House of Commons

Defence Committee

Remote Control: Remotely Piloted Air Systems – current and future UK use

Tenth Report of Session 2013–14

Volume I

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Conclusions and recommendations

Nomenclature

1. It is acknowledged by several contributors to the inquiry that the terms remotely piloted aircraft (RPA) and remotely piloted air(craft) system (RPAS) are not yet widely adopted. Nonetheless, we believe these are the most accurate terms to use when referring to the armed MQ-9 Reaper operated by the RAF in Afghanistan. These aircraft are flown remotely by a human pilot who, along with a wider crew operating from a ground control station, has general oversight and control. In relation to existing unarmed systems used by the Army for intelligence, surveillance and reconnaissance (ISR), it may be more appropriate to refer to unmanned air systems (UAS). (Paragraph 20)

Automation and autonomy

2. There is considerable potential for development of future remotely piloted air systems which have a greater degree of autonomy, however, the MoD has stated explicitly that remotely piloted combat missions will always involve human operators and pilots. We support this policy for all current and future UK armed remotely piloted air system operations. (Paragraph 28)

Current British doctrine

3. The conclusion to Joint Doctrine Note 2/11 conceded that its relevance was "of the order of 18 months and during that period much of its detail and many of the issues raised will be overtaken by events". Now, some three years later it is clear that further consideration of many of the issues the Joint Doctrine Note raises is overdue. We recommend that the MoD revisit these issues and publish an updated Joint Doctrine Note setting out its current approach to remotely piloted aircraft systems no later than September 2014. (Paragraph 38)

Personnel

4. It was very clear from the visit to XIII Squadron and discussions with Reaper aircrew that all were experienced professional personnel with a clear purpose and keen understanding of the Rules of Engagement which govern their operations. Despite being remote from the battle space they exhibited a strong sense of connection to the life and death decisions they are sometimes required to take. This was in stark contrast to the image portrayed by some commentators of "drone" pilots as video gaming "warrior geeks". We record here our appreciation for the important role they continue to perform in Afghanistan. (Paragraph 57)

A combined Reaper fleet?

5. In light of these apparently inconsistent answers by Ministers, we call upon the MoD to provide absolute clarity about whether UK Reaper aircraft have ever been operated by US personnel outside the launch and recovery phase. If public

confidence is to be built around the use of remotely piloted air systems it is important that it is clear that UK aircraft have only been utilised within Afghanistan and always in accordance with UK rules of **engagement.** (Paragraph 62)

Civilian casualties

6. We consider it important that the MoD is as transparent as it can be about remotely piloted air system operations in order to build public confidence about their use and to debunk myths and counter misinformation. We note that a review is conducted and a report produced after every remotely piloted aircraft weapons release. While the public do not need to know every time weapons are released they do need to feel confident that rules of engagement are applied and followed consistently. (Paragraph 66)

7. UK operations in Afghanistan have drawn heavily on new and emerging remotely piloted air system technologies in order to offer better protection to UK, ISAF and Afghan forces on the ground. The intelligence, surveillance and reconnaissance capabilities of our forces have been enhanced immeasurably. More controversial has been the use of the Reaper remotely piloted air system platform to conduct strike operations using precision-guided weapons. Following this inquiry, we are satisfied that RAF Reaper pilots and flight crew have a high level of experience and appropriate training to conduct such strikes. We are also satisfied that the RAF rules of engagement for Reaper operations, as outlined to us directly by senior RAF officers during this inquiry, are common with those in force for manned aircraft, and provide a high level of assurance that, as far as possible, civilian casualties will be avoided and collateral damage minimised. (Paragraph 67)

Constraints on the use of remotely piloted air systems

8. There are many constraints on the use of remotely piloted air systems in shared airspace whether in the UK or elsewhere. In its response to this report we invite the MoD to set out in detail what action the Government as a whole is taking domestically and internationally to facilitate the development of the technologies, systems and regulatory changes which will be required prior to the full and safe integration of remotely piloted air systems into shared airspace. (Paragraph 82)

Integration post-Afghanistan

9. We call upon the MoD to set out which of the existing remotely piloted and unmanned air systems it intends to retain beyond the end of operations in Afghanistan and to confirm that continuing operating costs can be funded from within its core programme budget from financial year 2014-15 onwards. (Paragraph 92)

ISTAR force composition

10. In its response to this report the MoD should set out how remotely piloted air systems, including Reaper, fit within its overall ISTAR strategy. (Paragraph 97)

Emerging technologies

11. Due to significant delays to the programme, it is now unlikely that Watchkeeper will be utilised on operations in Afghanistan, the theatre for which it was originally procured. The MoD should set out in detail in its response to this report the reasons for the delays experienced in bringing Watchkeeper to full operating capability and the lessons identified for future remotely piloted air system programmes. (Paragraph 102)

12. It is of vital importance that the lessons identified from the much delayed Watchkeeper system inform the development and trials of all future remotely piloted aircraft and any associated weapons systems by the MoD. In its response to this report we call on the MoD to provide us with a more detailed update on the Scavenger and Taranis programmes and explain how they will contribute to future UK air combat and ISTAR capabilities. (Paragraph 108)

13. We recognise the importance of sensor technology for ISTAR capability whether deployed on manned or unmanned platforms. We consider it vital that UK ISTAR assets are equipped with up to date sensor suites which maximise their effectiveness. We call upon the MoD to provide us with details of its planned investment in future sensor technology and exploitation for remotely piloted air systems and other ISTAR assets. (Paragraph 112)

14. We note the potential for deployment of new and increasingly accurate weapons systems, including the Brimstone missile, on UK armed remotely piloted aircraft. We call on the MoD to provide us, in its response to our report, with a progress report on current trials and future plans. (Paragraph 114)

Partnering—strategic choices

15. As part of SDSR 2015, the MoD has a strategic choice to make about the future direction for UK remotely piloted air systems. Post-Afghanistan, a commitment to the existing partnership arrangements with the USAF, including a continuing presence at Creech Airforce Base, would provide the RAF with access to future upgrades to the Reaper platform and training opportunities for UK Reaper aircrew which would be likely to prove problematic in the UK given the airspace restrictions which exist presently. However, with other European NATO nations, including France, Italy and the Netherlands now operating Reaper it may be advantageous to form more collaborative arrangements at a European level in order to share experience and seek economies of scale for the delivery of training and maintenance. In the medium to long term, projects such as Scavenger and the Future Combat Aircraft System demonstration programme being developed with France may require a shift in focus. We recommend that the MoD clarifies its intentions and explains how European level co-operation can be co-ordinated with existing bi-lateral partnership projects. (Paragraph 124)

Non-military uses

16. Remotely piloted air systems have extensive potential for non-military uses in the UK and overseas. Projects such as those developed by the ASTRAEA consortium

have begun to test the technologies and operating procedures required to make the use of RPAS more commonplace and research into the potential for other uses is continuing. We welcome Government support to strengthen UK research and development programmes which have the potential to expand the nascent civilian market for remotely piloted air systems in the future. We call upon the Government to set out in detail what joint working is currently ongoing across government departments to consider the implications for the utilisation of remotely piloted air systems in the civilian environment. In relation to the issue of privacy, we recognise that existing laws which protect personal privacy, including data protection and surveillance, whether by the police, state intelligence agencies or private companies, will need to be carefully reviewed and updated. (Paragraph 131)

Ethical and legal issues

17. It is important in maintaining the public acceptability of remotely piloted air systems that the perception cannot be allowed to develop that their increased use has in some way reduced the threshold for military intervention. We call on the MoD to set out how it intends to address this potential problem in its response to this report. (Paragraph 137)

18. We welcome the report of the UN Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. We note that he has identified a number of legal questions on which there is no clear international consensus. We recommend that the UK Government engage actively in the debate on these matters and report on progress in its response to our report. (Paragraph 157)

Targeted killings

19. We acknowledge that over the last few years there has been a growing concern in relation to the sharing of intelligence with allies and the uses to which such data may contribute. While the issues raised by Reprieve stray beyond the terms of reference for our inquiry and indeed the remit of the Defence Committee, we do believe that there should be greater transparency in relation to safeguards and limitations the UK Government has in place for the sharing of intelligence. Matters concerning the activities of the intelligence services are more appropriately addressed by the Intelligence and Security Committee of Parliament (ISC). We invite the ISC to consider in future work programmes the issues raised with us during this inquiry which fall within its remit. (Paragraph 161)

20. The licensing of arms exports and other controlled goods is a matter for the Committees on Arms Export Controls (CAEC). We will work with our colleagues on CAEC to ensure that this issue is given appropriate scrutiny. (Paragraph 162)

Conclusions

21. We consider that it is of vital importance that a clear distinction be drawn between the actions of UK Armed Forces operating remotely piloted air systems in Afghanistan and those of other States elsewhere. On the basis of the evidence we

have received we are satisfied that UK remotely piloted air system operations comply fully with international law. (Paragraph 163)

22. We recommend that the MoD should continue its public awareness programme surrounding remotely piloted air system operations in order to aid public understanding and acceptance. (Paragraph 164)

23. We note the conclusion of the UN Special Rapporteur that in any case in which civilians have been, or appear to have been, killed, there is an obligation on the State responsible to conduct a prompt, independent and impartial fact-finding inquiry and to provide a detailed public explanation. We recognise that this is not a simple and straightforward request as to do so could seriously jeopardise continuing operations. Nonetheless, we recommend that, to the extent that it is operationally secure to do so, following an event which has resulted in confirmed civilian casualties the MoD should seek to publish details about the incident and any lessons learned from the review process. (Paragraph 165)

24. The rapid development of remotely piloted air system capabilities by the UK Armed Forces over the past decade has contributed greatly to the effectiveness of military operations in Iraq and Afghanistan. The provision of enhanced intelligence, surveillance and reconnaissance support to our troops on the ground has undoubtedly saved lives and prevented casualties. With the final withdrawal of forces from Afghanistan now rapidly approaching, MoD thinking must turn to the future for the UK's existing remotely piloted air systems. We consider it to be a key capability which must continue to be supported. We expect future development, in partnership with allies, to form an important strand of the SDSR 2015 equipment programme. (Paragraph 166)

1 Introduction

Background to the report

1. In December 2012, we announced our intention of contributing to the next Defence and Security Review by carrying out an overarching strategic inquiry to examine the purpose and future use of the Armed Forces. In March 2013, we launched an inquiry entitled 'Towards the next Defence and Security Review'. We published our preliminary framework Report in January 2014.[1]

2. Separately, in July 2013, we announced a new inquiry into current and future use of remotely piloted air systems (RPAS) by the UK military and intelligence communities as part of a series which had evolved from our initial work on 'Towards the next Defence and Security Review'. Our intention was to make recommendations to inform the future development and use of these systems by the UK in the context of the next Strategic Defence and Security Review (SDSR).

3. The UK's remotely piloted air system capabilities are established and there is significant potential for future expansion. Several systems, including the armed Reaper aircraft, have been used by UK forces in Afghanistan. Separately, the potential for non-military use of these systems is extensive.

Purpose of the inquiry

4. There has been an increasingly contentious debate in the media and amongst the public in the UK in recent years surrounding the development and use of Remotely Piloted Air Systems or "drones", principally about armed systems. We recognise that the introduction and increasing use of this new technology has given rise to public concerns, mainly due to a lack of information or clarity on their operation, function and potential present or future use. As part of our work to examine the purpose and future use of the UK's Armed Forces we therefore decided to undertake this case study on RPAS in order to inform the debate.

5. In this context, we decided to examine:

- Nomenclature – defining the terms Remotely Piloted Air System, Unmanned Aircraft System and "drone"
- Current utility and dispersal – for what purposes are Remotely Piloted Air Systems used currently?
- Lessons learned from operations in Afghanistan
- Tomorrow's potential – what additional capabilities will the UK seek to develop from now to 2020?
- Constraints on the use of Remotely Piloted Air Systems in the UK and overseas

[1] Defence Committee, Seventh Report of Session 2013-14, *Towards the Next Defence and Security Review: Part One*, HC 197.

- Ethical and legal issues arising from the use of Remotely Piloted Air Systems

6. This inquiry has been led by a rapporteur, Madeleine Moon MP, appointed by the Committee to investigate the issues surrounding UK use of remotely piloted air systems and report to us. In response to a call for evidence issued in July 2013, we received 20 submissions. We are grateful to all those who submitted evidence.

7. As part of the inquiry, Madeleine Moon MP visited RAF Waddington, Lincolnshire, the base for RAF Remotely Piloted Air System operations in the UK, and BAE Systems, Warton, Lancashire. We wish to thank all those who facilitated these useful visits. We are also grateful to our Specialist Advisers[2] and our staff.

8. The inquiry focused principally on current and future UK use of remotely piloted air systems. Except to differentiate UK activities from those of others, we have not sought to consider in detail the development or use of these systems by other countries.

[2] The Committee's Specialist Advisers are: Mr Paul Beaver, Professor Mike Clarke, Chris Donnelly, Air Marshal (retired) Paul Colley, Dr John Louth, Major General (retired) Mungo Melvin, Rear Admiral (retired) Chris Snow, Air Marshal (retired) Philip Sturley. Their declarations of interests can be found in the Committee's Formal Minutes available on the Committee's website.

2 Remotely Piloted Air Systems

Nomenclature

9. This section provides some essential definitions related to remotely piloted air systems and other associated technologies. A glossary of terms used in the report is provided in Annex B.

10. In its written memorandum, the MoD pointed out that most existing manned aircraft terminology remains equally relevant to unmanned aircraft operations.[3]

11. In its memorandum, the Royal United Services Institute (RUSI) differentiated current remotely piloted air systems according to size and capabilities:

- Nano – smallest class of systems used for low-resolution image capture in scenarios such as infantry local-area reconnaissance, especially in the urban environment. Example: Black Hornet.
- Miniature – small size lightweight design used for short-range surveillance using small and fairly basic sensors. Example: Desert Hawk.
- Tactical – a larger class, with 20m wingspans, longer range and endurance. Equipped with medium-quality imaging and transmission systems for ISTAR purposes and, for armed variants, attack. Examples: MQ-9 Reaper; Watchkeeper.
- Strategic – largest class of current unmanned systems, having wingspans analogous with manned aircraft and able to carry large payloads. Equipped with high-powered surveillance systems able to work in numerous spectrums and high-quality video feeds. Used for battlefield reconnaissance, undertaking roles previously filled by manned aircraft. Example: Global Hawk.[4]

Drone

12. The term "drone" was used originally to refer to unmanned aircraft used for target practice. Its origins can be traced back to the de Havilland Queen Bee aircraft developed by the Royal Aircraft Establishment, Farnborough.[5] Development of an air gunnery practice machine started in the mid-1930s. Queen Bee aircraft were converted from standard de Havilland Tiger Moth trainers into which a primitive radio-control system could be fitted.

13. Using "drone" to refer to modern air systems is inaccurate and misleading as it fails to capture either their purpose or degree of technological sophistication. Nonetheless, we acknowledge that the term has become commonplace, particularly in the media, when referring to modern remotely piloted aircraft.

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[3] Ev w2, para 2.14

[4] Ev w11

[5] "Automatic Flight", Flight, 16 May 1958 Available at: http://www.flightglobal.com/pdfarchive/view/1958/1958%20-%200642.html

Unmanned Aircraft (UA), Unmanned Air Vehicle (UAV) and Unmanned Air(craft) System (UAS)

14. These terms describe an aircraft which is intended to operate with no human pilot on board as part of an unmanned aircraft system, which includes a number of elements such as the ground-based control unit, ground-launch system and the aircraft and all associated flight safety-critical elements. An unmanned aircraft:

- is capable of sustained flight by aerodynamic means;
- is remotely piloted or capable of autonomous operation;
- is reusable; and
- is not classified as a guided weapon or similar one-shot device designed for the delivery of munitions.

15. According to the Military Aviation Authority the terms unmanned aircraft, unmanned air vehicle and unmanned air system are obsolete having been superseded by remotely piloted aircraft and system. However, these terms are still in common usage particularly in relation to civilian systems or military systems which do not require to be flown by a qualified pilot.

Remotely Piloted Aircraft (RPA), Remotely Piloted Air Vehicle (RPAV) and Remotely Piloted Air(craft) System (RPAS)

16. These terms were introduced in order to convey the fact that these systems are not "unmanned" but rather under the control of a human pilot or operator. Larger and more sophisticated remotely piloted aircraft generally require a qualified pilot to be at the controls.

Unmanned Combat Air System (UCAS)

17. There is no commonly agreed definition of an unmanned combat air system, but several systems currently under development represent a class of remotely piloted aircraft with offensive and defensive capabilities, including low-observable (stealth) design, making it suitable for applications in high threat environments.[6]

18. Nomenclature has proven to be somewhat of a vexed issue as far as this subject is concerned. The use of the term "drone" has become commonplace, particularly among the mainstream media despite its outmoded status when used to refer to modern unmanned aircraft. We believe that it is important that the debate about current and future use of these systems by the UK Armed Forces and others is not confused due to the use of inaccurate terminology.

19. The MoD explained why it differentiated between the terms unmanned air system and remotely piloted air system:

> Although UAS is the preferred term in a military environment, there are occasions when such a generic term is unhelpful. The term 'unmanned' can cause confusion or

[6] Systems currently under development include Taranis (UK), Neuron (France), and X47B (USA).

> uncertainty over the actual level of human control and has led to safety, ethical and legal concerns being raised, particularly with regard to the employment of weapons and flight in non-segregated airspace. These concerns can be addressed in part by using terminology that better describes the level of human control of such aircraft as being equivalent to that of piloted aircraft; the pilot is simply physically remote from the aircraft itself. Consequently, the MoD believes it is more appropriate to use the term Remotely Piloted Aircraft (RPA) to describe such aircraft, and Remotely Piloted Air(craft) System (RPAS) to describe the entirety of that which it takes to deliver the overall capability.[7]

20. **It is acknowledged by several contributors to the inquiry that the terms remotely piloted aircraft (RPA) and remotely piloted air(craft) system (RPAS) are not yet widely adopted. Nonetheless, we believe these are the most accurate terms to use when referring to the armed MQ-9 Reaper operated by the RAF in Afghanistan. These aircraft are flown remotely by a human pilot who, along with a wider crew operating from a ground control station, has general oversight and control. In relation to existing unarmed systems used by the Army for intelligence, surveillance and reconnaissance (ISR), it may be more appropriate to refer to unmanned air systems (UAS).**

Automation and autonomy

21. The concepts of automation and autonomy are often applied to unmanned aircraft interchangeably, but, as the MoD has noted, the distinction is important "as there are moral, ethical and legal implications regarding the use of autonomous unmanned aircraft".[8]

22. In its written memorandum for this inquiry, the MoD pointed out that there is often a misconception that remotely piloted air systems are autonomous, despite the fact that there is always human involvement in the decision making process. Its submission explained:

> Industry and academia often discuss automation and autonomy interchangeably, referring to technology research for all types of UAS. There are no universally agreed definitions. But the MoD defines autonomy as a machine's ability to understand higher level intent, being capable of deciding a course of action without depending on human oversight and control. Automation refers to a system that is programmed to logically follow a pre-defined set of rules with predictable outcomes, such as an automatic landing system. Improving capability can include automating part of a process to make the remote Pilot or operator's job easier. But current UK policy is that the operation of weapon systems will always be under human control. No planned offensive systems are to have the capability to prosecute targets without involving a human.[9]

23. Referring specifically to the armed Reaper remotely piloted air system, the Royal Aeronautical Society summarised the present position:

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[7] Ev w2, para 2.13

[8] Ministry of Defence, *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11 (*JDN 2/11), March 2011. Available at: https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems

[9] Ev w2

> There has [also] proved to be a constant misconception that "drones" are autonomous killing machines, whereas in reality each Reaper is controlled all the time by highly-trained operators bound by the same [Rules of Engagement] ROE as manned combat aircraft. There is no artificial intelligence associated with Reaper, only a lower level automation, such as an autopilot. The current need for humans in the loop is dictated by the complexities of attack missions and airspace de-confliction requirements. Remote piloting is expected to remain required for the foreseeable future.[10]

24. Air Commodore (Retd) Bill Boothby, former Deputy Director of Legal Services (RAF), in a response to our inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operation*s, explained that autonomy and automation of attack decisions were the subject of significant current research. There was, however, no current internationally agreed interpretation of the precise meaning of autonomy:

> My current view is that autonomy can most sensibly be seen as something of an absolute in which it is the machine that, by understanding higher level intent and by perceiving its environment, itself decides on appropriate action without human oversight or control. Its individual actions may not be predictable. This interpretation of autonomy is not universally shared. I consider that reaching an internationally agreed interpretation of terminology is a necessary precursor to a sensible international discussion of the acceptability of such technologies. For the time being, however, it would seem sensible to regard autonomy as an absolute state in which the weapon system learns its own lessons, modifies its behaviour accordingly and in which its behaviours are not constrained by human involvement. All lesser forms of mechanical decision-making would then be classed as automation, so there will be 'degrees of automation' but not 'degrees of autonomy'.[11]

25. Drone Wars UK, a campaign group, argued that a new generation of unmanned aircraft being developed and test flown (such as BAE Systems Mantis and Taranis and the Northrop Grumman X-47B) "are not piloted remotely from the ground but rather fly autonomously following [a] pre-programmed mission".[12]

26. Northrop Grumman Corporation, a leading manufacturer of unmanned air systems, confirmed that a distinction should be drawn between the degree of autonomy of UAS versus RPAS:

> RPAS are aircraft, such as medium-altitude long endurance (MALE) unmanned aircraft, that are flown with a remote aircraft control stick by a ground based pilot-in-control through a direct link to the aircraft
>
> UAS are autonomous aircraft, flown by an on-board computer but controlled by a pilot from a ground station. These can fly routes that are entirely pre-programmed or a route that is entirely "ad-hoc" as changed by the pilot-in-command. Autonomy

[10] Ev w53, para 15

[11] Air Commodore (Retd) Bill Boothby, memorandum received in response to inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations*

[12] Ev w50, para 3

> separates command and control. Autonomy allows the aircraft to control itself, leaving the pilot free to command the aircraft and the mission.[13]

27. Looking to the future use of remotely piloted air systems by the UK, the MoD told us:

> Given the nature of combat operations there will always be a role for highly skilled operators and pilots to ensure that remotely piloted combat missions are conducted appropriately, proportionately and legally.[14]

28. **There is considerable potential for development of future remotely piloted air systems which have a greater degree of autonomy, however, the MoD has stated explicitly that remotely piloted combat missions will always involve human operators and pilots. We support this policy for all current and future UK armed remotely piloted air system operations.**

Current UK operations

29. The MoD operates a range of remotely piloted air systems and unmanned air systems principally for intelligence, surveillance and reconnaissance (ISR) purposes. The Department told us that the UK currently only deploys these systems in support of operations in Afghanistan:

> In Afghanistan UAS provide intelligence in support of our ground commanders, enabling them to stay one step ahead of the enemy. Whether for targeting the Taliban or supporting troops on patrol, their ability to loiter over and survey areas for enemy activity and then feed back images and video in real time means they are an invaluable asset to our forces on the ground. Together, the UK's fleet of UAS have carried out over 160,000 hours of ISR operations.[15]

30. In its written submission, the MoD emphasised that the UK operates remotely piloted air systems in Afghanistan under the authority of UN Security Council resolutions and that "governance and accountability arrangements in place for UK operated unmanned air systems are the same as those for manned aircraft".[16]

Systems

31. In its memorandum, the MoD provided us with information about all of the UK's current remotely piloted air systems.

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[13] Ev w41

[14] Ev w7

[15] Ev w2, para 3.2

[16] Ev w9, para 7.1

Unmanned Air System	Number of UAS	Comments
REAPER	10	Reaper RPAS is a medium altitude, long endurance remotely piloted aircraft system providing ISR capabilities to UK and coalition ground forces in Afghanistan. It is the only armed RPAS used by the UK. RAF aircrew operate the aircraft in Afghanistan from control stations based at RAF Waddington, Lincolnshire and Creech Air Force Base in the United States. Since it came into service in 2007 Reaper has flown over 50,000 hours on operations supporting ground forces in Afghanistan.
HERMES 450	8	Hermes 450 is a Tactical UAS providing ISR capability (principally video) in support of UK ground forces in Afghanistan. The system is provided to the UK MoD via a service provision contract with Thales. Hermes 450 is operated by 1st Artillery Brigade. Since it came into service in 2007 Hermes 450 has flown over 84,000 hours on operations supporting ground forces in Iraq and Afghanistan.
DESERT HAWK III	222	Desert Hawk III is a mini UAS providing an organic ISR capability (principally video) to Platoon, Company and Battle Group level ground forces in Afghanistan. Currently there are 12 Desert Hawk III systems operated in Afghanistan. The majority of these systems are operated by 1st Artillery Brigade. Each comprises between eight and ten aircraft. Since it came into service in 2007 Desert Hawk III has flown over 27,500 hours on operation in support of forces in Afghanistan.
BLACK HORNET	324	Black Hornet is a nano UAS providing 'over the wall' ISR capability (video) and is operated by the Infantry. There are 162 systems in operation. Each complete system comprises a handheld controller, a display, a base station and two Black Hornet Aircraft.
TARANTULA HAWK	18	The Tarantula Hawk (T-Hawk) is a mini UAS, part of the Talisman Route Proving and Clearance capability and is used for Counter-IED Convoy Protection on operations. T-Hawk is operated by 1st Artillery Brigade soldiers embedded in the Royal Engineer squadron.

Table 1: Ministry of Defence, Current MoD Systems (as at 1st April 2013). Images: Crown Copyright 2013

British Army

32. The Army currently operates four unarmed systems in Afghanistan:

- Hermes 450
- Desert Hawk III
- Tarantula Hawk
- Black Hornet

33. According to the MoD, the current purpose of these systems is to support UK, ISAF and Afghan forces:

> The supported forces will submit an ISR request in advance and, once a UAS has been tasked, the mission will be planned in close cooperation with the Ground Force, and communications maintained throughout the mission to ensure threats and opportunities are exploited rapidly.[17]

Royal Air Force

34. The RAF operates the UK's only armed remotely piloted air system, the General Atomics MQ-9 Reaper. It has been armed with precision-guided weapons since May 2008. The aircraft is operated by a pilot and a sensor operator, aided by a mission intelligence coordinator.

Royal Navy

35. The Royal Navy will shortly operate ScanEagle, a maritime surveillance remotely piloted air system, in conjunction with existing ISR assets used on naval operations such as helicopters and long-range radar.

Current British doctrine

36. In March 2011 the MoD published *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11* (JDN 2/11)[18] which "considers how UAS may contribute to the UK's future defence and security needs between now and 2030". The introduction to the Joint Doctrine Note states that:

> Unmanned aircraft now hold a central role in modern warfare and there is a real possibility that, after many false starts and broken promises, a technological tipping point is approaching that may well deliver a genuine revolution in military affairs.[19]

37. However, the conclusion to the Joint Doctrine Note raised a series of fundamental questions about the existing and future use of remotely piloted air systems by UK Armed Forces:

> Do military planners and politicians understand the full implications of the systems they are currently tasking and those they hope to procure? In the current economic climate, who will decide the best balance between keeping existing equipment and personnel, or whether to give these up to fund new unmanned systems? Do we understand even the basic implications of such decisions for the associated defence lines of development? Crucially, do we have a strategic level of understanding as to

[17] Ev w2, para 3.5

18 Ministry of Defence, *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11* (JDN 2/11), March 2011. Available at: https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems

[19] Ministry of Defence, *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11* (JDN 2/11), March 2011. Available at: https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems

how we will deliver the considerable number of changes that will need to be made to existing policy, concepts, doctrine and force structures?

38. **The conclusion to Joint Doctrine Note 2/11 conceded that its relevance was "of the order of 18 months and during that period much of its detail and many of the issues raised will be overtaken by events". Now, some three years later it is clear that further consideration of many of the issues the Joint Doctrine Note raises is overdue. We recommend that the MoD revisit these issues and publish an updated Joint Doctrine Note setting out its current approach to remotely piloted aircraft systems no later than September 2014.**

Rules of Engagement

39. As with UK manned combat aircraft, the MoD told us that UK remotely piloted aircraft operate within the constraints of UK rules of engagement (ROE) and policy, even where operational control is assigned to a Coalition Commander, such as the Commander of ISAF. The MoD also stated that UK policy relating to targeting by remotely piloted aircraft is exactly the same as that for manned aircraft (and land and maritime weapons where applicable):

> It is entirely compliant with International Humanitarian Law. Targets are always positively identified as legitimate military objectives and both pattern of life assessment and collateral damage estimate conducted. Strikes are carried out in accordance with the Law of Armed Conflict.[20]

40. Air Commodore (Retd) Bill Boothby stated:

> Remotely piloted aircraft, or drones as they are colloquially called, are subject to the same body of targeting and weapons law as other weapon systems, such as manned attack aircraft.[21]

Reaper operations

41. The General Atomics MQ-9 Reaper operated by the RAF is the UK's only armed remotely piloted air system. The RAF fleet rose to ten in early 2014 as an additional five aircraft were accepted into service. RAF Reapers provide persistent intelligence, surveillance, target acquisition and reconnaissance (ISTAR) for ISAF forces in Afghanistan, mostly in support of UK forces in Helmand province.

42. General Atomics explained the role the aircraft was able to fulfil:

> The RPA's ability to remain airborne for nearly 40 hours without refuelling provides the persistent ISR essential to the collection of extensive data on adversary activities. For the soldier on the ground RPA can transmit images directly to a portable device and also provide a time-sensitive strike capability to counter fleeting threats.

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[20] Ev w5, para 3.13

[21] Air Commodore (Retd) Bill Boothby, memorandum received in response to inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations*

> Additional applications include convoy protection, where the use of ISR sensors to identify IEDs (Improvised Explosive Devices) is invaluable.[22]

43. Since May 2008, UK Reaper aircraft have been armed with precision-guided weapons—Hellfire laser guided air-to-ground missiles and GBU-12 Paveway 500lb laser guided bombs. An investigation into the use of the MBDA Brimstone missile is also underway.[23] The Brimstone, currently used by the RAF on the Tornado, has an advanced sensor and a smaller warhead than a Hellfire missile, with a resulting higher level of accuracy and lower collateral damage.

44. By 31 August 2013, UK operated Reaper aircraft had flown over 50,000 hours on operations in the ISR role with 418 weapons fired in the same period.[24]

45. The Reaper is not an autonomous system—aircraft are remotely piloted with aircrew involved at all times. On current operations the Reaper is launched from Kandahar Airfield in Afghanistan by crews deployed in theatre. If the satellite communications link from the ground control station is lost and cannot be re-established the aircraft will fly a pre-programmed route to a "Launch and Recovery Element" area where it can be landed safely via line of sight communication links.

Personnel

46. Madeleine Moon MP's visit to RAF Waddington allowed her to meet with Reaper aircrew from XIII Squadron, including pilots, sensor operators and mission intelligence co-ordinators. She was also able to witness at first hand a Reaper mission being flown over Afghanistan from a ground control station in the base.

47. Prior to the visit, the MoD explained how remotely piloted air system operations compared with manned operations:

> The UK experience of operating the Reaper RPAS in Afghanistan suggests that Reaper aircrew, despite being based at RAF Waddington and Creech Air Force Base in the US, are just as, if not more, connected to the situation on the ground in Afghanistan as compared to operators of other aircraft types. The increased information available to operators and subsequently ground commanders, the endurance of Reaper and the substantial operational experience of Reaper crews, whose years of experience flying missions over Afghanistan, results in an unrivalled depth of knowledge. This in itself can make a significant contribution to the safety and security of UK and coalition forces in Afghanistan, while also helping to minimise the risk to civilians.[25]

48. Discussion with the men and women responsible for operating Reaper provided helpful insight into their roles and experience. XIII Squadron Reaper pilots have a mix of previous experience, having flown aircraft as diverse as Harrier, Nimrod and Tornado.

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[22] Ev w101, para 11

[23] Ev w11

[24] Ev w2, para 3.3

[25] Ev w5, para 4.4

There are few direct entrants to remotely piloted air system operations at present, but they would undertake appropriate pilot training before converting to remotely piloted air system operations. It is also possible for pilots to move from Reaper to other platforms: two pilots from 39 Squadron have retrained for Typhoon.

49. The vast majority of operational time by UK Reapers is spent on intelligence, surveillance and reconnaissance (ISR) tasks, supporting ground commanders in Afghanistan. Prior to an operation, crews receive a daily mission brief which sets out what their mission is that day. Important information such as key changes in theatre, weather conditions and planned shift changes are outlined. Crew members' procedural knowledge and judgement is also tested through questions and discussion of possible scenarios which might arise. Video footage from recent missions is used to highlight specific issues and to aid learning.

50. In general, crews operate on a 2-3 hour programmed shift followed by a break and crew change. They may return to the ground control station to continue the mission they were engaged in previously or receive a fresh mission brief.

51. Following any weapons release there is a formal debrief process in which learning points are identified. Lessons learned are shared with other aircrew as part of future daily mission briefs.

52. Asked about the psychological impact of their role and the challenges associated with balancing work with family life, crew members reflected on the importance of decompression and keeping the two parts of their lives discreet. Trauma Risk Management (TRiM)[26] assistance is available for anyone who requires it, but crew found that informal chats with one another are often the best way to decompress. In terms of separating work from family life, some personnel who had previously operated from Creech Air Force Base in Nevada, USA, as part of 39 Squadron, had found the one hour drive to and from work was beneficial to them in keeping work distinct from home life. That commute was not a feature of operating from RAF Waddington. Crew members were, however, disciplined about maintaining an operational focus during their shift by, for example, having no access to a mobile phone while at work.

53. Personnel were keen for the public to know more and understand better what it is they do and to dispel some myths that have grown up about Reaper operations in particular. One pilot commented that the public needed to know that remotely piloted aircraft are "not robots, they're not autonomous and we spend an awful lot of time training to fly them". This training emphasised all aspects of the RAF rules of engagement such as whether a strike is necessary, whether any civilians are nearby, and what instructions have been received from the ground commander. Reaper aircrew were firmly of the view that the loiter time of remotely piloted aircraft allowed more informed decisions to be made and consequently the risk of civilian casualties was reduced should a missile strike be required.

[26] The TRiM programme trains small teams of non-medical personnel to recognise the signs and symptoms of stress and to give advice to individuals from within their own units on coping strategies and how to manage them. Available at: http://www.raf.mod.uk/community/wellbeing/stressmanagement.cfm

54. All personnel present were convinced that the lives of British and ISAF forces had been saved through use of remotely piloted air systems in Afghanistan and they felt that there was a strong sense of gratitude from ground forces for the support Reaper crews provided.

55. Asked what they needed to do their jobs better, crew members focused on three elements:

- Additional personnel as, despite the enduring nature of the campaign, they only have the minimum necessary to fulfil the task;
- Upgrades to the sensor suites on the Reaper to further enhance their capability; and
- A UK training system rather than a continuing reliance on the USAF.

56. Personnel did, however, voice some concerns about career development prospects given uncertainty about the future of UK Reaper operations. They were unclear what would happen should the programme end at the conclusion of operations in Afghanistan.

57. **It was very clear from the visit to XIII Squadron and discussions with Reaper aircrew that all were experienced professional personnel with a clear purpose and keen understanding of the Rules of Engagement which govern their operations. Despite being remote from the battle space they exhibited a strong sense of connection to the life and death decisions they are sometimes required to take. This was in stark contrast to the image portrayed by some commentators of "drone" pilots as video gaming "warrior geeks". We record here our appreciation for the important role they continue to perform in Afghanistan.**

A combined Reaper fleet?

58. Some campaign organisations have raised concerns that the UK has provided assistance to a covert programme of remotely piloted air strikes by the USA in countries including Pakistan. Information released by the MoD in February 2014, in response to a Freedom of Information request from Drone Wars UK, revealed that between October 2006 and 31 December 2012, of the 2,150 Reaper missions flown by UK personnel in support of operations in Afghanistan and Libya, there were 271 missions in Afghanistan when UK personnel utilised a US Reaper as a UK Reaper was unavailable. During these missions, UK personnel released 39 weapons.[27]

59. Asked about the matter in a debate on Afghanistan, the Secretary of State for Defence, Rt Hon Philip Hammond MP, explained:

> We operate a combined fleet with the US and there is ISAF tasking. UK and US aircraft therefore fly ISAF mission tasks and they may be piloted by UK or US pilots. However, UK pilots always operate to UK rules of engagement. The rules of engagement for remotely piloted aircraft are exactly the same as those for our

[27] Ministry of Defence, FoI response 4 February 2014. Available at: http://dronewarsuk.files.wordpress.com/2014/02/20130204-cole-reaper-weapons-released-reply-u.pdf

> Tornado aircraft and those that will apply to our Apache rotary-wing aircraft when they are in action.[28]

60. The Secretary of State for Defence also stated that UK remotely piloted aircraft operated only in Afghanistan and that other members of ISAF had not been able to use any for intelligence gathering or for armed attacks in Pakistan.[29]

61. However, the Secretary of State's oral answer appeared in part to contradict a written answer given by Anna Soubry MP, Parliamentary Under Secretary of State and Minister for Defence Personnel, Welfare and Veterans. Asked to provide details of US Air Force personnel manning UK Reapers on non-UK missions outside the launch and recovery phase, the Minister replied: "Outside of the launch and recovery phase, UK Reaper RPAS have always been operated by UK pilots".[30]

62. **In light of these apparently inconsistent answers by Ministers, we call upon the MoD to provide absolute clarity about whether UK Reaper aircraft have ever been operated by US personnel outside the launch and recovery phase. If public confidence is to be built around the use of remotely piloted air systems it is important that it is clear that UK aircraft have only been utilised within Afghanistan and always in accordance with UK rules of engagement.**

Civilian casualties

63. The MoD told us that it was aware of only one incident involving an armed UK remotely piloted air system Reaper, which had resulted in the deaths of civilians:

> On 25 March 2011, an attack on two pick-up trucks resulted in the destruction of a significant quantity of explosives and the death of two insurgents. Sadly, four Afghanistan civilians were also killed. In line with current ISAF procedures, an ISAF investigation was conducted to establish if any lessons could be learned or if any errors in operational procedures could be identified. In that case, the report concluded that the actions of the Reaper crew had been in accordance with extant procedures and rules of engagement.[31]

64. An Operational Learning Account and After-Action Report (OLAAAR) is produced after every weapon release. Aircrew involved in the strike engage in a formal debrief process in which learning points are identified. Any lessons identified are shared with other aircrew as part of future daily mission briefs.

65. In light of concerns about the potential for civilian harm in remotely piloted aircraft strikes, the Bureau of Investigative Journalism argued that it was "important that the British government establishes the international precedent of publishing a fuller record of drone strikes and their impact, to the extent that is operationally secure".[32]

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[28] HC Deb, 10 February 2014, col 588

[29] HC Deb, 10 February 2014, col 593

[30] HC Deb, 15 January 2014, col 578W

[31] Ev w5, para 4.3

[32] Ev w31

66. **We consider it important that the MoD is as transparent as it can be about remotely piloted air system operations in order to build public confidence about their use and to debunk myths and counter misinformation. We note that a review is conducted and a report produced after every remotely piloted aircraft weapons release. While the public do not need to know every time weapons are released they do need to feel confident that rules of engagement are applied and followed consistently.**

Conclusion

67. **UK operations in Afghanistan have drawn heavily on new and emerging remotely piloted air system technologies in order to offer better protection to UK, ISAF and Afghan forces on the ground. The intelligence, surveillance and reconnaissance capabilities of our forces have been enhanced immeasurably. More controversial has been the use of the Reaper remotely piloted air system platform to conduct strike operations using precision-guided weapons. Following this inquiry, we are satisfied that RAF Reaper pilots and flight crew have a high level of experience and appropriate training to conduct such strikes. We are also satisfied that the RAF rules of engagement for Reaper operations, as outlined to us directly by senior RAF officers during this inquiry, are common with those in force for manned aircraft, and provide a high level of assurance that, as far as possible, civilian casualties will be avoided and collateral damage minimised.**

Use by other nation-states

68. In its submission, RUSI listed countries known to have RPAS capabilities:

USA	USAF General Atomics MQ-1 Predator (Armed or unarmed) General Atomics MQ-9 Reaper (Armed or unarmed) Northrop Grumman RQ-4 Global Hawk (Unarmed) AeroVironment RQ-11 Raven (Unarmed) Lockheed Martin RQ-170 Sentinel (Unarmed) The US Navy, Army, Border Agency, Coast Guard and CIA also operate fleets, totalling a larger number than in USAF service.
Italy	MQ-1 Predator (Armed or unarmed) MQ-9 Reaper (Armed or unarmed)
France	EADS Harfang
Israel	IAI Eitan, MALE Tactical RPAS, Israel Air Force IAI Heron, MALE Tactical RPAS, Israel Air Force Elbit Hermes 450, Tactical RPAS, Israel Air Force BlueBird SpyLite, Miniature RPAS, Israel Air Force

RUSI written memorandum.

In addition, the Dutch Ministry of Defence announced in November 2013 that it had decided to purchase four Reaper remotely piloted air systems, initially unarmed. The RUSI memorandum also noted that NATO nations operating under ISAF in Afghanistan, including Germany and Canada had invested in remotely piloted air systems. Other

countries such as Russia, Iran and China also have unmanned capabilities, but a lack of concrete information meant it was difficult to provide a detailed analysis.[33]

69. A study by the NATO Parliamentary Assembly, *Unmanned Aerial Vehicles: Opportunities and challenges for the Alliance*, published in 2012, provided additional information about NATO Member States' use of these systems.

> While at least 25 of the Alliance's Member States possess drones, most of these are smaller tactical drones with neither the capacity nor the endurance of larger "flagship" UAVs like the Predator, Reaper, or Global Hawk. Encouragingly, NATO has taken an important first step in remedying the UAV shortfall with the recent agreement on the Allied Ground Surveillance (AGS) system. By 2017, 13 Member States will have acquired five Global Hawk high-altitude long endurance drones, which will be operated and maintained by all 28 Member States.[34]

Constraints on the use of remotely piloted air systems

Constraints on military use

70. The MoD told us that the constraints on military use of unmanned air systems in the UK and overseas included, but were not limited to, the following:

Use of Airspace and Safety – the lack of "Sense-and-Avoid" technology

71. The MoD told us that Watchkeeper was being fitted with a system that would make it compliant with International Civil Aviation Organization (ICAO) standards.[35]

Basing – proximity to the target area of interest

72. The MoD told us that in order to utilise unmanned air systems in the most efficient manner, they should be based as close as possible to the target area of interest to allow for the longest loiter time possible. In a "non-permissive" or hostile environment this would be "extremely difficult":

> Larger platforms' reliance upon an airfield potentially reduces their utility, and consideration must be given to basing within a permissive location, which may create additional burdens (force protection, Command & Control, logistics etc). [36]

Command Delay – via satellite relay

73. As UAS suffer from a very slight command delay, inputs into the controls from the ground station take a brief time to reach the aircraft, but there are robust procedures to

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[33] Ev w13

[34] Pierre Claude Nolin, NATO Parliamentary Assembly, *Unmanned Aerial Vehicles: Opportunities and challenges for the Alliance*, 20 November 2012 Available at: http://www.nato-pa.int/default.asp?SHORTCUT=3024

[35] Ev w9, para 6.12

[36] Ev w9, para 6.12

deal with it. The main challenge is for take off and landing, leading to the need for a visual line of sight (VLOS) pilot at the airfield. [37]

Weather

74. This can be particularly difficult for lighter airframes to manage and significantly constrains their flying hours in certain environments, such as areas that suffer from high cross winds, icing or lightning strikes. [38]

Electromagnetic Environment (EME)

75. The use of UAS is entirely dependent upon data feeds. They also require access to frequencies and spectrum to operate.[39] Additional demands for bandwidth will need to be factored into future military electromagnetic spectrum requirements.

Regulation and airworthiness

76. The MoD explained that military registered remotely piloted air systems are regulated by the Military Aviation Authority (MAA), while the safe operation of civil remotely piloted air systems in the UK is governed by the requirements of the Air Navigation Order 2009. RPAS, as with all other aircraft, will only be permitted to operate in UK airspace if it is considered that it is safe for them to do so. Remotely piloted air system specific airworthiness regulations are in the early stages of development, but this is being done on an international scale, with a view to global harmonisation, rather than the UK 'going it alone'.[40]

77. The Royal Aeronautical Society stated that airspace integration was one of the great challenges for future remotely piloted air system operations. It pointed to various international efforts to evolve rules, regulations and the technology necessary for integration.[41]

78. The Joint Authorities for Rulemaking on Unmanned Systems (JARUS) is a group of experts from National Aviation Authorities (NAAs) and the European Aviation Safety Agency (EASA). Its purpose is to recommend a single set of technical, safety and operational requirements for the certification and safe integration of Unmanned Aircraft Systems into airspace and at aerodromes. The work of JARUS will take into account emerging ICAO standards, recommended practices and guidance material on the matter.[42] European participants in JARUS are also committed to the development of the European RPAS Steering Group Roadmap. The European RPAS Roadmap proposes a series of actions to be taken to achieve remotely piloted air systems integration into the European

[37] Ev w9, para 6.12

[38] Ev w9, para 6.12

[39] Ev w9, para 6.12

[40] Ev w9, para 6.9

[41] Ev w54, para 25

[42] JARUS, http://jarus-rpas.org/

air system from 2016. The material will be made available to interested parties such as, ICAO, EASA, NAAs and industry, for consideration and use.[43]

79. General Atomics argued that, at a pan-European level, the main area of constraint on the expansion of remotely piloted air systems is "precise specifications to enable RPA to conform to regulatory requirements governing full access to [controlled] airspace". It is presently prioritising the development of a "Type Certifiable"[44] Reaper aircraft.[45]

80. Due to safety and reliability issues, Drone Wars UK warned that it would be unlikely that British forces would be able regularly to fly and train with larger unmanned aircraft within non-segregated and even within segregated British airspace within a few years: "without a dramatic improvement in the reliability and safety record of military UAVs it is highly unlikely that the CAA as regulators nor the British public would accept this".[46]

81. Until the necessary technical, safety and operational requirements for remotely piloted air system integration into shared airspace are met, only a very limited number of zones around the UK will be available for flight training and testing. In May 2013, in response to a Parliamentary Question the MoD published a map of Ministry of Defence (MoD) reserved airspace areas within the UK where remotely piloted air systems may be operated. The answer stated that these airspace areas, which are subject to future changes as new operating practices and platforms come into service, can be used either for specific periods by RPAS as detailed in the UK Aeronautical Information Publication or by activation of a Notice to Airman (NOTAM).[47] A copy of the map of MoD reserved airspace areas is included at Annex A.

Conclusion

82. **There are many constraints on the use of remotely piloted air systems in shared airspace whether in the UK or elsewhere. In its response to this report we invite the MoD to set out in detail what action the Government as a whole is taking domestically and internationally to facilitate the development of the technologies, systems and regulatory changes which will be required prior to the full and safe integration of remotely piloted air systems into shared airspace.**

[43] European RPAS Steering Group, *Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System*, June 2013. Available at: http://ec.europa.eu/enterprise/sectors/aerospace/uas/index_en.htm

[44] A type certificate is issued to signify the approval of the design of certain types of aircraft, engines and propellers.

[45] Ev w100

[46] Ev w51, para 7

[47] HC Deb, 5 May 2013, col 222W

3 Forward Programme

Integration post-Afghanistan

84. Military operations in Iraq and Afghanistan were the genesis of many of the remotely piloted air systems currently used by UK Armed Forces with the majority procured as Urgent Operational Requirements (UORs). With operations in Afghanistan due to conclude at the end of 2014, we were interested to establish what lessons had been identified for future operations. We were also keen to understand whether the MoD had decided to integrate remotely piloted air systems into post-Afghanistan Armed Forces' structures.

Lessons identified

85. The MoD told us that there were a range of lessons identified from operating remotely piloted air systems in Afghanistan. The importance of their contribution lay in the better intelligence, precision and situational awareness they could provide and it was "difficult to imagine a future campaign where such technology will not have a role to play".[48]

86. The MoD stated that the key remotely piloted air system strength demonstrated in Afghanistan was the persistent ISR presence it provided, far in excess of manned air platforms whose endurance was often considerably less. It argued that "persistence also maximises precision", resulting in fewer civilian deaths arising from air strikes.[49]

87. However, the MoD also acknowledged that the lessons from Afghanistan might not be universally applicable because conditions there (adequate basing and lines of communication, operating in permissive and relatively uncongested air space, against a technologically unsophisticated adversary) would not necessarily exist in other theatres of war. [50]

88. The Royal Aeronautical Society highlighted some additional lessons:

> It has also brought challenges associated with dislocated operations. No. 39 Sqn., the first to operate the Reaper, is based in the USA and UK, and flies near constantly over Afghanistan. As a result the command and control chain is long and complex, with the challenge of balancing the many conflicting demands on this capable platform. Delivering an enduring 24/7 capability has proved to be a strain on Sqn. personnel, who are on operations for 3-year tours, rather than the 6 months for those deployed forward in theatre.[51]

[48] Ev w5, para 4.1

[49] Ev w5, para 4.3

[50] Ev w5, para 4.5

[51] Ev w53, para 14

Maintaining the capability

89. How the MoD will keep remotely piloted air system capability meaningfully alive post 2014 withdrawal from Afghanistan is dependent on funding decisions to be taken as part of SDSR 2015. Until now, all UK unmanned air systems and remotely piloted air systems have been funded from UORs. If such equipment is returned to the UK and becomes part of the Armed Forces' core equipment, the MoD would be responsible for the cost of regenerating it. However, as part of our inquiry into *Securing the Future of Afghanistan*, the Secretary of State for Defence told us that the MoD would not be liable to reimburse the capital costs of procurement for these systems.[52]

90. In its written submission, the MoD told us that it was considering whether its various systems (Reaper, Desert Hawk III, Black Hornet, Tarantula Hawk) acquired as UORs for Operation Herrick in Afghanistan should be retained as core programmes or not, when UK forces redeploy in 2014.[53] If they are not retained as core programmes it is unclear what will happen to the systems and the personnel who operate them. One option would be to retain some systems in a reduced formation. However, competition for funding for other capabilities such as maritime surveillance will have a significant bearing on available resources.

91. Interviewed in January 2014, Air Vice-Marshal Philip Osborn, Director of Capability, Joint Forces Command stated that the UK had "every intention of continuing to utilise Reaper beyond Afghanistan". He continued:

> You will see us plan to bring Reaper more into an expeditionary, rather than deployed mode, and over the next few years we will shift from Reaper into the Scavenger programme, [which] should be capable of doing far more, on a worldwide basis.[54]

92. **We call upon the MoD to set out which of the existing remotely piloted and unmanned air systems it intends to retain beyond the end of operations in Afghanistan and to confirm that continuing operating costs can be funded from within its core programme budget from financial year 2014-15 onwards.**

Training

93. The ability to train remotely piloted air system pilots, sensor operators and other aircrew is fundamental to maintaining a deployable future capability. The Royal Aeronautical Society told us:

> Recent operations have underlined the requirement for training specialised crews to operate unmanned aircraft. The RAF has recently graduated its first class of RPAS

[52] Defence Committee Tenth Report of Session 2012-13, Securing the Future of Afghanistan, HC 413, para 133

[53] Ev w5, para 5.1

[54] "RAF ready for Reaper fleet boost, confirms expeditionary plan", Flightglobal, 16 January 2014. Available at: http://www.flightglobal.com/news/articles/raf-ready-for-reaper-fleet-boost-confirms-expeditionary-394929/

> pilots and a number of RPAS operators are currently examining the training requirements to operate various classes of unmanned aircraft in future.[55]

94. In respect of Reaper operations, training for pilots and sensor operators is conducted jointly with the USAF in the USA. Given the current constraints on flying remotely piloted aircraft in UK airspace there is likely to be a continuing dependency on the USAF for flight training in the short to medium term.

ISTAR force composition

95. In the last Parliament, our predecessor committee published two reports into intelligence, surveillance, target acquisition and reconnaissance (ISTAR) and the contribution of unmanned systems to that capability.[56] We have maintained a close interest in the subject, particularly in relation to capability gaps in our maritime surveillance following the cancellation of the Nimrod MRA4 programme.

96. In July 2013, the MoD provided us with an update on the initial findings of its Air ISTAR Optimisation Study (AIOS), which is looking at the requirements and capabilities of air-based ISTAR to inform resource decisions as part of the next SDSR. This confirmed that unmanned air systems had been considered as options for delivering the range of desired air ISTAR capabilities. In addition, Air Command had assessed the utility of Reaper in a Maritime Surface Surveillance role for the period 2015-18.[57]

97. **In its response to this report the MoD should set out how remotely piloted air systems, including Reaper, fit within its overall ISTAR strategy.**

Emerging technologies

98. In the introduction to its Joint Doctrine Note *The UK Approach To Unmanned Aircraft Systems* (JDN 2/11) the MoD stated that its purpose was to:

> identify and discuss policy, conceptual, doctrinal and technology issues that will need to be addressed if such systems are to be successfully developed and integrated into future operations. Although broad agreement has been achieved amongst contributors, the JDN does not describe a position of consensus. It does, however, seek to energise debate within the UK and move UAS-related thinking forward.[58]

In that context, we invited the MoD to tell us about the systems it would be developing from now to 2020.

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[55] Ev w54, para 18

[56] Defence Committee, Thirteenth Report of Session 2007-08, *The contribution of Unmanned Aerial Vehicles to ISTAR capability*, HC 535; Eighth Report of Session 2009-10, *The Contribution of ISTAR to operations*, HC 225

[57] Defence Committee, Report on Future Maritime Surveillance: Government update, 10 July 2013.

[58] Ministry of Defence, *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11 (*JDN 2/11), March 2011. Available at: https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems

Unmanned Air System	Number of UAS	Comments
WATCHKEEPER	54	Watchkeeper is not yet in service and is planned to replace Hermes 450. Watchkeeper is the core Tactical Unmanned Aircraft System which will provide enduring ISR support to UK ground forces. It is equipped with a radar surveillance capability in addition to video. The original design and manufacturing contract was placed with Thales UK in 2005. The first UK flight took place in Parc Aberporth, West Wales in April 2010. In March 2014, Watchkeeper was cleared to begin military flight training with the Royal Artillery in a restricted airspace over the Salisbury Plain Training Area.
SCANEAGLE		Scan Eagle is a UAS being delivered to meet a UOR for additional maritime surveillance. The capability is expected to start becoming available to the Royal Navy from late 2013 onwards. The capability will be provided as a service provision by the contractor (Boeing UK) and will initially consist of 300 hrs surveillance per month.
SCAVENGER **Concept – no photograph**		Scavenger is the MoD's core requirement for a Deep and Persistent Armed ISR capability, from 2018. Analysis has indicated a medium altitude, long endurance RPAS-class system is the most cost-effective solution. The MoD is considering acquisition options from around the globe. At this stage the UK has not ruled out any possibilities and potential opportunities remain for international co-operation.
MARITIME UNMANNED AIR SYSTEMS **Concept – no photograph**		The Royal Navy has awarded a contract to Agusta Westland to provide a Capability Investigation and Concept demonstrator of an unmanned rotary wing air system. The air vehicle used for the demonstration will be a 1.8 ton helicopter which will demonstrate radar, electro-optics, mine counter measures and hydrographic survey capabilities.
TARANIS		Project Taranis is a UCAS technology demonstrator programme focusing on the next generation of Low Observable intelligence and attack aircraft. It will provide the MoD with experimental evidence on the potential capabilities, helping to inform decisions on the future mix of manned and remotely piloted systems. UCAS will not replace any of the RAF's front-line aircraft in the short term, but in the longer term a mix of manned fast-jets and UCAS could be used on operations. Taranis ground tests commenced in 2010 and flight trials took place in 2013. Taranis investment will be exploited in Future Combat Aircraft Systems which will offer more advanced capabilities compared to the current generation of aircraft. Given the nature of combat operations there will always be a role for highly skilled operators and pilots to ensure that remotely piloted combat missions are conducted appropriately, proportionately and legally.
Future Combat Aircraft Systems (FCAS) **Concept – no photograph**		The UK and France have a requirement to examine the options for the next generation of combat aircraft systems after Rafale and Typhoon are due to come out of service in the 2030 timeframe. One option being considered is Unmanned Combat Aircraft Systems and work has commenced scoping a cooperative Demonstration Programme.

Table 2: Ministry of Defence, Future MoD Systems. Images: Crown Copyright 2013

Watchkeeper

99. In 2005, the MoD awarded Thales UK a contract to develop an all-weather tactical ISTAR unmanned air system for the British Army. Watchkeeper is the UK MoD's largest current unmanned air system procurement programme (valued at approximately £1bn). It is designed to provide operational commanders with unmanned day and night all weather capability to detect and track targets without the need to deploy troops into potentially sensitive areas.

100. In response to a report by our predecessor committee in 2008, the MoD stated that the Watchkeeper programme was "on track" to reach full operating capability in 2013. However, since that time there have been significant delays to the programme and Watchkeeper achieved neither its initial forecast in-service date in 2010 nor the revised date of April 2012. In order to address the need for ISTAR in Afghanistan, the MoD procured Hermes 450 system as an urgent operational requirement in 2007. The MoD told us:

> The delay to the introduction of Watchkeeper into service is being mitigated by the continuation of the Hermes 450 service provision to ensure there is no capability impact on current operations.[59]

101. The system finally received a Statement of Type Design Assurance (STDA) from the Military Aviation Authority in October 2013.[60] On 5 March 2014, the MoD announced that Watchkeeper had been cleared to begin military flight training with the Royal Artillery in a restricted airspace over the Salisbury Plain Training Area.[61]

102. **Due to significant delays to the programme, it is now unlikely that Watchkeeper will be utilised on operations in Afghanistan, the theatre for which it was originally procured. The MoD should set out in detail in its response to this report the reasons for the delays experienced in bringing Watchkeeper to full operating capability and the lessons identified for future remotely piloted air system programmes.**

Taranis

103. Taranis is an unmanned combat aircraft system (UCAS) advanced technology demonstrator programme, designed and built by BAE Systems, Rolls-Royce, the Systems division of GE Aviation (formerly Smiths Aerospace) and QinetiQ, working alongside UK MoD military staff and scientists.[62]

104. The MoD explained that the project would provide "experimental evidence on the potential capabilities, helping to inform decisions on the future mix of manned and remotely piloted systems". Although unmanned combat aircraft systems would not replace any of the RAF's front-line aircraft in the short term, in the longer term a mix of manned

[59] Ev w5, para 5.2

[60] Thales UK "Thales's Watchkeeper receives Statement of Type Design Assurance from the UK Military Aviation Authority" www.thalesgroup.com

[61] Ministry of Defence "Army cleared to fly next-generation eye-in-the-sky" www.gov.uk 5 March 2014

[62] BAE Systems "Taranis" www.baesystems.com

fast-jets and UCAS could be used on operations. Ground tests commenced in 2010 and flight trials took place in 2013.[63]

105. Announcing details of the first flight of the Taranis demonstrator, BAE Systems stated:

> The aircraft was designed to demonstrate the UK's ability to create an unmanned air system which, under the control of a human operator, is capable of undertaking sustained surveillance, marking targets, gathering intelligence, deterring adversaries and carrying out strikes in hostile territory.[64]

106. The MoD told us:

> Any future in-service systems based on such a concept design will at all times be under the command of highly skilled ground-based crews controlling a platform able to operate in contested airspace behind enemy lines unlike current unmanned systems.[65]

Scavenger

107. Scavenger is an MoD programme which is intended to deliver future UK capability for "deep and persistent armed ISR collection from 2018 to 2030", as a replacement for Reaper. The programme is "pre-Initial Gate", which means that the concept is still in development and options are being assessed. It is currently planned to be met by a Medium Altitude Long Endurance (MALE) remotely piloted air system capable of conducting ISR across a very wide area and with the potential to be armed. The MoD told us:

> The Scavenger Assessment Phase is focused on maturing and de-risking the sole-source acquisition of a future variant of Reaper, as a Military-Off-The-Shelf solution. The UK is still considering acquisition options to satisfy its Scavenger capability requirement, including retaining its Reaper as a Core Capability. Nothing has been ruled out and UK remains open to considering cooperative options.[66]

108. **It is of vital importance that the lessons identified from the much delayed Watchkeeper system inform the development and trials of all future remotely piloted aircraft and any associated weapons systems by the MoD. In its response to this report we call on the MoD to provide us with a more detailed update on the Scavenger and Taranis programmes and explain how they will contribute to future UK air combat and ISTAR capabilities.**

Sensor technology

109. General Atomics Aeronautical Systems, Inc. (General Atomics), a leading manufacturer of remotely piloted air systems (including the RAF's Reaper), tactical

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[63] Ev w7

[64] BAE Systems "Taranis" www.baesystems.com

[65] Ev w6, para 5.5

[66] Ev w6, para 5.3

reconnaissance radars, and electro-optic surveillance systems, told us that the UK had the potential to expand further its remotely piloted air system capability and utility:

> By introducing various enhancements, including podded systems and extended endurance, the range of missions for both military and civilian applications could be expanded significantly. This would provide opportunities for the UK's world-class aerospace industry to collaborate more closely with GA-ASI and potentially access wider markets, e.g. through the provision of a flexible maritime surveillance capability and possibly the integration of self-protection measures which could enable operations in less benign environments than hitherto. Operations in more demanding environments might also be facilitated by adoption, in time, of a possible Avenger[67]/Reaper fleet mix.[68]

110. Thales UK, another major defence contractor, told us that "to maintain and strengthen the UK's relative position in UAS, development of key sensor and information exploitation elements is of primary importance". It explained that the key determinant of reconnaissance effectiveness was the range and capabilities of the sensors an aircraft carried.[69]

111. The European Defence Agency (EDA) has stated that over half the cost of building a complex intelligence, surveillance and reconnaissance remotely piloted air system is related to sensing technologies and data exploitation capabilities.[70]

112. **We recognise the importance of sensor technology for ISTAR capability whether deployed on manned or unmanned platforms. We consider it vital that UK ISTAR assets are equipped with up to date sensor suites which maximise their effectiveness. We call upon the MoD to provide us with details of its planned investment in future sensor technology and exploitation for remotely piloted air systems and other ISTAR assets.**

New weapons systems

113. Looking towards the development of weapons systems which might be deployed on the Reaper or other armed remotely piloted air systems in the future, MBDA, manufacturer of the Brimstone missile, told us:

> An RPAS equipped with reliable and accurate missile systems are able to deliver the desired operational effect with a much smaller warhead charge than those equipped with less accurate weapons. Furthermore, the use of reliable and accurate missile systems increases the number of opportunities available to engage legitimate targets, including some that would ordinarily be considered too difficult to attack, with confidence that the risk of causing unintended collateral damage had been

[67] The jet powered Predator C Avenger is described by General Atomics as a "highly advanced, next generation UAS". http://www.ga-asi.com/products/aircraft/predator_c.php

[68] Ev w100

[69] Ev w20

[70] European Defence Agency, *Factsheet – Remotely Piloted Aircraft Systems*, November 2013. Available at: http://www.eda.europa.eu/info-hub/publications/publication-details/pub/factsheet-remotely-piloted-aircraft-systems-(rpas)

significantly reduced. Accuracy also means that the cost per successful engagement is minimised.[71]

114. **We note the potential for deployment of new and increasingly accurate weapons systems, including the Brimstone missile, on UK armed remotely piloted aircraft. We call on the MoD to provide us, in its response to our report, with a progress report on current trials and future plans.**

Partnering – strategic choices

115. As part of our call for written evidence for this inquiry we invited comments on the UK's future requirements for remotely piloted air systems out to 2020. We were keen to explore the potential for new systems to be researched and developed with allies should the UK decide to a develop a strategic partnership.

The USA – an existing partnership

116. A strong partnership exists between the RAF and USAF built upon extensive shared experience of operating Reaper remotely piloted air systems in Afghanistan. The RAF's 39 Squadron still operates from Creech Air Force Base in Nevada, USA, alongside USAF counterparts.

117. The Royal Aeronautical Society argued that co-operation with the USAF Reaper programme had allowed the UK to benefit from economies of scale and shared facilities that it would not otherwise have enjoyed.[72] However, the consequence of this strategic partnership is a significant continuing UK dependence on the USAF for support infrastructure and future upgrades to Reaper systems, and access to the USAF training programme for Reaper pilots and sensor operators.

UK-France defence co-operation

Future Combat Aircraft Systems

118. In its memorandum, the MoD told us that as part of the requirement to examine the options for the next generation of combat aircraft systems, the UK and France were considering unmanned combat air systems and work had commenced scoping a co-operative demonstration programme. It also explained that the investment in Taranis would be exploited in a "Future Combat Air System" (FCAS) "which will offer more advanced capabilities compared to the current generation of aircraft".[73]

119. The MoD explained that as the UK must make a strategic capability decision on FCAS as part of the next SDSR, the next phase of the programme was important to "de-risk critical technologies", and would underpin SDSR 2015 decision making.[74]

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[71] Ev w117

[72] Ev w53, para 14

[73] Ev w7

[74] Ev w6, para 5.6

120. Following the UK-France Summit held on 31 January 2014, it was announced that the two governments had agreed to launch a two year £120m Feasibility Phase to develop the concepts and technologies to provide their respective Armed Forces with an unmanned combat air vehicle. This would build on preparatory studies conducted since the last Summit by six industry partners – Dassault Aviation, BAE Systems, Thales France, Selex, Rolls Royce and Safran. A decision would be taken in 2016 whether to collaborate on demonstration and manufacturing phases. A formal Memorandum of Understanding is expected to be signed at the 2014 Farnborough Airshow.[75] We understand that this will also build on the French led multinational "nEUROn" UCAS demonstrator project with Dassault Aviation as prime contractor.[76]

Medium Altitude Long Endurance

121. The *Declaration on Defence and Security* issued following the 2014 UK-France Summit also provided an update on co-operation on MALE remotely piloted air system capabilities, including a proposed "joint user group" for Reaper, "to exchange lessons learnt and work together on air certification, training, through life support and interoperability". This group would be set up in consultation with the United States, and would be open to the European nations operating Reaper.[77]

122. In respect of Watchkeeper, the Declaration anticipated France taking a decision on procurement by the end of 2014. In addition to joint acquisition, the two countries were "looking at the potential benefits of a joint force in terms of training, support, equipment, operations and development".[78]

The EU dimension

123. The European Council of 19-20 December 2013 held a thematic debate on defence and identified priority actions for stronger cooperation.[79] In its conclusions, the Council stated that it remained committed to "delivering key capabilities and addressing critical shortfalls through concrete projects by Member States, supported by the European Defence Agency". As part of this the Council committed to:

> the development of Remotely Piloted Aircraft Systems (RPAS) in the 2020-2025 timeframe: preparations for a programme of a next-generation European Medium Altitude Long Endurance RPAS; the establishment of an RPAS user community among the participating Member States owning and operating these RPAS; close synergies with the European Commission on regulation (for an initial RPAS

[75] Prime Minister's Office, 10 Downing Street, "UK-France Summit 2014: agreements: Declaration on Defence and Security", www.gov.uk

[76] Dassault Aviation, "nEUROn". Available at: http://www.dassault-aviation.com/en/defense/neuron/introduction/

[77] Prime Minister's Office, 10 Downing Street, "UK-France Summit 2014: agreements: Declaration on Defence and Security", www.gov.uk

[78] Prime Minister's Office, 10 Downing Street, "UK-France Summit 2014: agreements: Declaration on Defence and Security", www.gov.uk

79 European Council Conclusions, Nr: EUCO 217/13, 20 December 2013. Available at: http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/140245.pdf

integration into the European Aviation System by 2016); appropriate funding from 2014 for R&D activities.[80]

Conclusion

124. **As part of SDSR 2015, the MoD has a strategic choice to make about the future direction for UK remotely piloted air systems. Post-Afghanistan, a commitment to the existing partnership arrangements with the USAF, including a continuing presence at Creech Airforce Base, would provide the RAF with access to future upgrades to the Reaper platform and training opportunities for UK Reaper aircrew which would be likely to prove problematic in the UK given the airspace restrictions which exist presently. However, with other European NATO nations, including France, Italy and the Netherlands now operating Reaper it may be advantageous to form more collaborative arrangements at a European level in order to share experience and seek economies of scale for the delivery of training and maintenance. In the medium to long term, projects such as Scavenger and the Future Combat Aircraft System demonstration programme being developed with France may require a shift in focus. We recommend that the MoD clarifies its intentions and explains how European level co-operation can be co-ordinated with existing bi-lateral partnership projects.**

Non-military uses

125. ADS, the trade organisation representing the UK aerospace, defence, security and space industries suggested that if current regulations on remotely piloted aircraft in UK airspace could be reformed, increased domestic uses might include:

- Security – through the increased use of airborne surveillance systems at events and dangerous situations
- Search and Rescue – to eventually replace manned services where more efficient
- Agriculture – the monitoring of crops
- Telecommunications – creating temporary communications links in emergency situations or at every day events
- Conservation – to track endangered species and changes to wildlife habitats
- Energy – the monitoring of overhead power-lines and Nuclear PowerStation construction
- Construction – to inform architects and project managers of progress and for the lifting of materials
- Logistics – for movement and delivery

Other submissions we received suggest that to the list might be added:

[80] European Council Conclusions, Nr: EUCO 217/13, 20 December 2013. Available at: http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/140245.pdf

- Oil and gas – exploration, installation and pipeline monitoring
- Airport security
- Border security
- Humanitarian and disaster relief

126. Research Councils UK told us that within the science community remotely piloted air systems are used for a number of applications including species surveys, terrain mapping and geophysics surveys. In addition, research is being conducted on applications in areas such as remote inspection in hostile environments, autonomous driving, defence, logistics, security, and environmental research (e.g. atmospheric and climate studies). Funding from the Department for Business, Innovation and Skills (BIS), delivered via the Research Councils, has supported a wide range of research projects in these areas.[81]

ASTRAEA

127. ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation and Assessment) is a UK industry-led consortium focusing on the technologies, systems, facilities, procedures and regulations that will allow autonomous vehicles to operate safely and routinely in civil airspace over the United Kingdom. The consortium comprises seven companies: AOS, BAE Systems, Cassidian, Cobham, QinetiQ, Rolls-Royce and Thales. Its aim is to:

> enable the routine use of UAS (Unmanned Aircraft Systems) in all classes of airspace without the need for restrictive or specialised conditions of operation. This will be achieved through the coordinated development and demonstration of key technologies and operating procedures required to open up the airspace to UAS.[82]

The project was co-funded by the Technology Strategy Board (the UK's innovation agency), the Welsh Assembly Government and Scottish Enterprise.[83]

128. In April 2013, ASTRAEA conducted a first remotely piloted flight from Preston, Lancashire, to Inverness using an adapted Jetstream research aircraft. The flight through shared UK airspace was staged in conjunction with NATS (the UK's En-Route Air Traffic Control Service provider) and used advanced sensors and on-board robotic systems to control the aircraft once in the air, with the pilot based at Warton, Lancashire.[84]

Privacy issues

129. The potential expansion of the use of remotely piloted air systems for security and other purposes raises the prospect of privacy infringements. The European RPAS roadmap identified that increased use of remotely piloted air systems "may raise serious and unique

[81] Ev w60, para 7

[82] ASTRAEA, http://astraea.aero/

[83] ASTRAEA, http://astraea.aero/

[84] ASTRAEA, http://astraea.aero/

privacy and data protection concerns", potentially undermining the overall benefits from this innovative technology. It encouraged action to ensure full compliance of remotely piloted air system operations with existing privacy and data protection legislation or amendment of the existing regulatory framework if required.[85]

130. Professor Nicholas Wheeler, Institute for Conflict, Co-operation and Security, University of Birmingham, told us:

> Privacy is a factor which any UK Government would need to consider in the deployment of any ISR system. Legal measures for their use and any data collected would need to be in force. There will also be advocacy groups which will make their views known and there will be a lively public debate in consequence [...] The role of public opinion in such a debate could provide one of the strongest impediments to the use of UAVs in the round. It may take time for the public to accept them and many people will not be confident in their utility.[86]

Conclusion

131. **Remotely piloted air systems have extensive potential for non-military uses in the UK and overseas. Projects such as those developed by the ASTRAEA consortium have begun to test the technologies and operating procedures required to make the use of RPAS more commonplace and research into the potential for other uses is continuing. We welcome Government support to strengthen UK research and development programmes which have the potential to expand the nascent civilian market for remotely piloted air systems in the future. We call upon the Government to set out in detail what joint working is currently ongoing across government departments to consider the implications for the utilisation of remotely piloted air systems in the civilian environment. In relation to the issue of privacy, we recognise that existing laws which protect personal privacy, including data protection and surveillance, whether by the police, state intelligence agencies or private companies, will need to be carefully reviewed and updated.**

Ethical and legal issues

132. Some human rights groups and humanitarian organisations have questioned the legality of the use of armed remotely piloted air systems for combat operations. This section considers the ethical and legal issues pertaining to UK use of remotely piloted air systems: consideration of remotely piloted air system operations by other States is addressed only to the extent that it serves to highlight differences with the UK approach.

133. In its memorandum, the MoD discussed a number of ethical issues commonly raised in relation to the use of armed remotely piloted air systems, the most significant of which are discussed below.

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[85] European RPAS Steering Group, *Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System*, June 2013. Available at: http://ec.europa.eu/enterprise/sectors/aerospace/uas/index_en.htm

[86] Ev w126

Removal of a man in the loop

134. The Royal Aeronautical Society expressed the view that significant legal and ethical questions arise over the expanding use of military remotely piloted air systems, especially as technology enables their operation to become more autonomous. The MoD, however, rejected the perception held by some people that the removal of a pilot from the cockpit combined with distance from the "action" led to reduced situational awareness and impaired the judgement of remotely piloted air system aircrew. It argued that "the situational awareness offered by numerous information feeds into a HQ is greater than that of a pilot operating in isolation, potentially facilitating wiser judgement calls to be made" and pointed out that a conscious decision is still required to prosecute a target.[87]

Is the use of armed RPAS moral?

135. The MoD argued that the greater loiter-time of Reaper aircraft enabled crews to "exercise their judgement in a more measured way, free from the stresses of the combat zone or concerns about survivability", thus minimising the risk of civilian casualties and increasing confidence levels in target identification. In response to arguments from some quarters that distance from the battlefield introduced an emotional and possibly moral disengagement by Reaper aircrew, the MoD stated:

> It is true that Reaper crews do not face the same level of direct danger as crews of conventional aircraft. However crews are commonly assigned to Reaper operations for several years and may fly missions in Afghanistan over extended periods, rather than on the short deployments associated with conventional crews. Experience of Reaper shows that aircrew are fully immersed in the reality of combat, possibly to an even greater extent than operators of conventional-aircraft. The persistence offered results in crews observing the aftermath of their attacks: a sobering experience rarely shared by other pilots or artillerymen. Furthermore, viewing the battlefield indirectly through sensors or targeting systems is far from new or unique to Reaper operators.[88]

Will the UK allow autonomous release of weapons?

136. The MoD ruled out autonomous release of weapons from remotely piloted air systems:

> Current UK policy is that the operation of weapon systems will always be under human control and that no planned offensive systems are to have the capability to prosecute targets without involving a human. By retaining highly-trained and qualified aircrew at the heart of the decision making process, the UK ensures that the legal requirements governing the use of force during armed conflicts are observed. There are no plans to replace military pilots with fully autonomous systems.[89]

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[87] Ev w10, para 7.5

[88] Ev w10, para 7.5

[89] Ev w2

Threshold for intervention

137. Some commentators have raised the possibility that remote warfare might lower the threshold for Governments to intervene militarily because they are not putting their own troops at risk[90]. As there is limited evidence available at present it is not possible to reach a conclusion on this point in this report. However, the decision to undertake military action is never one that should be taken lightly. **It is important in maintaining the public acceptability of remotely piloted air systems that the perception cannot be allowed to develop that their increased use has in some way reduced the threshold for military intervention. We call on the MoD to set out how it intends to address this potential problem in its response to this report.**

International humanitarian law and international human rights law

138. The International Committee of the Red Cross considers that international humanitarian law (IHL) and international human rights law are two distinct but complementary bodies of law. IHL applies in situations of armed conflict while human rights law applies at all times, in peace and in war.[91]

> Both international humanitarian law and human rights law apply in armed conflicts. The main difference in their application is that international human rights law allows a State to suspend a number of human rights if it faces a situation of emergency. IHL cannot be suspended (except as provided in Article 5 to the Fourth Geneva Convention). [...]
>
> States have a legal duty to respect and implement both IHL and human rights law. Compliance with IHL requires a state to introduce national legislation to implement its obligations, to train its military and to bring to trial those in grave breach of such law. Human rights law also contains provisions requiring a State to take legislative and other appropriate measures to implement its rules and punish violations. [92]

139. Often referred to as the 'law of armed conflict', or the 'law of war', IHL is defined by the ICRC as:

> […] a set of rules which seek, for humanitarian reasons, to limit the effects of armed conflict. It protects persons who are not or are no longer participating in the hostilities and restricts the means and methods of warfare.[93]

140. The ICRC considered that human rights, being tailored primarily for peacetime, apply to everyone:

> Their principal goal is to protect individuals from arbitrary behaviour by their own governments. Human rights law does not deal with the conduct of hostilities.[94]

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[90] See for example: RUSI, *Hitting the target: How New Capabilities are Shaping International Intervention*. Whitehall Report 2-13. March 2013.

[91] International Committee of the Red Cross, "IHL and human rights law", 29 October 2010

[92] International Committee of the Red Cross, "IHL and human rights law", 29 October 2010

[93] International Committee of the Red Cross, "War and International Humanitarian Law"

The legality of UK remotely piloted air system operations

141. The ICRC, in a submission to our inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations,* stated that there was currently a lot of controversy about the legality of the extraterritorial use of force using remotely piloted air systems. It stated that "extraterritorial use of force by drones can be governed either by IHL or by international human rights law and the relevant domestic law, depending on whether the situation in which they are used amounts to an armed conflict or not". It concluded:

> It is important that this issue continue to be discussed and clarified among States. In the view of the ICRC there is no "one-size-fits-all" approach. The ICRC takes a case-by-case approach in determining which body of law is applicable to which situation of violence and, consequently, which rules have to be followed.[95]

142. Professor Steven Haines, Professor of Public International Law, University of Greenwich, in a submission to our inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations*, explained why remotely piloted aircraft were not in and of themselves unlawful:

> UAVs are, quite simply, aeroplanes. The fact that they are un-manned and remotely operated does not alter that basic fact in any way. Aeroplanes are not unlawful; UAVs are not, therefore, in and of themselves unlawful. UAVs operating exclusively for reconnaissance, data gathering and intelligence purposes are not weapons. It is only when a UAV is weaponised that it becomes a weapon and is required to be compliant with LOAC weapons law. Even then, as long as the weapon it is carrying is itself lawful (not subject to a ban under the Certain Conventional Weapons Convention, for example), the UAV will be compliant with the law. That is not to say that it cannot be operated in an unlawful manner or for unlawful purpose. All weapons can be put to unlawful purpose; UAVs are no different from other weapons in that respect.[96]

143. Public Interest Lawyers (PIL) submitted a legal opinion which concluded that "armed drones themselves are unlikely to be illegal *per se*, but that fully automated drones would breach international law". In respect of the question of the legality of the UK Government's use of armed remotely piloted air systems in Afghanistan, PIL concluded it was "highly likely" that the UK's use was unlawful:

> There is a strong probability that the UK has misdirected itself as to the requirements of the IHL principles of proportionality, distinction and humanity and as to its human rights obligation to protect human life and to investigate all deaths (civilians and combatants alike) arguably caused in breach of that obligation. We conclude that the European Court of Human Rights (ECHR) is capable of application to the

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[94] International Committee of the Red Cross, "IHL and human rights law", 29 October 2010

[95] ICRC, memorandum received in response to inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations.*

[96] Professor Steven Haines, memorandum received in response to inquiry into *UK Armed Forces Personnel and the Legal Framework for Future Operations.*

> UK's use of drones and that human rights accountability and the rule of law require its application. We call for urgent accountability for the UK's drones programme.[97]

144. The MoD insisted that the UK complied fully with all of its obligations under international humanitarian law irrespective of the weapons systems used:

> This includes those set out in Article 36 of Additional Protocol I to the Geneva Conventions to review all new weapons, means and methods of warfare to determine whether the employment would in some or all circumstances be prohibited by the Protocol or any other rule of international law. That process applies to UAS just as to manned capabilities. The UK is also a signatory to the Missile Technology Control Regime, which controls the proliferation of unmanned delivery systems. The weaponisation of Reaper was reviewed under this basis in accordance with all relevant domestic and international law before its introduction into service.[98]

145. The MoD memorandum stated that UK Rules of Engagement reflect international humanitarian law "following the principles of *distinction, humanity, proportionality* and *military necessity*" and are the same for Reaper as for manned aircraft.[99] It continued:

> The RAF has well-established command, control, supervisory, training and qualification frameworks for conducting air operations and makes full use of these structures to ensure Reaper are used in a legal and ethical manner.[100]

Transparency and accountability

146. The All Party Parliamentary Group on drones raised concerns about a lack of transparency and accountability about the use of remotely piloted air systems by the UK Government particularly in relation to:

- the poor recording of the status and numbers of those killed and injured in drone strikes;
- the limited consideration of the psychological impact of drones on operators and those living in affected areas; and
- the broader relationship between the achievement of the UK's military and diplomatic objectives and drone use.

147. The Association of Military Court Advocates submitted:

> The problem is not that UAVs are unlawful in themselves, but that their numbers, sophistication, relative cheapness and adaptability offer unparalleled opportunities for secrecy. If there are no independent arrangements for the scrutiny of deployment and targeting decisions, then there can be no means of ensuring compliance with the basic principles of proportionality and discrimination. Just as importantly for the

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[97] Ev w80, para 1.5

[98] Ev w9, para 7.2

[99] Ev w9, para 7.3

[100] Ev w9, para 7.4

major democracies, public support for hostilities is unlikely to be sustained unless there is a perception of *jus in bello* (law in war).[101]

Governance and oversight

148. The MoD provided us with details of UK governance and oversight arrangements for unmanned and remotely piloted air systems deployed on operations. It explained that all UK operations are authorised by Ministers and directed by the Chief of Defence Staff (CDS) in accordance with agreed plans. The chains of command for the tasking of UAS and RPAS in Afghanistan are summarised below:

Army Operated UAS (Hermes 450, Desert Hawk III, T Hawk, Black Hornet)
Full Command – Chief of the General Staff ↓ Operational Command – Chief of Joint Operations ↓ Operational Control – Commander Task Force Helmand
RAF Operated RPAS (REAPER)
Full Command – Chief of the Air Staff ↓ Operational Command – Chief of Joint Operations ↓ Operational Control – Commander ISAF ↓ Tactical Command – UK Air Component Commander

Source: Ministry of Defence[102]

149. Where operational control of UK remotely piloted air systems is assigned to a Coalition Commander, such as the Commander of ISAF, the MoD explained that that commander can only direct UK operations within the constraints of UK Rules of Engagement (ROE) and policy:

> A UK officer 'Red Card holder' is assigned to each ISAF HQ, with responsibility for coalition operations including the use of UK UAS, so that UK ROE and policy are strictly adhered to. Crews operating UAS receive training on a regular basis on domestic and international law concerning the use of force by UK forces in Afghanistan. Training includes the understanding of, and compliance with, UK ROE. In addition, UAS crews have access to legal advice and support during operations 24 hours a day, every day of the year (this includes the ability to talk with legal advisors and commanders by phone if required, an option not available to crews of manned aircraft).[103]

[101] Ev w31, para 44

[102] Definition of the command terms above can be found in Ministry of Defence, *Allied Joint Publication (AJP)-01(D): Allied Joint Doctrine.* Available at: https://www.gov.uk/government/publications/ajp-01-d-allied-joint-doctrine

[103] Ev w4, para 3.12

UN Special Rapporteur

150. UN Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism, Ben Emmerson QC, published in September 2013 an interim report to the UN General Assembly on the use of remotely piloted aircraft in counter-terrorism operations. The central objective of the Special Rapporteur's inquiry was to "evaluate allegations that the increasing use of remotely piloted aircraft has caused disproportionate civilian casualties, and to make recommendations concerning the duty of States to conduct independent and impartial investigations".[104]

151. Commenting on the accountability and transparency of strikes by remotely piloted aircraft, the UN Special Rapporteur's report stated:

> The single greatest obstacle to an evaluation of the civilian impact of drone strikes is lack of transparency, which makes it extremely difficult to assess claims of precision targeting objectively.[105]

152. In respect of operations conducted by the UK, the Special Rapporteur acknowledged that the RAF was accountable, through the MoD, to Parliament, which "allowed for a degree of transparency, including as to civilian casualties" although he noted that the MoD did not comment publicly on use of remotely piloted air systems for special operations. The report continued:

> The Ministry has informed the Special Rapporteur that, under operating procedures followed by the United Kingdom in Afghanistan, every remotely piloted aircraft weapons discharge is the subject of internal review involving the senior qualified weapons instructor. A mission report is prepared and is then reviewed by the most senior British officer at the Combined Air Operations Centre in Afghanistan and his or her legal adviser. This includes a review of video footage and communications reports. If there is any indication of civilian casualties, the incident is referred to the Joint Incident Assessment Team at ISAF, whose personnel are independent of the chain of command involved in any strike. Individuals are presumed to be civilian for this purpose unless it can be established that they were directly involved in immediate attempts or plans to threaten the lives of ISAF personnel.[106]

Targeting intelligence

153. The UN Special Rapporteur commented that "the accuracy of targeting intelligence is critical to the proper application of the principles of distinction, proportionality and precaution". He reported that the UK had informed him that during its operations in Afghanistan targeting intelligence was "thoroughly scrubbed" to ensure accuracy before authorisation to proceed was given.[107]

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[104] United Nations, *Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism*, A/68/389, 18 September 2013. Available at: http://unispal.un.org

[105] As above

[106] As above

[107] As above

154. Acknowledging that responsibility for drawing up a targeting directive and rules of engagement in any armed conflict rests with the MoD, the UN Special Rapporteur explained that the targeting directive set out legitimate targets (which may be individuals, groups or locations) and included a list of restricted and prohibited targets. The report concluded:

> the United Kingdom has specifically informed the Special Rapporteur that in making targeting decisions involving the use of remotely piloted aircraft in Afghanistan it does not authorize strikes on the basis that the infliction of civilian casualties would be proportionate to a high-value military target. It is the policy of the Ministry of Defence that weapons should not be discharged from any aerial platform unless there is a zero expectation of civilian casualties, and that any individual or location should be presumed to be civilian in nature unless there is clear evidence to the contrary.[108]

Special Rapporteur's conclusions

155. The Special Rapporteur concluded that if used in strict compliance with the principles of international humanitarian law, remotely piloted aircraft were capable of reducing the risk of civilian casualties in armed conflict by significantly improving the situational awareness of military commanders.[109]

156. In relation to the duty of States to protect civilians in armed conflict, the Special Rapporteur concluded:

> in any case in which civilians have been, or appear to have been, killed, the State responsible is under an obligation to conduct a prompt, independent and impartial fact-finding inquiry and to provide a detailed public explanation. This obligation is triggered whenever there is a plausible indication from any source that civilian casualties may have been sustained, including where the facts are unclear or the information is partial or circumstantial. The obligation arises whether the attack was initiated by remotely piloted aircraft or other means, and whether it occurred within or outside an area of active hostilities.[110]

157. **We welcome the report of the UN Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. We note that he has identified a number of legal questions on which there is no clear international consensus. We recommend that the UK Government engage actively in the debate on these matters and report on progress in its response to our report.**

Targeted killings

158. The greatest controversy and debate about the use of armed remotely piloted air systems has arisen not from ISAF military operations in Afghanistan, but rather due to

[108] United Nations, *Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism*, A/68/389, 18 September 2013. Available at: http://unispal.un.org

[109] As above

[110] As above

counter-terrorism operations conducted by the Central Intelligence Agency(CIA) and the US Joint Special Operations Command (JSOC) in other countries such as Pakistan, Yemen and Somalia. These so called "targeted killings" were only acknowledged publicly by President Obama and other US Administration officials in 2010.

159. In its submission to our inquiry, Reprieve, a legal charity, argued that the remotely piloted air system programmes of the UK and the US were closely intertwined. It alleged that the UK shared intelligence with the US "in order to support its programme of covert drone strikes, carried out by the CIA and Special Operations in Pakistan, Yemen and Somalia". Reprieve also alleged UK complicity in these operations because:

- The UK Government and UK companies provide communications networks without which the US would not be able to operate this programme;
- The US is able to make use of RPAS airframes belonging to the RAF;
- UK companies manufacture key drone components, and are allowed to export them to the US by the UK Department for Business.[111]

160. UN Special Rapporteur, Ben Emmerson QC, considered the principal areas of legal controversy surrounding the use of armed remotely piloted air systems. He expressly avoided use of the expression "targeted killing" because "its meaning and significance differ according to the legal regime applicable in specific factual circumstances", principally whether such a killing takes place within or outside a situation of armed conflict. In the conclusion to his interim report, the Special Rapporteur urged the United States to clarify its position on the legal and factual issues raised, including its publicly asserted right under international law to use lethal force in counter-terrorism operations outside areas of active hostilities. He also sought declassification of information relevant to its lethal extraterritorial counter-terrorism operations and the release by the US Government of its own data on the level of civilian casualties inflicted through the use of remotely piloted air systems, together with evaluation methodology.[112]

161. **We acknowledge that over the last few years there has been a growing concern in relation to the sharing of intelligence with allies and the uses to which such data may contribute. While the issues raised by Reprieve stray beyond the terms of reference for our inquiry and indeed the remit of the Defence Committee, we do believe that there should be greater transparency in relation to safeguards and limitations the UK Government has in place for the sharing of intelligence. Matters concerning the activities of the intelligence services are more appropriately addressed by the Intelligence and Security Committee of Parliament (ISC). We invite the ISC to consider in future work programmes the issues raised with us during this inquiry which fall within its remit.**

[111] Ev w117

[112] United Nations, *Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism*, A/68/389, 18 September 2013. Available at: http://unispal.un.org

162. **The licensing of arms exports and other controlled goods is a matter for the Committees on Arms Export Controls (CAEC). We will work with our colleagues on CAEC to ensure that this issue is given appropriate scrutiny.**

4 Conclusions

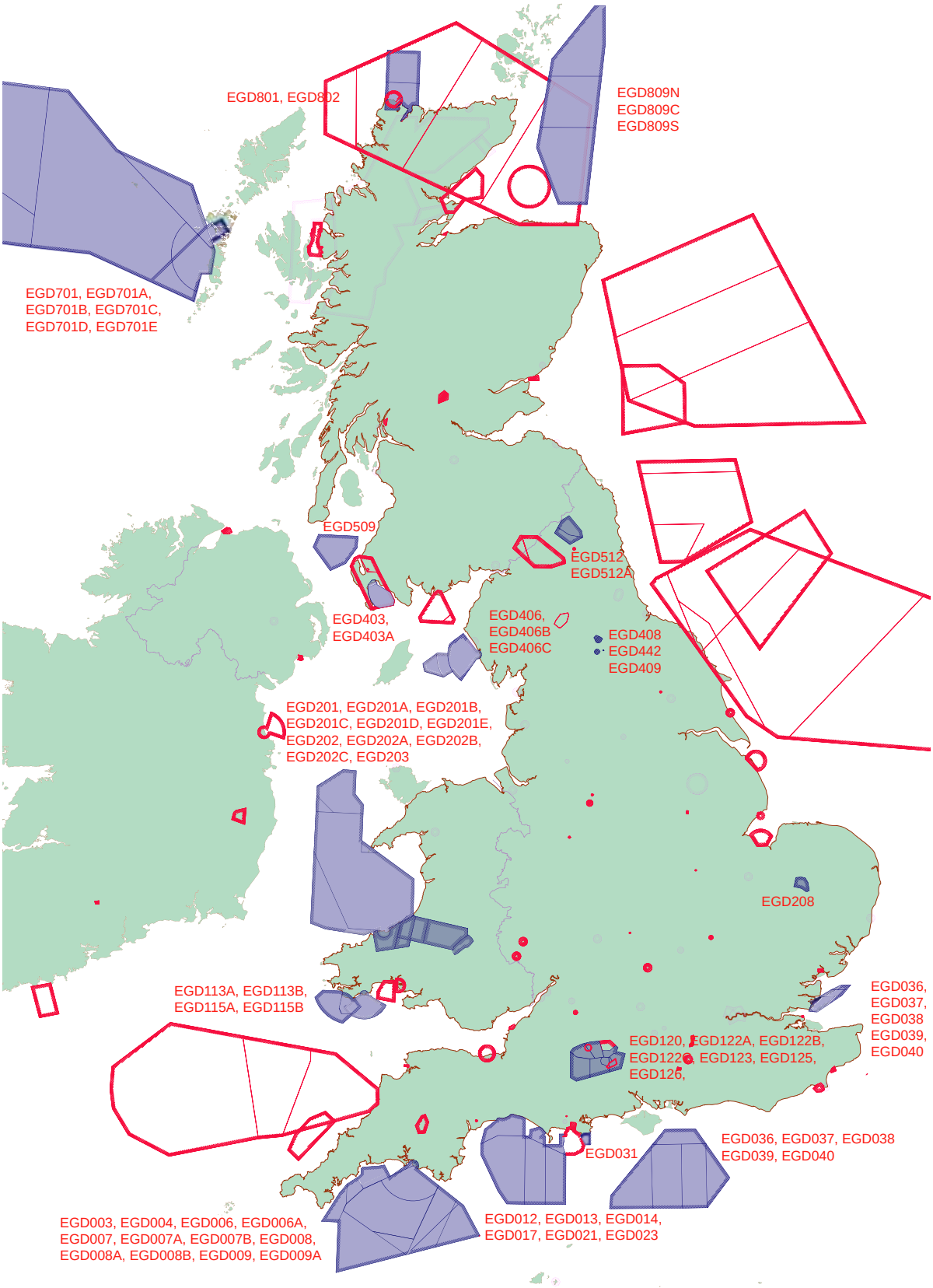
163. We acknowledge that a sense of public disquiet has grown in the UK regarding the increasing use of remotely piloted aircraft in military operations, fed in part by misunderstandings and misinformation. The UK use of armed remotely piloted air systems during operations in Afghanistan since 2008 has not been without controversy, in part because of questions about whether such operations comply with international law. This controversy has been further heightened as comparisons have been made with counter-terrorism operations conducted by the USA in other countries such as Pakistan, Yemen and Somalia. **We consider that it is of vital importance that a clear distinction be drawn between the actions of UK Armed Forces operating remotely piloted air systems in Afghanistan and those of other States elsewhere. On the basis of the evidence we have received we are satisfied that UK remotely piloted air system operations comply fully with international law.**

164. We welcome recent initiatives by the MoD to improve transparency surrounding remotely piloted air system operations, for example by allowing journalists to visit RAF Waddington. We believe that this will help to enhance understanding among the media and general public of this developing capability and help to counter many of the misconceptions about UK Reaper operations in particular. **We recommend that the MoD should continue its public awareness programme surrounding remotely piloted air system operations in order to aid public understanding and acceptance.**

165. We welcome the interim report of the UN Special Rapporteur on promotion and protection of human rights and fundamental freedoms while countering terrorism. This recognised the accountability of the Royal Air Force for remotely piloted aircraft operations, through the Ministry of Defence, to Parliament, and acknowledged that this allowed for a degree of transparency, including as to civilian casualties. We are satisfied that a robust system is in place to review every remotely piloted aircraft weapons discharge by a UK aircraft. However, we also understand the desire of some interested organisations and the public to see a greater degree of disclosure from the MoD. **We note the conclusion of the UN Special Rapporteur that in any case in which civilians have been, or appear to have been, killed, there is an obligation on the State responsible to conduct a prompt, independent and impartial fact-finding inquiry and to provide a detailed public explanation. We recognise that this is not a simple and straightforward request as to do so could seriously jeopardise continuing operations. Nonetheless, we recommend that, to the extent that it is operationally secure to do so, following an event which has resulted in confirmed civilian casualties the MoD should seek to publish details about the incident and any lessons learned from the review process.**

166. **The rapid development of remotely piloted air system capabilities by the UK Armed Forces over the past decade has contributed greatly to the effectiveness of military operations in Iraq and Afghanistan. The provision of enhanced intelligence, surveillance and reconnaissance support to our troops on the ground has undoubtedly saved lives and prevented casualties. With the final withdrawal of forces from Afghanistan now rapidly approaching, MoD thinking must turn to the future for the UK's existing remotely piloted air systems. We consider it to be a key capability which must continue to be supported. We expect future development, in partnership with allies, to form an important strand of the SDSR 2015 equipment programme.**

Annex A: Map of MOD Reserved Air Space where Remotely Piloted Air Systems may be operated



Annex B: Nomenclature

Modern definitions of unmanned aircraft system terminology can be found in:

- Civil Aviation Authority: *Cap 722 Unmanned Aircraft Systems Operations in UK Airspace - Guidance*[113]
- Military Aviation Authority: *MAA02: Military Aviation Authority Master Glossary*[114]
- Ministry of Defence: *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11* (JDN 2/11)[115]

In addition, the nomenclature employed by the International Civil Aviation Organisation (ICAO) and the European Aviation Safety Agency (EASA) provides a legally binding series of definitions.

[113] CAP 722 Unmanned Aircraft System Operations in UK Airspace – Guidance, Civil Aviation Authority, August 2012. Available at: http://www.caa.co.uk/docs/33/CAP722.pdf

[114] MAA02: Military Aviation Authority Master Glossary, Military Aviation Authority, Issue 4, August 2013. Available at: http://www.maa.mod.uk/regulation/about_policy.htm

[115] Ministry of Defence, *The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11* (JDN 2/11), March 2011. Available at: https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems

Abbreviations and glossary of terms used in the report

Term	Abbreviation	Definition
Air Navigation Order	ANO	
Aircraft Operating Authority	AOA	The Aircraft Operating Authority shall be any one of: a. The military commander of a discrete organisation empowered by a Letter of Delegation from the Secretary of State through the Chiefs of Staff to operate specified types of UK Military Aircraft. AoA is a command chain function, or b. The Chief Executive of a MoD agency empowered by a Letter of Delegation from the Secretary of State through the Chiefs of Staff to operate specified types of UK Military Aircraft, or c. The Chief Executive of a commercial company granted approval by the MoD regulator to operate specific types of UK Military Aircraft.
Beyond (Visual) Line of Sight (CAA)	BLOS (BVLOS)	Operation of a UA beyond a distance where the Remote Pilot is able to respond to or avoid other airspace users by visual means.
Command and Control	C2	
Command and Control Link	C2 Link	The data link between the remotely-piloted aircraft and the remote pilot station for the purposes of managing the flight.
Department for International Development	DfID	
Department for Transport	DfT	
Detect and Avoid		The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action.
European Aviation Safety Agency	EASA	
Electro-magnetic Environment	EME	
Ground Control Station	GCS	See Remote Pilot Station
High Altitude Long Endurance (MoD)	HALE	Example platforms include: Global Hawk
Improvised Explosive Device	IED	
International Civil Aviation Organisation	ICAO	
International Security Assistance Force	ISAF	

Intelligence, Surveillance, and Reconnaissance	ISR	
Intelligence, Surveillance, Target Acquisition, and Reconnaissance	ISTAR	
Joint Authorities for Rulemaking on Unmanned Systems	JARUS	Expert group of National Aviation Authorities (NAAs) and regional aviation safety organisations.
(Visual) Line of Sight (CAA)	LOS (VLOS)	Operating within Visual Line of Sight means that the Remote Pilot is able to maintain direct, unaided (other than corrective lenses) visual contact with the UA which is sufficient to monitor its flight path in relation to other aircraft, persons, vessels, vehicles and structures for the purpose of avoiding collisions.
Low Observable	LO	Low-observable (stealthy) through passive or active signature reduction techniques.
Medium Altitude Long Endurance (MoD)	MALE	Example platforms include: Reaper, Heron, Hermes 900.
Ministry of Defence	MoD	
Remote Pilot		A person charged by the operator with duties essential to the operation of a remotely-piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.
Remotely Piloted Aircraft	RPA	An unmanned aircraft which is piloted from a remote pilot station.
Remotely Piloted Air(craft) System (MAA)	RPAS	An unmanned air system includes a number of elements such as the ground-based control unit, ground-launch system and the Remotely Piloted Air Vehicle (RPAV) and all associated flight safety critical elements.
Remotely Piloted Air Vehicle (MAA)	RPAV	A RPAV is defined as an aircraft which does not carry personnel and: a. Is capable of sustained flight by aerodynamic means. b. Is remotely piloted or automatically flies a pre-programmed flight profile. c. Is reusable. d. Is not classified as a guided weapon or similar one shot device designed for the delivery of munitions.
Remote Pilot Station	RPS	The component of the remotely-piloted aircraft system containing the equipment used to pilot the remotely-piloted aircraft.
Sense and Avoid		See 'Detect and Avoid'

Unmanned Aircraft (CAA)	UA	An aircraft which is intended to operate with no human pilot on board, as part of an Unmanned Aircraft System. Moreover a UA: is capable of sustained flight by aerodynamic means; is remotely piloted or capable of autonomous operation; is reusable; and is not classified as a guided weapon or similar one-shot device designed for the delivery of munitions. *Note: RPA is considered a subset of UA.*
Unmanned Air(craft) System(s) (MAA)	UAS	Obsolete: An unmanned air system includes a number of elements such as the ground-based control unit, ground-launch system and the Remotely Piloted Air Vehicle (RPAV) and all associated flight safety-critical elements. See: Remotely Piloted Air System
Unmanned Air Vehicle (MAA)	UAV	Obsolete: A UAV is defined as an aircraft which does not carry personnel and: a. Is capable of sustained flight by aerodynamic means. b. Is remotely piloted or automatically flies a pre-programmed flight profile. c. Is reusable. d. Is not classified as a guided weapon or similar one shot device designed for the delivery of munitions. See: Remotely Piloted Air Vehicle
Unmanned Combat Air System	UCAS	A class of RPA with low-observable (stealth) design making it suitable for applications in high threat environments.
United States Air Force	USAF	

Sources: *Civil Aviation Authority – CAP 722 Unmanned Aircraft System Operations in UK Airspace – Guidance*

Military Aviation Authority – MAA02: Master Glossary

Ministry of Defence – The UK Approach To Unmanned Aircraft Systems Joint Doctrine Note 2/11 (JDN 2/11)

Formal Minutes

Wednesday 5 March 2014

Members present:

Mr James Arbuthnot, in the Chair

Mr Julian Brazier	Madeleine Moon
Jeffrey Donaldson	Sir Bob Russell
Mr James Gray	Bob Stewart
Mr Dai Havard	John Woodcock

Draft Report (*Remote Control: Remotely Piloted Air Systems – current and future UK use*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 166 read and agreed to.

Annexes agreed to.

Resolved, That the Report be the Tenth Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

[Adjourned till Tuesday 11 March 2014 at 2.00p.m.

List of written evidence

(published in Volume II on the Committee's website www.parliament.uk/defcom)

1	Ministry of Defence	Ev w1
2	Royal United Services Institute (RUSI)	Ev w11
3	The Baptist Union of Great Britain, The Methodist Church and The United Reform Church	Ev w14
4	Thales UK	Ev w20
5	ADS	Ev w24
6	James Earle on behalf of the Association of Military Court Advocates	Ev w26
7	Bureau of Investigative Journalism	Ev w31
8	Network for Social Change	Ev w37
9	Northrop Grumman Corporation (NGC)	Ev w40
10	Dr David Goldberg	Ev w46
11	Drone Wars UK	Ev w50
12	Royal Aeronautical Society	Ev w51
13	Defence Synergia	Ev w56
14	Research Councils UK (RCUK)	Ev w60
15	All Party Parliamentary Group on drones	Ev w70
16	Public Interest Lawyers on behalf of Peacerights	Ev w79
17	General Atomics Aeronautical Systems, Inc. (GA-ASI) and General Atomics Aeronautical Systems United Kingdom Ltd (GA-UK)	Ev w99
18	Stefan Wolff, Professor of International Security, University of Birmingham	Ev w107
19	MBDA UK Ltd	Ev w117
20	Reprieve	Ev w117
21	Professor Nicholas Wheeler, Institute for Conflict, Co-operation and Security, University of Birmingham	Ev w124

List of Reports from the Committee in Session 2013–14

The reference number of the Government's response to each Report is printed in brackets after the HC printing number.

Session 2013–14

First Report	MoD Supplementary Estimate 2012–13	HC 291 (HC 644)
Second Report	Ministry of Defence Main Estimates 2013–14	HC 517 (HC 670)
Third Report and First Joint Report	Scrutiny of Arms Exports and Arms Control (2013): Scrutiny of the Government's UK Strategic Export Controls Annual Report 2011 published in July 2012, the Government's Quarterly Reports from October 2011 to September 2012, and the Government's policies on arms exports and international arms control issues	HC 205 (Cm 8707)
Fourth Report	The Armed Forces Covenant in Action? Part 3: Educating the Children of Service Personnel	HC 586 (HC 771)
Fifth Report	The Armed Forces Covenant in Action? Part 4: Education of Service Personnel	HC 185 (HC 759)
Sixth Report	The Defence Implications of Possible Scottish Independence	HC 198 (HC 839)
Seventh Report	Toward the Next Defence and Security Review: Part One	HC 197
Eighth Report	Ministry of Defence Annual Report and Accounts 2012–13	HC 653
Ninth Report	Future Army 2020	HC 576