4.26 At the hearing, Ms Turner observed that Australia could benefit from the experiences of the US and the UK UAV programs:

> Starting early is really important—and definitely using our allies' capabilities and facilities in terms of maintaining and enhancing our personnel's capabilities and training in those areas. And the US has certainly started targeting younger people, targeting different people, in terms of recruiting drone operators, because of course this is very different from recruiting fighter pilots.[39]

Armed unmanned platforms

4.27 The decision to acquire armed unmanned platform was highlighted as a significant one. The Defence submission emphasised the Defence Capability Plan 'does not currently contain a project to procure an armed unmanned platform or system'.[40] It noted that the 'procurement of an armed UAS capability remains the subject of the Force Structure Review'.[41] At the April hearing, Air Vice-Marshal Davies commented that 'Air Force think that an armed medium-altitude, long-endurance vehicle gives us the tactical flexibility to have a greater impact on the battlefield'.[42]

4.28 Dr Davies outlined two applications for armed UAVs: armed reconnaissance 'being able to survey the battlefield and the wider environment, with the ability to engage the enemy if necessary'; and 'flying fire support for land force elements that find themselves under fire or otherwise in danger'.[43] However, Dr Derek Rogers, from

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38 *Submission 13*, 'Lessons for the ADF from Britain's armed drone program', pp 1-2.

39 *Committee Hansard*, 14 April 2015, p. 25.

40 *Submission 23*, p. 10

41 Department of Defence, *response to question on notice 3*, p. 1.

42 *Committee Hansard*, 14 April 2015, p. 48.

43 *Submission 13*, 'The ADF and armed drones', p. 1.

Saab Australia, commented that 'there is not always a need to weaponise such systems to be effective in a number of operational scenarios'. He noted that 'the ability of unmanned platforms 'to shadow, loiter, picket, record video evidence and standoff may be a valuable deterrent in anti-piracy operations for example'.[44]

4.29 If Australia decided to acquire armed UAVs some argued there was a need to establish rigid standards of practice in relation to their use. For example, Dr Christian Enemark observed that 'some decision-makers within Britain and the United States have already expressed concerns about the need to champion normative limitations on the use of drones'.[45] Similarly, Mr Ben Fitzegerald from the Lowy Institute has argued that to 'have a credible voice in developing appropriate norms and policies for drone use on the world stage, Australia must establish itself as a leading operator of drone capability, including armed variants'. He stated:

> The greatest risk to Australian interests is not that other nations will acquire drones and use them against us…The more likely risk is that some nations will use them in ways that undermine the rules-based international order that Australia subscribes to, or will increase regional instability through risky use…These incidents are likely to increase in frequency as nations acquire drones and seek to push the boundaries of international norms or re-establish them in their favour.[46]

4.30 The Human Rights Law Centre also argued that, as unmanned platforms are increasing used by State and non-State actors, it was in Australia's interest that they are used according to law. It considered it was 'critical that a rules-based order for the use of drones is established and followed'.[47]

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44 *Submission 24*, p. 2.

45 *Submission 20*, p. 3.

46 Ben Fitzgerald, 'Apply Australian values to drone warfare', *The Interpreter*, 3 March 2015, available at http://www.lowyinterpreter.org/post/2015/03/03/Applying-Australian-values-to-drone-warfare.aspx (accessed 31 May 2015).

47 *Submission 16*, pp. 5.

Chapter 5

Legal issues

Introduction

5.1 This chapter will consider several of the legal issues raised regarding ADF use of unmanned platforms. These included:

- the applicability of the law of armed conflict (LOAC), international humanitarian law (IHL) and international human rights law (IHRL);
- civilian operation of unmanned platforms;
- autonomous weapons systems; and
- other legal and regulatory issues.

Law of armed conflict, international humanitarian law and human rights

5.2 Contributors to the inquiry agreed that any use of unmanned platforms by the ADF must comply with Australia's international law obligations, including the LOAC IHL, and IHRL. These obligations arise from customary international law as well as the treaty commitments made by the Australian Government. In particular, appropriately abiding by the principles applicable to the use of force in armed conflict (distinction, proportionality and precaution) was emphasised. For example, the Programme on the Regulation of Emerging Military Technology (PREMT) commented that the fact that 'a platform is controlled by a remote operator rather than an on-board pilot does not reduce the applicability of existing international or domestic law to the operations of the ADF':[1]

> The key IHL rules pertaining to the conduct of hostilities require attacks to be directed only against military personnel and objects (principle of distinction), prohibit launching attacks against legitimate targets where incidental damage to civilians would be disproportionate to the military advantage anticipated (principle of proportionality), and demand that constant care be taken to spare the civilian population (principle of precaution).[2]

5.3 A number of legal issues were raised regarding the use of unmanned platforms, particular if they were armed. Frequently, these issues were in the context of the use of armed unmanned platforms as part of operations conducted by other countries. For example, Professor Ben Saul noted that the UN General Assembly had urged States in countering terrorism:

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1 *Submission 22*, p. 1. Also see Dr Ian Henderson, *Submission 20*, p. 1.

2 *Submission 22*, p. 4.

> To ensure that any measures taken or means employed to counter terrorism, including the use of remotely piloted aircraft, comply with their obligations under international law, including the Charter of the United Nations, human rights law and international humanitarian law, in particular the principles of distinction and proportionality[3]

5.4 The Human Rights Law Centre (HRLC) considered that 'weaponised drones open up a Pandora's box of legal and ethical considerations'. It noted that while the use of drones is not per se illegal under international law 'the use of drones is subject to the rule of law, in particular [IHL] and [IHRL]':

> Both of these systems of law require the protection of human life. The right to life requires that lethal force only be used where strictly necessary and proportionate, whilst the humanitarian law strives to protect the life of civilians in armed conflict.[4]

5.5 The HRLC drew the committee's attention to two significant studies undertaken by UN officials to develop state legal and accountability standards in relation to 'drones'. These were conducted by the UN Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism, Mr Ben Emmerson, and the UN Special Rapporteur on extrajudicial, summary or arbitrary executions, Mr Christof Heyns. The HRLC stated:

> In short, these two experts have explained that:
>
> (a) all States need to **comply with international law** when using, or involved in the use of, drones;
>
> (b) the targeted killing of individuals by drones will be **lawful only in very limited circumstances**;
>
> (c) use or involvement with drones should be **transparent** so that there is accountability to the people and international community;
>
> (d) where there have been, or appear to have been, civilian casualties that were not anticipated when a drone attack was planned, a **prompt, independent and impartial fact-finding inquiry should be conducted and a public and detailed explanation of the results p**rovided; and
>
> (e) victims of a violation of international law caused by drones should be provided with an **effective remedy**.[5]

5.6 One of the HRLC's key recommendations was that the 'Australian government not procure armed drones unless it has a system of transparency and accountability for their use that is consistent with Australia's legal obligations, including under international human rights law and international humanitarian law'.[6]

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3 *Submission 3*, p. 1.

4 *Submission 16*, p. 2.

5 *Submission 16*, pp 2-3 [emphasis in original].

6 *Submission 16*, p. 4.

5.7 However, others did not consider the expanded use of unmanned platforms (including armed UAVs) would have significant legal ramifications for Australia. Some argued the concerns raised by 'drone strikes' conducted by other countries were not applicable to the use of unmanned platforms by the ADF due to differing legal regimes for the use of force. For example, the *Intelligence Services Act 2001* prohibits the Australian Security Intelligence Service from paramilitary activities, violence against the person or the use of weapons.[7] Dr Andrew Davies from ASPI observed that 'the use of armed drones by [Australian] civilian agencies would be a dramatic departure from current practice requiring legislative change'.[8]

5.8 Others considered that existing legal frameworks were sufficiently applicable to unmanned platforms. For example, Northrop Grumman thought that unmanned platforms would bring few new international legal considerations 'into play'. It commented that 'most defence and "warlike" capabilities are already governed by the laws of war and the conventions of conflict, such as: just cause; proportionality of response; minimisation of collateral damage; avoidance of civilian casualties'.[9] Similarly, Dr Ian Henderson argued the 'resort to the use of force and the regulation of particular instances of the use of force is comprehensively addressed in international law'. He cautioned:

> Great care should be taken before identifying limitations or restrictions on the employment and use of unmanned systems. This is because any such limitation or restriction would prima facie apply equally to manned systems as there is no legally significant difference between the two.[10]

5.9 Professor Tim McCormack from PREMT at Melbourne Law School emphasised that, while the applicable legal frameworks will depend on the operational context, 'the law is adequate and capable of regulating the dramatically increasing use of [unmanned platforms]'.[11] He stated:

> The existing law is adequate to deal with the existing ADF assets which are used not only for intelligence gathering, surveillance and reconnaissance but also for remotely piloted, armed unmanned vehicle systems. It just has to be applied…[W]e have a track record of compliance with the law. It is something we should be really proud about and eternally vigilant to ensure it continues to be the case.[12]

5.10 An argument was also made that unmanned systems might potentially facilitate greater compliance with legal requirements in armed conflict. For example, Dr Henderson argued 'the greater intelligence, surveillance and reconnaissance

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7 *Intelligence Services Act 2001*, subsection 6(4).

8 *Submission 13*, 'The ADF and armed drones', p. 2.

9 *Submission 12*, p. 8.

10 *Submission 20*, p. 2.

11 *Committee Hansard*, 14 April 2015, p. 33.

12 *Committee Hansard*, 14 April 2015, p. 38.

persistence that can be provided by current unmanned systems can facilitate better target discrimination and lead to less incidental injury to civilians and damage to civilian property'. He also argued that remote operators of unmanned platforms 'may be less likely (when compared to operators who are personally at risk) "to resort to greater force to address threats"'.[13] Along the same lines, the Defence submission argued that the 'heightened level of situational awareness of the environment and threat warning, with the ability to further discriminate between combatants, non-combatants and friendly forces' provided by unmanned platforms 'promotes adherence to the Law of Armed Conflict (LOAC)'.[14]

5.11 Defence stated that the ADF's use of unmanned platforms and systems satisfies domestic and international legal obligations, in particular, under the Geneva Conventions and the Law of Armed Conflict (LOAC). It emphasised:

> Unmanned ADF air, maritime and land platforms and their control systems, are subject to, and employed under the same legal framework as manned ADF platforms. Specifically, these platforms and associated systems are subject to the same legal considerations and constraints under LOAC as manned ADF platforms.[15]

5.12 Further, Rear Admiral Peter Quinn stated that the use of any unmanned platform in the application of force would be subject to the same robust targeting procedures applicable to manned platforms.[16]

Shared intelligence

5.13 The Centre for Military and Security Law (CMSL) highlighted that multinational military operations, such as those conducted in Afghanistan and Iraq, often involved the sharing and pooling of intelligence with operational partners. This could mean that intelligence generated by an ADF unmanned platform may 'then be used by an operational partner to, for example, facilitate a specific targeting operation'. It stated:

> This possibility raises two specifically legal issues for Australia and the ADF: (1) the international law issue of Australia's state responsibility for the outcome perpetrated by the operational partner using ADF [unmanned platform] generated intelligence as a component or enabler of that operation; and (2) the Australian domestic criminal law issue of individual criminal responsibility of ADF personnel for aiding or abetting that outcome (complicity).[17]

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13 *Submission 20*, p. 3.

14 *Submission 23*, p. 7.

15 *Submission 23*, p. 7.

16 *Committee Hansard*, 14 April 2015, p. 42.

17 *Submission 6*, pp 5-6.

5.14 The CMSL, after considering potential scenarios in relation to shared intelligence, recommended 'the development of a clear policy establishing the parameters for ADF [unmanned platform] operations which contribute intelligence to a shared operational pool…'.[18]

Review

5.15 The Australian Red Cross urged that unmanned platforms only be deployed if respect for international humanitarian law (IHL) can be guaranteed. It made several recommendations including that 'unmanned platform systems as either weapons, means, or method of warfare must be thoroughly tested to ensure that they are capable of complying with IHL at all times'.[19] At the April hearing, Rear Admiral Quinn stated that ADF air, maritime and land unmanned platforms are subject to the same legal considerations and constraints under the LOAC as manned ADF platforms. This included review to determine whether the employment of the unmanned platforms would, in some or all circumstances, be prohibited or restricted by international law or any other rule of international law applicable to Australia.[20]

Training

5.16 The Australian Red Cross recommended that 'unmanned platform systems should not be used, controlled, programmed or operated by individuals who are not fully conversant with and understand the principles of IHL'[21] Further, Dr Phoebe Wynn-Pope observed:

> [T]he Australian government has provided support to Australian Red Cross for the purposes of providing dissemination of IHL to the Australian population since the ratification of additional protocol 1 and its enactment into domestic legislation in 1991…However, further outreach would be required to an entirely new sector if unmanned or semiautonomous weapons were to be used during armed conflict. Those involved may not be apparent or easily identifiable. The Australian government may like to carefully consider whether the current dissemination program offered through Australian Red Cross and the training provided by the Australian Defence Force to their own personnel would be adequate to discharge the government's responsibilities with respect to this dissemination.[22]

5.17 At the April hearing, Air Commodore Chris Hanna told the committee all ADF personnel would receive training on the basic laws of armed conflict and international humanitarian law. If ADF personnel were to be deployed overseas, this

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18 *Submission 6*, p. 11.

19 *Submission 15*, p. 2; Dr Phoebe Wynn-Pope, Australian Red Cross, *Committee Hansard*, 14 April 2015, p. 28.

20 *Committee Hansard*, 14 April 2015, p. 41.

21 *Submission 15*, p. 2.

22 *Committee Hansard*, 14 April 2015, p. 28.

would be supplemented by predeployment training and specific training on the rules of engagement which would take into account the LOAC and IHL.[23]

Civilian operation of unmanned platforms

5.18 Civilian operation of military unmanned platforms was an area of policy where there were conflicting views expressed during the inquiry. Dr Davies from ASPI observed that the ADF had already accepted civilian contractors, even in front-end support roles and considered that 'the ADF could not do what it does if it were not for civilian contract support'. However he distinguished between a civilian supporting an unmanned platform and 'commanding it and controlling it'.[24] He stated:

> If they are demonstrably in support of military operations and there is a military chain of command responsible for the targeting decisions, I suspect that there is not a problem if there are civilians actually flying the drones or dealing with some of the intelligence feeds that come from them. That would be my anticipation—that it is how they are used, not the workforce that employs them…[25]

5.19 However, the CMSL identified civilian involvement in the operation of unmanned platforms as a 'potential area of concern'. It stated:

> Civilian involvement in warfare is not prohibited under international law; however, those who directly participate in hostilities will be deprived of the legal protection that is accorded to them as civilians and can lawfully be targeted. This is regardless of whether the civilian is operating as a member of a government organisation such as a civilian intelligence organisation or as a civilian contractor.[26]

5.20 Dr Rain Liivoja from the PREMT explained there was no established test for when a civilian was considered to be taking part in hostilities:

> There is still a grey area between the clear situation where a civilian is directly participating in hostilities—say, for instance, launching a Hellfire missile from an unmanned system—to the point where it is a civilian who, say, in Australia is providing basic maintenance for an unmanned platform. The test is unclear, but there are circumstances where civilians have been used as drone operators and where they have clearly crossed the line into direct participation in hostilities.[27]

5.21 The CMSL recommended the ADF, in cooperation with other relevant government departments and agencies, develop comprehensive guidelines on civilian

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23 *Committee Hansard*, 14 April 2015, pp 43-44.

24 *Committee Hansard*, 14 April 2015, p. 27.

25 *Committee Hansard*, 14 April 2015, p. 27.

26 *Submission 6*, p. 5.

27 *Committee Hansard*, 14 April 2015, p. 33.

engagement in the operation of unmanned platforms for military purposes.[28] Similarly, PREMT commented:

> [C]are should be taken when assigning civilians – for example, contractors or civilian staff members of government agencies – to operate [unmanned platforms] in armed conflict. While international law does not prohibit such practice, the operators run the risk of taking a direct part in hostilities, which makes them legitimate military targets and renders them liable to arrest and prosecution if, for example, travelling abroad after the end of the conflict. Also, facilities from which UVs are operated may become targetable as lawful military objectives.[29]

5.22 Similarly, the Australian Red Cross also recommended that 'unmanned platform systems should not be used, controlled, programmed or operated by individuals whose accountability lies outside military mechanisms of control in relation to potential breaches of IHL'.[30]

Autonomous weapons systems and unmanned platforms

5.23 Many military, civilian and recreational unmanned platforms currently available have a degree of automated functionality designed to reduce operator workload or errors. These functionalities could include automated take-off and landing, height keeping, and route following/planning. However, Mr Ken Crowe from Northrop Grumman observed that in terms of true autonomy 'unmanned systems still have a long way to go':

> The aircraft, the ground systems and the underwater systems follow various pre-programmed rules either to repatriate themselves to an area of safety and land or to avoid impacting adversely on their environment. So true autonomy I do not think has arrived in unmanned systems, but they exhibit elements of autonomy. To the untrained observer it may look as if the systems are thinking for themselves, but of course they are not. There are acting under pre-programmed rules and they are following the direction of their pilots or mission commanders back at base.[31]

5.24 Fully autonomous unmanned platforms capable of using lethal force do not currently exist. However, so-called autonomous weapons systems (AWS) are being developed. For example, there are a number of air defence systems which have human supervised autonomous modes which detect, track and guide weapons to destroy targets such as the Israeli Iron Dome system or the Aegis Combat System which will be operated on the RAN Air Warfare Destroyers. Active protection systems are also

28 *Submission 6*, p. 11.

29 *Submission 22*, p. 5.

30 *Submission 15*, p. 2.

31 *Committee Hansard*, 14 April 2015, p. 14.

being deployed on armoured vehicles which can autonomously detect and intercept incoming munitions.[32]

5.25 Recent research and development has included a focus on increasing the level of autonomy of unmanned platforms for both civilian and military applications. The International Committee of the Red Cross (ICRC) noted that 'a truly autonomous system capable of operating in a dynamic environment against a range of targets has not yet been developed…[h]owever, there is considerable interest in (and funding of) relevant research'.[33] For example, the US Defense Advanced Research Projects Agency (DARPA) Collaborative Operations in Denied Environment (CODE) project aims at developing improvements in collaborative autonomy of unmanned platforms, including the capability for groups of UAVs to work together under limited human supervision. The program manager for the CODE project stated:

> Just as wolves hunt in coordinated packs with minimal communication, multiple CODE-enabled unmanned aircraft would collaborate to find, track, identify and engage targets, all under the command of a single human mission supervisor.[34]

5.26 Concerns were raised regarding the legal implications of unmanned platforms capable of autonomously using lethal force. There were doubts that an AWS would be capable of adequately complying with the fundamental principles of IHL such as proportionality. Uncertainties were also highlighted in relation to the accountability for acts performed by AWS which amounted to violations of IHL including individual criminal responsibility or State responsibility.

5.27 Dr Brendan Gogarty from the University of Tasmania urged the committee to consider the issue of full autonomy of unmanned platforms as a long term concern requiring 'immediate and wide ranging action':

> A computer without human restraints will always be faster than one with some form of human control and therefore, realistically, once one nation has fully autonomous weaponised [unmanned platforms] the others will follow. That situation may be fifty years away, or it may be five, but ultimately, now is the best time to have the debate about whether the community is willing to accept such a future. If it is determined that full weapons autonomy is not an acceptable path then Australia will have to participate in, or even lead, international dialogue towards effective regulation and restriction of such technology.[35]

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32 For example, David de Bruijn, 'Israel's Iron Dome, Tank Edition: The Trophy System', *The National Interest*, 30 July 2014.

33 *Submission 25*, p. 2.

34 Defense Advanced Research Projects Agency, 'Establishing the CODE for unmanned aircraft to fly as collaborative teams', *Media release*, 16 January 2015.

35 *Submission 18*, p. 3.

5.28 The moral and ethical issues regarding the use of AWS were also raised with the committee. The ICRC commented:

> Even if technology could one day allow an autonomous weapon system to be fully compliant with IHL in a dynamic environment, there remain some fundamental questions…Additional Protocol I of the Geneva Conventions provides that the acceptability of such systems should be examined according to the principles of humanity and the dictates of public conscience.
>
> Would the dictates of public conscience be prepared to yield to a machine the decision to take human life on a battlefield? And if it is agreed that some human control or oversight is required in such life and death situations, what kind and degree of human control would be meaningful?[36]

5.29 Dr Christian Enemark identified the critical issue as 'whether or how technology can overcome ethical shortcomings in the use of force while preserving the moral influence of human responsibility'. He considered that 'there is little scope for optimism that robotics engineers could program autonomous drones to exercise better ethical judgement than on-board pilots or ground-based operators, and a more serious concern is that these machines might be deployed before achieving even a roughly equal standard'.[37]

5.30 On 27 February 2014, the European Parliament adopted a non-binding resolution on the use of armed drones that included support for a ban on 'the development, production and use of fully autonomous weapons which enable strikes to be carried out without human intervention'.[38] Several human rights and other civil society groups have also commenced a campaign for international action against the development of AWS. The Campaign to Stop Killer Robots has called for a comprehensive, pre-emptive prohibition on the development, production and use of fully autonomous weapons achieved through an international treaty, as well as through national laws and other measures. It has also urged all countries to consider and publicly elaborate their policy on fully autonomous weapons.[39] A range of other possible measures have been suggested to regulate AWS, including controls to slow the proliferation, requirements they be defensive in nature, limitations on their firepower or compulsory neutralising mechanisms.[40]

5.31 The Australian Red Cross outlined that State Parties to the Convention on Certain Conventional Weapons (CCW) have convened a number of meetings to discuss issues surrounding AWS together with observer States, UN agencies, the

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36 *Submission 25*, pp 2-3.

37 *Submission 5*, pp 6-7.

38 European Parliament, *Resolution on the use of armed drones*, (2014/2567)

39 Australian Red Cross, responses to questions on notice no. 1, p. 4.

40 Gary Martinic, 'Drones' or 'Smart' Unmanned Aerial Vehicles', *Australian Defence Force Journal*, Issue 189, 2012, pp 47-48.

ICRC, NGOs and subject matter experts.[41] Australia, as a signatory to the CCW, has participated in these discussions. At the first informal meeting of experts, the Australian representative, former Ambassador Mr Peter Woolcott stated:

> For us, this topic has raised many more questions than answers. Consistent with Australia's approach to other emerging technologies, like in the cyber context, Lethal Autonomous Weapon Systems, if they are to be used, should only be used in accordance with existing international law. How international law, including the use of force, international humanitarian law and international human rights law, applies to Lethal Autonomous Weapon Systems will need to be addressed as the technology continues to develop…
>
> Like any other weapon, Australia notes that a Lethal Autonomous Weapon System might be employed in a defensive mode or an offensive mode. As such, Australia would like to eventually see a definition of a Lethal Autonomous Weapon System which identifies its key distinguishing aspects to enable further discussion on this topic.[42]

5.32 Australia did not make a statement at the next meeting of experts held in Geneva on 13-17 April 2015. Many countries and organisations participating at that meeting identified the concept of 'meaningful human control' as important to potential future regulation of AWS.[43] However, others countries urged caution, highlighted definitional issues and argued that it was premature to consider specific action to regulate AWS. For example, the UK stated:

> To legislate now, without a clear understanding of the potential opportunities as well as the dangers of a technology that we cannot fully appreciate, would risk leading to the use of generalised and unclear language which would be counterproductive. IHL has successfully accommodated previous evolutions of military technology…There is no reason to believe that IHL will not be capable of dealing with an evolution in automation.[44]

5.33 In 2012, the US Department of Defence (US DoD) issued a policy statement on autonomy in weapons systems. The directive appeared to be the first policy statement by any country on AWS. In particular, the directive states it is US DoD policy that '[a]utonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment

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41 Australian Red Cross, responses to questions on notice no. 1, p. 2.

42 HE Mr Peter Woolcott, Australian statement, General debate, CCW Informal Meeting of Experts on Lethal Autonomous Weapon Systems (LAWS), 13 May 2014.

43 For example, Austria, 'The concept of "meaningful human control"', *Working Paper*, Lethal Autonomous Weapons Systems; Expert Meeting, Geneva, 13-17 April 2015; Australian Red Cross, responses to questions on notice no. 1, p. 4.

44 UK, Possible challenges to IHL due to increasing degrees of autonomy, Statement to the informal meeting of experts on lethal autonomous weapons systems, 13-17 April 2015, p. 3.

over the use of force'.[45] The US delegation to the informal meeting of experts on AWS in April 2015 described the framework established by the directive:

> The framework establishes a deliberative approval process by senior officials, sets out the technical criteria that would need to be satisfied in order to develop autonomous weapon systems, and then assigns responsibility within our Defense Department for overseeing the development of autonomous weapons systems. The Directive imposes additional requirements beyond what is normally required during our weapons acquisition process. These additional requirements are designed to minimize the probability and consequences of failure in autonomous and semi-autonomous weapons systems that could lead to unintended engagements and ensure appropriate levels of human judgment over the use of force.[46]

5.34 Defence stated that its approach was that 'where lethal force is involved a trained operator will remain responsible for the application of that force'.[47] It noted:

> It is theoretically possible that an unmanned system with sufficient processing power and a library of threat signatures could be armed and programmed to apply lethal force autonomously. The ADF will embrace semi-autonomous systems where that capacity can save lives or reduce exposure - for example by replacing truck drivers in some vehicles of a resupply convoy with autonomous systems that can follow the vehicle ahead – but where lethal force is involved a trained operator will remain responsible for the application of that force.[48]

5.35 At the April hearing, Rear Admiral Peter Quinn stated:

> Australian unmanned systems retain a human in the loop, meaning that, while some basic functions are conducted autonomously, ultimate control is retained by a system operator. This will remain the case if in the future the ADF asks the government to consider the benefits of arming unmanned systems.[49]

Other legal and regulatory issues

5.36 A broad range other legal issues were raised in relation to the use of unmanned platforms. The majority of these issues were also applicable to civilian or government use of unmanned platforms. These included negligent use, traffic

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45 US Department of Defence, *Autonomy in Weapons Systems*, Directive 3000.09, 21 November 2012.

46 Michael Meier, US Delegation Opening Statement, Convention on Certain Conventional Weapons (CCW) Informal Meeting of Experts on Lethal Autonomous Weapons Systems, 13 April 2015, p. 2.

47 *Submission 23*, p. 6.

48 *Submission 23*, p. 6.

49 *Committee Hansard*, 14 April 2015, p. 41.

regulation considerations, use of evidence gathered, privacy regulations and regulation of no-fly zones.[50]

50 For example, Dr Brendan Gogarty, *Submission 18*, pp 3-5.

Chapter 6

Research, industry and procurement

Introduction

6.1 This chapter will consider Australia's defence research and development capabilities and industrial expertise in relation to unmanned platforms. It will also examine issues with acquisition and procurement of unmanned platforms by the ADF.

Research and development

6.2 The importance of research and development to ADF use of unmanned platforms was repeatedly stressed during the inquiry. Defence emphasised that research and development 'influences every aspect of unmanned platforms including roles, cost, mission effectiveness, force structure, risk, policy, public confidence and safety'.[1] Australia has had a continuing role in global UAV research and development. For example, in February 2014, it was reported that the UK Ministry of Defence conducted test flights of its Taranis Unmanned Combat Air Vehicle at the Woomera Prohibited Area in South Australia.[2] Defence commented:

> The rather sparse population density and low air traffic volumes seen in Australia provide an ideal environment for testing UAS. The Royal Australian Air Force (RAAF) Woomera Test Range in particular has provided an established facility that has already been used by local and overseas agencies to test UAS…[3]

6.3 A number of submissions highlighted niche unmanned platform research and development activities being undertaken in Australia. Many universities in Australia (University of Sydney, Royal Melbourne Institute of Technology, Queensland University of Technology) have active research and development programs. The Australian Research Centre for Aerospace Automation (ARCAA) is a collaborative UAV research organisation established between Queensland University of Technology and Australian industry. The CSIRO has also been working with private companies, including in developing mining autonomy research and development.

6.4 Defence observed that '[a]cademia, when unified through public and private funded cooperative research centres, has achieved significant successes in unmanned systems'. It noted that the Australian Centre for Field Robotics (ACFR) at University of Sydney is recognised as a world-leader in Simultaneous Location and Mapping, a

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1 *Submission 23*, p. 14.

2 Matthew Grimson and Mark Corcoran, 'Taranis drone: Britains's $336m supersonic unmanned aircraft launched over Woomera', *ABC News*, 7 February 2014.

3 *Submission 23*, p. 14.

technology used to allow an unmanned platform to know where it is in the world and map its environment without the use of a GPS receiver.[4]

6.5 Saab Australia told the committee it had established a research centre focused on USVs in South Australia:

> The Australian Centre of Excellence in Autonomous Surface Vessels seeks to harness the skills developed in Saab in support of the RAN surface fleet and leverage the sophisticated unmanned platform technology developed in Saab worldwide to provide an incubator for the development of novel applications for unmanned surface platforms.[5]

6.6 The challenges of bringing together research and development resources from the academic, industry and defence sectors were also emphasised.[6] Defence noted the Defence Science and Technology Organisation was a key 'industry/academia partner and the lead agency for innovation integration across Defence'. DSTO was also described as having a fluctuating focus on unmanned platforms. ACUO identified DSTO as a 'focal point for Defence's experimentation with UAS on a broad frontage, this ranging from airframes, propulsion systems, sensors, guidance and control and flight testing of complete systems, subsystems, and unit items'. However, it considered DSTO's overall level of engagement with the national UAS industrial base was 'not reflective of the realities of the sector as currently exists and is likely to exist in short years'.[7]

6.7 A need for further support for research and development into unmanned platforms was identified. The Australian Association for Unmanned Systems (AAUS) considered that Australian industry 'has demonstrated "runs on the board" with respect to world-leading innovative unmanned systems R&D'. It stated:

> The ADF/DSTO have provided support for a small number of research and development programs through funding programs such as concept technology demonstrators (CTD). We believe that it is in the national interest to increase support for local R&D for reasons of strategic national security and economic prosperity. It is a potential growth sector and one that Australia has proven competence.[8]

6.8 Similarly, the ARCAA stated:

> There is an opportunity for greater federal leadership and R&D support for the growth of a UAS industry for the purposes of national security and economic prosperity. Whereas competitive university research is predominantly supported through the Australian Research Council, there is

4 *Submission 23*, p. 14.

5 *Submission 24*, p. 3.

6 For example, Dr Derek Rogers, *Committee Hansard*, 14 April 2015, pp 20-21.

7 *Submission 11*, p. 35.

8 *Submission 17*, p. 3.

> a need to provide greater support to realise commercial outcomes from research.[9]

6.9 Dr Andrew Davies from ASPI noted the relatively small budget for Defence research and innovation through the Rapid Prototyping, Development and Evaluation Program and the Capability and Technology Demonstrator Program. He commented:

> One of things I would very much like to see is the Department of Defence taking a more experimental approach to developing drone capability in Australia. The Land 129 project under Army stagnated for a very long time, and they were more or less dragged kicking and screaming into grabbing something and using it with the operations in Afghanistan. There is a lot to be said for experimentation, and natural selection will identify the industry players who can add value.[10]

6.10 Mr Ken Crowe outlined Northrop Grumman's engagement with the community and academia, including providing PhD placements.[11] He commented:

> The strength of the Australian workforce, I believe, it in its innovation…Australia's small population and its huge maritime and land areas of interest demand of us more from our systems. We cannot afford to use them in the same way that other countries will use them. I think that the primary opportunities for Australia's students, technical resources, engineers and scientists is by investigating the innovative use of this technology, not just to meet Australia's requirements for situation awareness, for surveillance, for long-range mission but to then feed them back perhaps through OEMs to the rest of the world.[12]

Defence industrial base

6.11 A new Defence Industry Policy Statement will be released following the release of the Defence White Paper 2015.[13] The *Defence Issues Paper 2014* outlined that worldwide trends have put pressure on the local defence industry:

> Sophisticated military equipment has become steadily more expensive and resource intensive to develop and produce. The ability of individual countries to maintain an end-to end capability has diminished. The result has been a trend towards multinational collaboration and the globalisation of the defence industry sector. Equipment for the ADF is often sourced from offshore suppliers.[14]

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9 *Submission 21*, p. 3.

10 *Committee Hansard*, 14 April 2015, p. 25.

11 Mr Ken Crowe, Northrop Grumman, *Committee Hansard*, 14 April 2015, p. 16.

12 Mr Ken Crowe, Northrop Grumman, *Committee Hansard*, 14 April 2015, p. 17.

13 The Hon Kevin Andrews MP, Minister for Defence, *Speech to Australian Member Committee of the Council for Security Cooperation in the Asia Pacific*, 22 May 2015.

14 Department of Defence, *Defence Issues Paper*, 2014, p. 23.

6.12 Defence noted that 'Australia holds a significant body of advanced engineering development expertise relevant to unmanned systems in industry'. However, it acknowledged that 'some reduction in industry development effort is being experienced in recent years due to a lack of uptake and a more stringent national regulatory environment'.[15]

6.13 Despite these challenges, many contributors were optimistic regarding the future of Australia's unmanned platform industry.[16] Mr Peter La Franchi, who appeared with Australian Certified UAV Operators (ACUO), considered there were clear opportunities for Australian industry 'in terms of software systems related to imagery intelligence, in terms of sensor payloads and in terms of finding derivatives that might flow across to the commercial marketplace'.[17] Mr Brad Mason, also from ACUO, outlined the achievements being made by the Australian UAV industry:

> Australia's UAS industry is currently well placed in global terms. Our sector has proven it can be competitive and penetrate portions of the world market. The US Navy and Special Operations Command use Australian designed and manufactured Aerosonde mark 4.7 systems in operational roles with deliveries on an ongoing basis. The Royal Thai Air Force Academy uses Australian designed and manufactured Cyber Technology CyberEye II V2 systems as training assets. The United States Air Force's Eglin range uses Australian designed and manufactured Silvertone Flamingo systems as flying test beds for experimental sensors. New generation engines from the Australian Stock Exchange listed Orbital are being adopted by Boeing Insitu for its future production ScanEagle systems. Melbourne based Sentient Vision Systems has successfully entered the United States military UAS market with its Kestrel movement detection software.[18]

6.14 The growth of commercial unmanned platforms businesses was also highlighted by ACUO, which noted its membership had grown from eight operators in 2009 to over 200. Mr La Franchi highlighted that large mining, engineering and resources companies in Australia were developing unmanned system capabilities for survey work, pipeline monitoring and surveillance of facilities.[19] Saab Australia also noted that unmanned platforms were also likely to be further utilised in other industries in Australia 'with crossovers between defence and other industries such as Oil and Gas, Mining, Customs and Border Protection, Remote Surveillance, and Agriculture and Fishing'. It commented:

> Unmanned Surface Vessels are truly an emerging opportunity and one Australian Industry can take an active and world leading role in, leveraging

15 *Submission 23,* p. 14.

16 *Submission 11*, p. 11.

17 *Committee Hansard*, 14 April 2015, p. 7.

18 *Committee Hansard*, 14 April 2015, p. 1.

19 *Committee Hansard*, 14 April 2015, pp 4-5.

> the skills of our Publicly Funded Research Organisations (PFRO) in collaboration with key Electronics and Information Technology (ICT) industry players and skilled boat and ship builders.[20]

6.15 Mr Anthony Patterson from Cobham Aviation Services also suggested that Australia could generate expertise 'in the operation of these systems…rather than just being single-mindedly focused on manufacture'. He noted that while there was a focus on manufacture 'in terms of the amount of spend or revenue that is generated or spent, operations is a very large area of economic activity.[21]

6.16 Northrop Grumman observed that the Australian research sector and industrial base lacked the scope and depth to cover all areas of unmanned systems development. It considered most major unmanned systems developments would occur overseas and be driven by the US defence/industrial base. However, it stated that Australian research organisations and industry do have the skills to become significant players in niche areas related to unmanned systems development. It recommended:

> Australia should seek involvement in:
>
> - unmanned systems co-operative development programs with US partners;
> - unmanned systems research, trials and demonstration programs;
> - the development of supporting unmanned systems technologies, such as software, communication or sensor technologies; and
> - the development of the supporting PED systems and data processing technologies, without which unmanned systems will largely be ineffective…
>
> [R]ealistically, as the range, pace and depth of unmanned technological developments will tax the capabilities of Australia's relatively small military/industrial base, the most sensible and cost effective approach is for Australia to seek to collaborate with the US and the other trusted allies, as a contributing junior partner, in selected and appropriate unmanned programs…[22]

6.17 Cobham Aviation Services took a similar view:

> From an Australian industry perspective it is most logical to follow the manned aircraft industry model driven by the market size where the larger more complex platforms originate from the established manufacturers and Australia's RPAS manufacturing opportunities focussed on the smaller

20 *Submission 24*, p. 7.

21 *Committee Hansard*, 4 May 2015, p. 6.

22 *Submission 12*, p. 8; Also see Mr Ken Crowe, Northrop Grumman, *Committee Hansard*, 14 April 2015, p. 15.

platforms and the development of unique sensor packages for integration into the larger platforms.[23]

6.18 The ACUO submission made a large number of proposals for supporting Australian defence industry involvement in UAVs. These included:

- developing and adopting a national Unmanned Aircraft Industry Strategy which links its requirements with the rapidly expanding domestic commercial UAV sector;
- the establishment of domestic sourcing thresholds for Group I and Group II UAV adopted by the ADF as a means of reducing its costs of acquisition, operation and support by linking with commercial development activity;
- the formal establishment of project offices for developing ADF Group IV UAV and Royal Australian Navy maritime UAS capabilities; and
- the establishment of a commercially provided UAS training capability for the ADF at the Group I and Group II level by leveraging the near 200 commercially certified UAV operators already trading in the Australian domestic market.[24]

6.19 The need to support exports of Australian defence products related to unmanned platforms has also been highlighted. CEA Technologies, which produces Phased Array Radar systems, has noted that valuable assistance to Australian defence exports can be provided from the Australian Military Sales Office and the Defence Export Control Office. However, it also identified the lack of a defined process to assist Australian Government sales of sensitive defence technologies as well as complications with the administration of the Defence Strategic Goods List as challenges for Australian defence exporters.[25]

Acquisition and procurement

6.20 Some contributors to the inquiry suggested that Australia had been slow or reluctant to adopt unmanned platforms for defence purposes. For example, Mr Brian Weston stated that 'Australia despite its compelling [UAV] friendly geography and environment has lagged in investing in [UAV] capability'.[26] Cobham Aviation Services considered that the 'current White Paper development and associated Force Structure Review, Defence Capability Plan and appropriate Defence budget are the opportunities for the capability acquisition process to catch up and deliver unmanned

23 *Submission 14*, p. 5.

24 *Submission 11*, pp 1-2.

25 CEA Technologies, *Submission 38*, pp 1-4 to the Joint Standing Committee on Foreign Affairs, Defence and Trade inquiry into Australian defence industry exports.

26 *Submission 4*, p. 4.

systems to the ADF that it requires to maintain Defence capability advantage in today's world'.[27]

6.21 There were indications that Defence's rapid acquisition of unmanned platforms to address operational needs had affected opportunities for Australian defence industry involvement. ACUO listed a series of examples of 'project failures', 'sliding milestones for new capability developments', 'missed opportunities', 'failed multilateral cooperation activities' and 'poor in-service support planning' in relation to unmanned platforms acquisitions.[28] Mr La Franchi who appeared with ACUO stated:

> We have had a fairly significant war to focus upon, and industry engagement has suffered as a result of that across the board at a broad level. The unmanned systems industry has to some extent been held at arms' length. Where there have been priority military requirements to support war-fighting operations those sections of our industry have done well; they have been able to reach in and establish good relations.[29]

6.22 The AAUS commented:

> Whilst Australia has a significant unmanned platform industry, the ADF does not operate any locally developed or manufactured systems. A possible reason for this is that apart from JP129 and Air7000, the indigenous unmanned platform industry has not been able to obtain a clear strategic view of ADF requirements and have been caught off-guard by these rapid acquisitions.[30]

6.23 ACUO observed that 'the limited UAS capability now fielded by the ADF comes after significant financial outlays over the past 14 years'. It argued that the discrepancy between the fiscal commitments and extant ADF operational capability in relation to UAS 'points to a problematic engagement by Defence with the Australian UAS industrial base at a broad level'.[31]

6.24 The rapid development of unmanned platforms was also seen as introducing risks for defence procurement decisions. The ACUO highlighted that '[c]ontemporary UAS development cycles are instead more closely aligned with consumer technology trends, this facilitating a tempo which is also well ahead of the timeframes associated with research and development as conducted by traditional academic institutions'. It considered '[t]his shift poses challenges for the Australian Defence Organisation in the broad, requiring adoption of a posture of continual learning in its doctrinal,

27 *Submission 14*, p. 4.

28 *Submission 11*, pp 8-10.

29 *Committee Hansard*, 14 April 2015, p. 4.

30 *Submission 17*, p. 2.

31 *Submission 11*, p. 8.

technological and acquisition practices if it is to attain the full benefits of the ongoing UAS revolution'.[32]

6.25 Similarly, the AAUS commented:

> Unmanned system programs outlined in the current Defence Capability Plan (DCP) are those with typical Defence acquisition timescales. The developmental pace of unmanned systems in the US and Israel has seen relevant technology become available to the ADF in timescales much shorter than White Paper or DCP timescales.
>
> The Australian Government has an opportunity to develop a more agile plan to allow this rapidly evolving technology to be utilised quickly by the ADF, whilst keeping the indigenous industry actively engaged.[33]

6.26 In the context of a rapidly evolving area of technology, Dr Andrew Carr suggested 'Australia should focus on smaller single-purpose "swarm" technologies rather than multiple-purpose mega systems':

> To put it in the words of one report on defence technology: It should buy more R2D2's and less Death-Stars. As we do not know how the technology will develop, a focus on purpose and processes rather than platforms is important…With emergent technologies like unmanned platforms however, a focus on quick development, testing and replacement is critical until the ADF gains mature knowledge of how best to use these systems.[34]

32 *Submission 11*, p. 10.

33 *Submission 17*, p. 2.

34 *Submission 19*, p. 2.

Chapter 7

Airspace regulation

Introduction

7.1 A number of airspace regulation issues with ADF use of UAVs were outlined during the inquiry, with air safety issues and airworthiness certification frequently mentioned topics. For example, Ms Rosalyn Turner from ASPI identified that airspace regulation for UAVs was 'something that should be addressed up-front, because it can cause delays and restrictions on the use of the platforms in-country'.[1]

7.2 An information paper provided by the Civil Aviation Safety Authority (CASA) outlined some of the operational issues with UAV or 'remotely piloted aircraft' (RPA) used in civilian airspace. In particular, CASA distinguished between large UAVs operating at high altitude fitted with transponders and Automatic Dependant Surveillance-Broadcast (ADS-B) avionics (which broadcast an aircraft's position) allowing them to be identified by air traffic control and other smaller UAVs which are not fitted with these features. It noted that with the latter UAVs, positive separation and directed traffic information services cannot be provided by air traffic control as the UAVs 'are not visible to the air traffic management system'.[2] It noted:

> Aircraft operating under the [visual flight rules] use 'see-and-avoid' as a method for preventing mid-air conflicts. [UAV] do not have the ability to 'see-and-avoid' other aircraft, therefore the majority of Area Approvals have been granted to [UAVs] operating within Visual Line of Sight (VLOS). The operator must be able to see and control the aircraft at all times. VLOS operations limits the operational area of the UAV.[3]

Regulatory developments

7.3 In Australia, CASA regulates unmanned aircraft through the Civil Aviation Safety Regulation (CASR) Part 101. An operating certificate and unmanned aircraft controller's certificate are required to be issued by CASA to conduct UAV operations.[4] CASA told the committee that CASR Part 101 (promulgated in 2002) has become outdated due to technological developments and is in the process of being updated:

> Under CASA Project OS 11/20, amendments have been drafted to reflect the terminology being used by [the International Civil Aviation Organisation] to clarify the requirements for remote pilot training and

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1 *Committee Hansard*, 14 April 2015, p. 27.

2 CASA, 'Remotely Piloted Aircraft Systems', *Information Paper*, 2015, p. 4.

3 CASA, 'Remotely Piloted Aircraft Systems', *Information Paper*, 2015, p. 5.

4 CASA, 'Remotely Piloted Aircraft Systems', *Information Paper*, 2015, p. 2.

> certification, to remove redundant requirements and to simplify the process for approval. The project also examined the establishment of a risk-based framework for regulating RPA operations by weight.[5]

7.4 Mr Peter Boyd from CASA told the committee that a draft of the update had been completed and been distributed for consultation last year. He also noted the UAV subcommittee of CASA's Standards Consultative Committee was finalising a road map of regulatory development priorities including 'whether or not we can get technology to detect and avoid and how we look at operations in a controlled airspace'.[6]

7.5 Defence has introduced a new set of regulations against which UAVs can be certified and operated. These new regulations are not based on weight or size for categorisation, but risk to third parties (other airspace users, non-mission essential personnel and critical infrastructure). Defence noted:

> [This] categorisation of UAS is unique, being based on likely risk and operations, rather than purely physical characteristics. Defence has the opportunity to promote this system with allied agencies, though of course the development of recognised standards is still required.[7]

7.6 Defence stated that CASA's proposed new RPA regulations and Defence UAV regulations are not aligned as CASA maintained a weight based categorisation system. However, Defence did not have any other concerns with the methodology of CASA's regulatory development and stated that it would seek to ensure that both Defence and CASA regulations are compatible to allow required access to airspace.[8]

7.7 Internationally, CASA outlined that the International Civil Aviation Organisation (ICAO) 'supports the safe, secure and efficient integration of RPA into non-segregated airspace and aerodromes'. It noted ICAO is developing a roadmap for the integration of [UAV], guidance to States as they establish their own regulatory frameworks for UAVs and contributing to 'the development of technical specifications for detect and avoid and command and control data-links for [UAVs]'.[9] CASA also noted it was engaged with other national air regulators through the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) and other forums on the issues raised by UAVs.[10] The objective of JARUS is to provide guidance material to national air authorities and recommend technical, safety and operational requirements for the certification and safe integration of UAVs in to airspace and at aerodromes.[11]

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5 CASA, 'Remotely Piloted Aircraft Systems', *Information Paper*, 2015, p. 3.

6 *Committee Hansard*, 13 May 2015, p. 4.

7 Defence, response to questions on notice no. 2, p. 2.

8 Defence, response to questions on notice no. 2, p. 3.

9 CASA, 'Remotely Piloted Aircraft Systems', *Information Paper*, 2015, p. 5.

10 Mr Peter Boyd, CASA, *Committee Hansard*, 13 May 2015, p. 3.

11 JARUS, 'Terms of reference', 1 August 2012, p. 1.

7.8 There was broad agreement that CASA had been progressive in the regulatory management of UAVs, but that further work was required. For example, Mr Anthony Patterson from Cobham Aviation Services considered that 'Australia has been very forward leaning in a regulatory sense'.[12] While Defence appeared to agree with this assessment, it also highlighted different priorities existed in relation to regulatory development:

> CASA is currently more concerned with the development and enforcement of regulations to support the operations of small RPA (generally less than 7kg), with the number of applications for commercial operators increasing exponentially in the past two years. On the other hand, Defence is currently more concerned with the development and implementation of regulations to support the employment of much larger platforms such as the Heron-1 and Triton.[13]

7.9 In this context, the ACUO argued that 'civil aviation regulators are under-resourced to be meet extant civil as well as emergent Defence specific requirements'.[14]

7.10 The lack of consistent regulatory frameworks for UAVs was identified as an obstacle to increased UAV use in civilian airspace.[15] Defence considered that '[a]chieving a common understanding/agreed method to categorise unmanned aircraft, and hence apply a common or agreed set of regulations and standards, should be the first priority of the international aviation community'. It explained there was no agreed categorisation system for UAV across allied nations. Defence considered that this was 'an area deserving of further consideration, in order to support the consistent certification of future platforms'.[16] It noted:

> In the civilian sense, there is a common understanding of the design requirements for sports aircraft, general aviation aircraft, light commuter airlines all the way up to large commercial airlines….This is not the case for unmanned aircraft, as no standard currently exists. This situation is made more acute by the fact that the various states and agencies have yet to agree on the scheme by which unmanned aircraft are categorised and therefore where the various design requirements should be applied.[17]

7.11 Similarly, the Australian Research Centre for Aerospace Automation (ARCAA) commented:

> There is a need to move towards a framework of airworthiness certification based on an appropriate set of standards for the platform and operational scenario, and the development of requirements for the appropriate

12 Mr Anthony Patterson, Cobham Aviation, *Committee Hansard*, 4 May 2015, p. 6.

13 Department of Defence, response to questions on notice no. 2. p. 5.

14 *Submission 11*, p. 2.

15 For example, Northrop Grumman, *Submission 12*, p. 9.

16 *Submission 23*, p. 16.

17 Department of Defence, responses to question on notice no. 2, p. 4.

> technologies and procedures to maintain aircraft separation and deal with aircraft emergencies such as engine failure.[18]

7.12 Mr Anthony Patterson from Cobham Aviation Services also considered that a certification standard was the 'real piece missing' from civil regulatory activity:

> One does not exist internationally, so it is difficult to get type certification because no standard exists against which to get type certification. That is the real challenge… I think from a regulatory point of view we will catch up, but, because the regulatory environment—or particularly the certification environment—is dependent on Australia being harmonised with the rest of the world, Australia is in advance of the rest of the world and so we are waiting for what the rest of the world is going to do. That is the conundrum.[19]

Defence UAVs in civilian airspace

7.13 Air Vice-Marshal Gavin Davies stated that, at the moment, Defence currently only had limited opportunities to fly the Heron UAV outside of military controlled airspace. However, he foreshadowed an expanded future role for the Heron and other ADF UAVs:

> Our intention is to work with our civil agencies, and indeed with other government departments, to understand that operating in this case a Heron but any modern remotely piloted aircraft is not a dangerous situation, that there are proper rules and engineering applications…When we get through those gates, it will be outside of military airspace but not over built-up areas. Then it will be further expanded.[20]

7.14 The ADF's Heron UAV is expected to operate outside restricted military airspace in Australia for the first time (flying from Rockhampton Airport in Queensland) in mid-2015 as part of the joint Australia/US military training exercise Talisman Sabre.[21]

7.15 Despite general concerns with the reliability of UAVs, a high degree of confidence was expressed in relation to the ADF's ability to safely operate UAVs in civilian airspace. For example, the Australian Association for Unmanned Systems stated:

> Risks associated with the use of unmanned platforms include collision with other aircraft, people and property. From our perspective, the ADF has successfully and safely integrated unmanned systems into Defence controlled airspace during Iraq and Afghanistan deployments using a

18 *Submission 21*, p. 4.

19 *Committee Hansard*, 4 May 2015, p. 6.

20 *Committee Hansard*, 14 April 2015, p. 45.

21 Royal Australian Air Force, 'Airservices Australia and the Royal Australian Air Force strengthen collaboration on unmanned aircraft systems', *Media release*, 29 May 2015.

> sensible risk based approach. We hope that our civil regulator and industry can benefit from lessons learned and processes adopted in order to progress regulations for RPAs operations in Australian civil airspace.[22]

7.16 On 29 May 2015, Airservices Australia and the RAAF entered into a Memorandum of Agreement (MoA) regarding the operation of the Heron in Australian civil airspace. The MoA sets out procedures to facilitate the initial operation and integration of UAVs into civilian airspace, based on the RAAF's airworthiness and aviation safety system.[23]

7.17 Currently CASA deals with Defence use of UAVs on a 'case-by-case basis' where under certain circumstances temporary restricted areas and permanent or temporary danger areas to cover activities will be put in place.[24] In terms of regulators facilitating further use of civilian airspace by UAVs, Mr Peter Cromarty from CASA observed:

> I come to this with an open mind, but I also come to it with a mind that I am the regulator, and I need to be convinced that it is adequately safe, because otherwise I am going to be in front of the senators trying to argue why I allowed something that crashed on somebody's head.[25]

22 *Submission 17*, pp 3-4.

23 Royal Australian Air Force, 'Airservices Australia and the Royal Australian Air Force strengthen collaboration on unmanned aircraft systems', *Media release*, 29 May 2015.

24 Mr Peter Cromarty, CASA, *Committee Hansard*, 13 May 2015, p. 4.

25 *Committee Hansard*, 13 May 2015, p. 5.

Chapter 8

Conclusion

Introduction

8.1 The committee's terms of reference direct consideration of the 'potential use' of unmanned platforms by the Australian Defence Force (ADF) which invites speculation about an area of defence technology which is rapidly evolving. A degree of caution is warranted. Nonetheless, it is clear that increasing utilisation of unmanned platforms by military forces, including the ADF, will be an important trend in the next decades.

8.2 The development and utilisation of military unmanned platforms can be viewed as a 'megatrend'[1]—the result of improvements in a number of areas of technology including computing, automation, communications, sensors and precision munitions. Unmanned platforms appear well suited to Australia's defence and strategic circumstances. Australia's vast land mass, distant population bases, offshore assets and remote terrain, as well as its history of joint overseas operations with allies, align well with the features of unmanned platforms. Unmanned platforms have proven they can extend the reach of the ADF as a highly skilled but numerically small military force. Their range, persistence and additional functionality can provide the ADF with improved capabilities.

8.3 Unmanned platforms will also enhance the ADF's ability to contribute to the response to emergencies and national support tasks such as the regulation of Australia's borders through Border Protection Command. In a budgetary environment where additional efficiencies are always being sought, unmanned platforms can also be cost-effective alternatives to manned platforms in some circumstances. There is the potential for unmanned platforms to contribute to ADF operations in a broad range of areas beyond aerial surveillance. These could include as undersea sensors, emergency battlefield medical assistance and as key parts of the ADF's logistical operations.

8.4 However, despite the advantages of unmanned platforms, there is a risk in viewing any new technology as a panacea. While their capabilities have proven their value in permissive areas, it is unclear how these capabilities will perform in a contested environment. Further, it is unclear how identified vulnerabilities such as communications will be resolved. Manned platforms will remain the key ADF assets for the foreseeable future. As new unmanned platforms are adopted, the ADF should also be cautious not to diminish existing manned capabilities due to these acquisitions. As the Minister of Defence has acknowledged 'the ADF's reliance on high-technology

1 CSIRO, *Our future world: Global megatrends that will change the way we live*, 2012, p. 2.

enablers to undertake modern operations is also a potential vulnerability that needs to be managed'.[2]

Perceptions

8.5 The management of perceptions in relation to ADF unmanned platforms was highlighted as a significant issue in relation to their deployment. As the Heron and Triton commence operations in civilian airspace, Australians may be concerned due to misconceptions about their capabilities and functions. In order to counter the 'dark mystic' of unmanned platforms, Defence should assess its public communications strategies to ensure Australians are able to receive accurate and timely information about the use of unmanned platforms by the ADF. The reliability of unmanned platforms, their operation in populated areas and interaction with civilian aviation should all be addressed.

Recommendation 1

8.6 The committee recommends that the Department of Defence strengthen its public communications in relation to military unmanned platforms.

Armed platforms

8.7 The acquisition of armed unmanned platforms by the ADF (particularly MALE UAV) was seen as inevitable by several contributors to the inquiry. However, in the view of the committee, the increased integration of UAV into ADF operations will lead to a number of changes planning and deployment procedures. There are some areas where the committee understands the characterisation, made by some during the inquiry, that an unmanned armed aircraft simply removes the pilot and cockpit to a different location. There are other areas where the situation more complex. For example, while unmanned platforms have been perceived as removing risk and stresses for operators, it is worth noting studies from the US military which have indicated some 'drone pilots' have suffered elevated levels of mental health disorders.[3] Further, the committee considers that the use of armed unmanned platforms will change the risk profiles of missions, a fact which would have to be considered by commanders and politicians. Australia would also need to clearly articulate its intentions in acquiring armed unmanned platforms in public documents that may be considered by other nations.

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2 The Hon Kevin Andrews MP, Minister for Defence, *Speech to Australian Member Committee of the Council for Security Cooperation in the Asia Pacific*, 22 May 2015.

3 For example, Jean Otto and Bryant Webber, 'Mental Health Diagnoses and Counselling Among Pilots of Remotely Piloted Aircraft', *MSMR*, March 2013, pp 3-8; Wayne Chappelle, Tanya Goodman, Laura Reardon and William Thompson, 'An Analysis of Post-Traumatic Stress Symptoms in United States Air Force Drone Operators', *Journal of Anxiety Disorders*, June 2014.

8.8 It is likely that the forthcoming Force Structure Review will contain an option for the acquisition of unmanned platforms which are capable of being armed. In the view of the committee, this option should be taken up by the Australian Government. The committee has not identified any reason to negatively assess the capabilities of armed unmanned platforms solely due the fact they are unmanned. Any decision to acquire armed unmanned platforms for use by the ADF should be accompanied by the normal review of inputs to capability (such as training, operating procedures and doctrine).

8.9 A policy statement governing the deployment of armed unmanned platforms should be clearly articulated by the Australian Government. This should reinforce Australia's longstanding commitment to use military capabilities of any kind in accordance with Australia's international legal obligations, including processes for review under Article 36 of Additional Protocol I to the Geneva Conventions. In making this policy statement, the Australian Government should recognise it has the opportunity to contribute to the shaping of international norms and practices in relation to the use of armed unmanned platforms.

8.10 The committee notes that the United Kingdom's adoption of armed unmanned platforms provides valuable guidance for Australia. In line with this approach, appropriate transparency measures regarding the use of armed unmanned platforms by the ADF could also be outlined in the policy statement on the use of unmanned platforms. However, the committee also recognises these transparency measures will need to be balanced against the operational requirements of the ADF.

Recommendation 2

8.11 The committee recommends that the Australian Defence Force acquire armed unmanned platforms when the capability requirement exists and the Australian Government make a policy statement regarding their use. This policy statement will:

- **affirm that armed unmanned platforms will be used in accordance with international law;**
- **commit that armed unmanned platforms will only be operated by the Australian Defence Force personnel; and**
- **include appropriate transparency measures governing the use of armed unmanned platforms.**

Civilian support of unmanned platforms

8.12 Arguments were made during the inquiry regarding the potential benefits expanded use of civilian operation and support of military unmanned platforms. In the view of the committee, the direct operation of unmanned platforms must continue to be undertaken by the optimal mix of uniformed ADF, public servants or contract personnel taking into account maintenance, training and operational requirements. Considerations of the status of civilians and the laws of armed conflict should also be taken into account. In terms of other civilian support, there will need to be a careful

balance between the cost-effectiveness of civilian support to ADF unmanned platforms (such as maintenance) and the potential risks of civilian involvement with military operations. This includes the risk that those civilians involved in the support of ADF unmanned platforms may lose protection under the law of armed conflict. However, this is not a new challenge for the ADF and the committee expects it will be managed appropriately.

International humanitarian law training

8.13 Australia's military has a recognised record of compliance with the law of armed conflict and international humanitarian law. The committee was pleased to receive evidence from the Australian Red Cross regarding the high level of engagement in Australia in relation to international humanitarian law.[4] The introduction of armed unmanned platforms will need to address the law of armed conflict and international humanitarian law in the context of managing fundamental inputs to capability (such as training and doctrine).

Recommendation 3

8.14 The committee recommends that the Australian Defence Force notify the Australian Government of measures taken to address any identified gaps training and dissemination programs regarding the law of armed conflict and international humanitarian law when armed unmanned platforms are acquired.

Rapid acquisition

8.15 A mixed/hybrid fleet of manned and unmanned platforms is likely to be the future force structure model of modern military forces, including the ADF. In this context, some manned platforms acquired in the near future which will have long operational life-cycles will need (where appropriate) to be capable of supporting, controlling and deploying unmanned platforms. For example, a future manned submarine may need the capability to store, deploy and control maritime unmanned platforms which may be developed in the future. The committee notes that it appears this sort of capability integration is already being undertaken by the ADF. For example, the recently demonstrated advanced satellite communication and imagery display system for the C-17A Globemaster which is capable of receiving live ISR video from the Heron UAV.[5]

8.16 Defence has a demonstrated capacity to rapidly acquire, deploy, adapt and sustain new unmanned platforms where they may be needed. The committee notes that the First Principles Review calls for the integration of the Defence Materiel Organisation into the Department as well as a change in philosophy to see the defence industry as a fundamental input to capability. Defence must therefore engage with the

4 Dr Phoebe Wynn-Pope, Australian Red Cross, *Committee Hansard*, 14 April 2015, p. 31.

5 Department of Defence, 'New advanced Air Force capability demonstrated in Canberra', *Media release*, 20 May 2015.

Australian industry to provide the maximum opportunity for industry to be involved in both sustainment of unmanned platforms as well as research development and, where possible, production of components or in some cases, entire systems.

8.17 In relation to unmanned platforms, the Defence Capability Plan may need to be structured flexibly to allow for technological developments. Sufficient additional technical, engineering and scientific resources in Defence will also be required to assess, adapt and sustain new unmanned platforms acquired by the ADF.

Research and development

8.18 The valuable Australian research and development being undertaken in relation to unmanned platforms was highlighted during the inquiry. Further opportunities for research and development activities important to Australia's defence needs were also identified, in particular in the area of maritime unmanned platforms. However, in the view of the committee many of these research activities could be improved through enhanced collaboration and a focus on defence priorities.

8.19 Given the importance of unmanned platforms to future defence capabilities, the committee considers that a cooperative research centre should be created to support research and industry in this area. The committee's view is that the Australian Government should establish an organisation modelled on the existing Defence Materials Technology Centre. This is a proven approach for effective collaboration in defence technology research and development. A Defence Unmanned Platforms Centre (DUPC) would collaboratively bring together Defence, industry, academic and government research resources to develop new unmanned platform technologies which will support Australia's defence capabilities. The education program of the DUPC would provide opportunities for specialist skills development in relation to defence-focused unmanned platforms.

Recommendation 4

8.20 The committee recommends the Australian Government:

- **increase funding for innovation in the relation to unmanned platforms; and**
- **establish a Defence Unmanned Platforms Centre as a cooperative research centre in the area of military unmanned platforms.**

Defence and the unmanned platform industry

8.21 Australia's industrial base has a demonstrated capacity to design and manufacture a range of sub-systems and components for complex unmanned platforms. There are a large number of specialist and niche opportunities in relation to unmanned platforms for Australian industry in both the civil and military areas. In many cases the structure of an unmanned platform is less important than the associated software, communications, sensors, payload or integration with other defence systems.

8.22 Australia has a range of existing defence industry supports and programs. Many of these existing programs (such as the Priority Industry Capabilities and Strategic Industry Capabilities) have not proven effective despite being identified in the Defence and Industry Policy Statement. It is likely that all three services will be operating a significant number of unmanned platforms in the future. As the importance of unmanned platforms for the ADF increases, the associated industrial requirements will need to be reflected in the new Defence Industry Policy Statement. In particular, the committee considers there is merit in the ACUO proposal for the creation of an unmanned platforms national industry strategy as a part of the new Defence Industry Policy Statement.[6]

8.23 In recent years immediate operational needs have dictated the acquisition of unmanned systems from overseas. However, there is scope for improvement in Defence's industry engagement in undertaking major foreign military sales acquisitions of unmanned platforms. A number of issues were raised during the inquiry in relation to the local unmanned platform industry's relationship with Defence and the communication of future capabilities needs. In the view of the committee, resolving these issues should be a priority in the next Defence Industry Policy Statement.

Recommendation 5

8.24 The committee recommends that strategic engagement with the Australian unmanned platform industry be addressed in the forthcoming Defence Industry Policy Statement.

Deployment within Australia

8.25 On 13 March 2014, the Prime Minister, the Hon Tony Abbott MP, confirmed Australia's commitment to purchase a number of Triton UAVs which would operate alongside the manned P-8A Poseidon marine surveillance aircraft at RAAF Base Edinburgh. Additional works to prepare the base for maintaining and operating the Triton were also announced.[7]

8.26 However, the committee notes that there will be benefits in the establishment of forward operating facilities for these unmanned platforms in the Northern Territory. This recommendation is consistent with the Australian Government's recent White Paper into the development of Australia's north. It recognised that Australia's north is the 'gateway for our defence and security cooperation into the Indo-Pacific region and supports Australia's ability to project and sustain forces into the region for surveillance, humanitarian assistance and disaster relief'.[8] It is also in line with the

6 *Submission 11*, p. 12.

7 The Hon Tony Abbott MP, Prime Minister, 'Joint Remarks at RAAF Base Edinburgh', *Transcript*, 13 March 2014.

8 Australian Government, Our North, Our Future: White Paper on Developing Northern Australia, June 2015, p. 2.

recommendation of the Defence Force Posture Review in 2012 for upgraded facilities at RAAF Base Tindal to support maritime surveillance aircraft.[9] Further consideration of how ADF unmanned platforms are deployed and supported in Australia's north should also be undertaken.

Recommendation 6

8.27 The committee recommends that the Australian Government:

- **consider establishing additional support facilities for the Triton in the Northern Territory; and**
- **review the future deployment and support needs of Australian Defence Force unmanned platforms in the Australia's north.**

Autonomous weapons systems

8.28 Autonomous weapons systems (AWS) were associated with the potential use of military unmanned platforms during the inquiry. The use of force by AWS, which could identify and attack a target without human supervision, raises a variety of ethical, legal and public policy issues. The rapid pace of technological change in this area demands policy-makers consider these issues. It is a truism that the law rarely keeps pace with the development of technology. However, in this case, there is the opportunity for international arms regulation to keep pace with an obvious trend in military technology.

8.29 The committee notes that there are significant moral and ethical questions about any situation where human lives could be ended by a determination made by software. However, the committee acknowledges that contrary arguments exist. Sufficiently advanced AWS may potentially have a higher level of compliance with international humanitarian law than military personnel. In situations where a stressed combat pilot may make incorrect judgements, an AWS deployed on a UAV could potentially be programmed to exercise greater restraint in the use of force. Nonetheless, until there is sufficient evidence that AWS are capable of rigid adherence to the law of armed conflict their development and deployment should be appropriately regulated.

8.30 The committee is not convinced that the use of AWS should be solely governed by the law of armed conflict, international humanitarian law and existing arms control agreements. A distinct arms control regime for AWS may be required in the future. The Convention on Certain Conventional Weapons (CCW) was intended to serve as an umbrella for protocols dealing with specific weapons in order to be capable of dealing with new technologies applied to military circumstances. This is illustrated by Protocol IV, adopted on 13 October 1995, which restricts the use of blinding laser weapons. The development of an additional protocol to the CCW is

9 Department of Defence, *Defence Force Posture Review*, 30 March 2012, p. 43.

likely to be the most appropriate multilateral avenue to regulate the use of AWS, including those on unmanned platforms.

8.31 Australia continues to have an important role in international disarmament and arms controls regulation to promote global peace and security. In the view of the committee, Australia should form and advocate a considered position which supports the eventual establishment of international regulation on the use of lethal force by AWS. However, the committee acknowledges that any international regulation of AWS will take significant time as the technology evolves and definitional issues are clarified.

8.32 The committee notes that the US Department of Defence has issued a policy directive in relation to AWS. This directive covers a range of matters including those related to '[s]emi-autonomous systems that are onboard or integrated with unmanned platforms'.[10] In this context, the committee considers the ADF should review its own policy directives to assess whether a similar policy directive on AWS, or amendments to existing policies, are required.

Recommendation 7

8.33 The committee recommends that the Australian Government support international efforts to establish a regulatory regime for autonomous weapons systems, including those associated with unmanned platforms.

Recommendation 8

8.34 The committee recommends that following the release of the Defence White Paper 2015 the Australian Defence Force review the adequacy of its existing policies in relation to autonomous weapons systems.

Air regulation

8.35 The committee appreciates that CASA and Defence are working together to safely integrate ADF UAVs into Australian civilian airspace. In a response to a question on notice, Mr Mark Skidmore, Director of Aviation Safety at CASA, outlined he had written to the Chief of the Defence Force, 'seeking his views on options for closer cooperation between CASA and the Defence Force on regulatory development for UAVs'.[11] The committee agrees with Air Vice Marshal Gavin Davies that Australia has an opportunity to lead in integrating UAVs into civilian airspace.[12] While the ADF may be the pioneer users of large UAVs in Australian airspace, Australian commercial UAV operators will also benefit as the regulatory environment is clarified.

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10 US Department of Defence, *Autonomy in Weapons Systems*, Directive 3000.09, 21 November 2012, p. 3.

11 CASA, responses to question on notice to questions on notice, p. 1.

12 *Committee Hansard*, 14 April 2015, p. 50.

8.36 Currently, the RAAF has two Heron UAV which have been retained following the ADF's Afghanistan operations. The estimated cost of the Heron is $120 million over six years, including portable ground control stations, maintenance, logistics, training and renovations to facilities at RAAF Base Amberley.[13] While the Heron platform is limited and consideration of air safety is clearly paramount, the committee believes that greater utilisation of the Heron within Australian civilian airspace could assist to build practical expertise and to test capabilities for emergency response and national support operations.

Recommendation 9

8.37 The committee recommends that Defence, the Civil Aviation Safety Authority and Airservices Australia increase their cooperation to facilitate the safe use of unmanned platforms in Australian airspace.

Conclusion

8.38 Australia faces a growing number of strategic and defence challenges which extend beyond the scope of the committee's inquiry. These include changing strategic circumstances in the Asia-Pacific, long-standing issues about major defence acquisitions and the appropriate force structure of the ADF. However, it is clear that the effective use of unmanned platforms by the ADF will play an increasingly important role in the response to all of these challenges. The committee hopes this importance will be appropriately reflected in the forthcoming Defence White Paper 2015, Force Structure Review, the Defence Capability Plan and the Defence Industry Policy Statement.

Senator Alex Gallacher
Chair

13 Senator the Hon David Johnston, Minister for Defence, 'Heron to be retained to keep Australia's unmanned aerial capability', *Media release*, 28 October 2014.

Appendix 1

Submissions

1 Mr Gary Martinic

2 Dr Clinton Fernandes

3 Professor Ben Saul

4 Mr Brian Weston

5 Dr Christian Enemark

6 Centre for Military and Security Law, Australian National University

7 Confidential

8 Confidential

9 Northern Territory Government

10 Australian Federal Police

11 Association of Australian Certified UAV Operators Inc

12 Northrop Grumman Australia

13 Australian Strategic Policy Institute

14 Cobham Aviation Services

15 Australian Red Cross

16 Human Rights Law Centre

17 Australian Association for Unmanned Systems

18 Dr Brendan Gogarty

19 Dr Andrew Carr

20 Dr Ian Henderson

21 Australian Research Centre for Aerospace Automation

22 The Programme on the Regulation of Emerging Military Technology, Melbourne Law School

23 Department of Defence

24 Saab Australia Pty Ltd

25 International Committee of the Red Cross

Appendix 2

Tabled documents, answers to questions on notice and additional information

Additional Information

- 'Armed and Dangerous?: UAVs and U.S. Security', RAND Corporation Report, 2014, received 5 February 2015
- Civil Aviation Safety Authority, 'Remotely Piloted Aircraft Systems', Information paper, received 11 May 2015
-

Answers to questions on notice

- Australian Red Cross responses to questions on notice taken at the public hearing in Canberra, 14 April 2015.
- Department of Defence responses to questions on notice taken at the public hearing in Canberra, 14 April 2015.
- Civil Aviation Safety Authority responses to questions on notice taken at the public hearing in Canberra, 13 May 2015.

Appendix 3

Public hearings and witnesses

Tuesday 14 April 2015, Canberra

Association of Australian Certified UAV Operators
Mr Brad Mason, Secretary
Mr Peter La Franchi, Head, Strategy and Commercial, LFRG Pty Ltd

Northern Territory Government
Mr Stephen Mencshelyi, General Manager, Defence, Security and Emergency Recovery, Department of the Chief Minister
Mr Peter Sims, Director Strategic Defence Liaison
Mr Timothy McOwan, Member, Defence Strategic Advisory Board, Department of the Chief Minister

Northrop Grumman Australia
Mr Ken Crowe, Director, Strategy and Business Development

Saab Australia
Dr Derek Rogers, Programme Manager and Engineering Manager

Australian Strategic Policy Institute
Dr Andrew Davies, Senior Analyst and Director of Research
Ms Rosalyn Turner, Researcher

Australian Red Cross
Dr Phoebe Wynn-Pope, Director, International Humanitarian Law and Movement Relations
Ms Petra Ball, International Humanitarian Law Officer
Ms Annabel McConnachie, Member, NSW International Humanitarian Law Advisory Committee

Centre for Military and Security Law, ANU
Associate Professor Robert McLaughlin, Co-Director
Dr Hitoshi Nasu, Co-Director

Programme on the Regulation of Emerging Military Technology, Melbourne Law School
Dr Rain Liivoja, Senior Lecturer
Professor Tim McCormack, Professor of Law

Department of Defence
Rear Admiral Peter Quinn, Head, Joint Capability Coordination
Air Commodore Christopher Hanna, Acting Head, Defence Legal
Mr Chris Birrer, Acting First Assistant Secretary, Strategic Policy
Air Commodore Michael Kitcher, Director General Capability Planning Air Force
Air Vice Marshal Gavin Davies, Deputy Chief of Air Force
Dr Ken Anderson, Acting Deputy Chief Defence Scientist, Partnerships and Outreach

Monday 4 May 2015, Canberra

Cobham Aviation Services
Mr Timothy Dore, Manager, Defence and Security
Mr Anthony Patterson, Director, Business Development

Wednesday 13 May 2015, Canberra

Civil Aviation Safety Authority
Mr Terry Farquharson, Acting Director of Aviation Safety
Mr Peter Boyd, Executive Manager, Standards Division
Mr Peter Cromarty, Executive Manager, Airspace and Aerodrome Regulation Division