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.

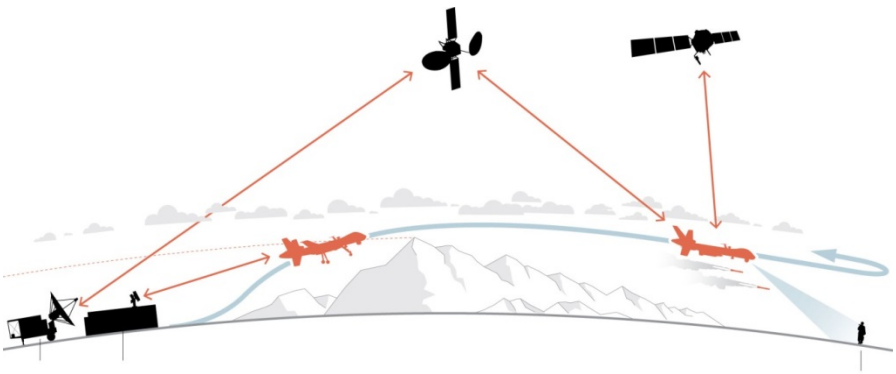
Terminology

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.

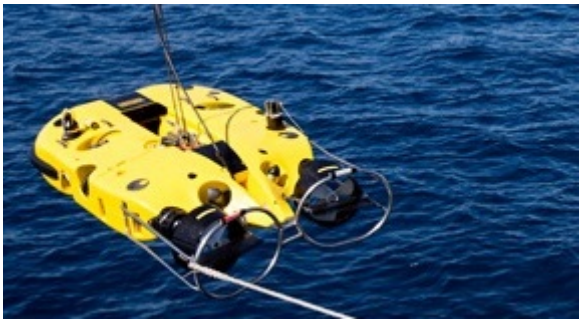
29 *Submission 23*, p. 10.

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).