An overview of US-UK co-operation on armed drone operations
Drone Wars UK is a small British NGO established in 2010 to undertake research and advocacy around the use of armed drones. We believe that the growing use of remotely-controlled, armed unmanned systems is encouraging and enabling a lowering of the threshold for the use of lethal force as well as eroding well established human rights norms. While some argue that the technology itself is neutral, we believe that drones are a danger to global peace and security. We have seen over the past decade that once these systems are in the armoury, the temptation to use them becomes great, even beyond the constraints of international law. As more countries develop or acquire this technology, the danger to global peace and security grows.

Note: The term ‘drone’ is used interchangeably with ‘Unmanned Aerial Vehicle (UAV)’

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CONTENTS

Executive Summary 2

1 Introduction 4

2 UK armed drone operations – a brief timeline 6

3 Operations 8
   3.1 Beginnings
   3.2 Afghanistan
   3.3 Iraq and Syria
   3.4 Targeted Killing Operations
   3.5 Embedding
   3.6 Command and Control of Air Operations

4 Infrastructure 22
   4.1 Intelligence Sharing
   4.2 Satellites and communication networks
   4.3 Launch and recovery and on-base maintenance
   4.4 Contractors
   4.5 Key bases
   4.6 Maintenance, training and contractual arrangements

5 Conclusion 45

6 List of Acronyms 47

Appendix 48
   1 Expert informants
   2 Selected examples of cases where RAF Reaper drones have supported other coalition aircraft in conducting strikes in Iraq and Syria
   3 Contracts awarded by the US government and won by American companies for support to the Royal Air Force Reaper programme
EXECUTIVE SUMMARY

• Britain’s armed Reaper drone programme evolved directly from the United States Air Force Predator drone programme and as a result the Royal Air Force works extremely closely with the USAF on its drone operations. Harmonisation of equipment and concepts of operation, interoperability, and a single centre of command and control help to tie the UK into ‘coalition’ wars led by the US.

• Perhaps because of this close joint working, the UK is often extremely reluctant to discuss many aspects of its Reaper programme, particularly the ways in which it relies on the US for UK Reaper operations. Over the course of the 18 months we spent investigating US-UK joint working in this area, we repeatedly hit a brick wall in terms of those willing to discuss and share information.

• RAF Reaper drones have flown alongside US drones in wars in Afghanistan, Iraq, and Syria, and have participated in the targeted killing of British ISIS fighters. The controversial nature of drone operations raises significant questions about aspects of US-UK co-operation, particularly joint operations, the use of shared intelligence and the use of British bases to support US drone operations.

• RAF and USAF drone operations are closely intertwined in a number of respects. For example, embedded aircrew from the RAF undertake tours of duty with the air forces of allied nations to share skills and tactics. A number of RAF Reaper personnel are embedded with the US Air Force’s 432nd Wing which flies Reaper drones. Embedded RAF pilots follow the host air force’s chain of command but are meant to follow UK rules of engagement and UK law. As well as participating in embedding and exchange arrangements, British and American Reaper aircrews cooperate closely with each other in combat situations, for example by ‘buddy lasing’, that is highlighting targets by means of a laser, for the other nations drones to strike.

• Although Ministers have regularly stated that the US does not operate drones from the UK, evidence indicates that certain US military bases in the UK are significantly involved in activities which support US drone operations, notably intelligence gathering and sharing and intelligence analysis.
Evidence suggests that RAF Reaper drones currently use the US satellite systems at Ramstein airbase in Germany for communication with RAF Reaper drones and buy ‘airtime’ from commercial satellite service providers such as Inmarsat. While it was thought that communications and control of RAF Reaper drones in the Middle East was through the UK’s Skynet satellite system, the MoD told us the two systems use different wavebands.

The UK is in the process of acquiring the latest version of the Predator drone, which the UK is calling the Protector. This system will be able to use Skynet satellite systems and information we have obtained indicates that it will also use the UK’s own satellite ground systems at Oakhanger, Hampshire and Colerne in Wiltshire.

Reaper and the new Protector drone are built by the American company General Atomics Aeronautical Systems Inc, which ultimately means that the RAF is dependent upon General Atomics for the supply and, to large extent, maintenance of the system. Much of the training for RAF crews also takes place as part of the Foreign Military Sales package through which the Ministry of Defence has purchased Reaper from the US government.

MoD should address concerns about issues arising from collaboration with the US, and demonstrate its commitment to being a responsible drone operator, by increasing the transparency of its drone operations, logistics, and procurement processes. This would provide evidence to demonstrate that the UK is operating an independent military drone programme which complies with international law.
INTRODUCTION

The UK co-operates with the US on a broad range of military and foreign policy initiatives, and perhaps not surprisingly, many of these are sensitive in nature. Even so, in undertaking the research which underlies this report – to document the scope of cooperation between the US and the UK on the Royal Air Forces’ Reaper drone operations – we were surprised at the high level of reticence to even talk about the subject among those ‘in the know’. A representative from the Ministry of Defence (MoD), for example, who had initially agreed to speak to us, pulled out and offered apologies after we’d sent a list of topics we wanted to discuss. A retired RAF officer who had worked on the Reaper programme told us directly that “this gets a little too close to areas that I won’t speak about”, while requests for interviews with other insiders who have spoken publicly about Reaper operations went unanswered.

Despite such difficulties however, this report gives a detailed overview of:

• how the US supports UK armed drone operations;
• how the US and UK have worked together in coalition to undertake drone surveillance and strike operations, both in South-East Asia and the Middle East;
• the realities of interoperation between the RAF and the USAF;
• and the reliance between the two nations on shared bases and technology.

Britain’s armed Reaper drone programme evolved directly from the United States Air Force (USAF) Predator drone programme. During its first years, the RAF Reaper was little more than an offshoot from the USAF programme, and was heavily reliant on American infrastructure and technology. Although the RAF’s Reaper programme is a fraction of the size of the USAF’s’, over the past decade and a half the UK’s programme has ‘grown up’, and become somewhat more independent – and is likely to take on even more of its own flavour when the RAF’s new ‘Protector’ drones begin to be delivered in the mid-2020s. Nevertheless, the UK’s armed drone programme is still heavily intertwined with the US’ and significant questions about aspects of US-UK co-operation over these operations remain, notably operational working, intelligence sharing and how shared intelligence may be used in selecting targets, as well as the use of British bases to support the US drone operations.

As joint operations and command and control arrangements can blur accountability and reduce the transparency of the UK’s military action these are significant issues. On the international stage, many concerns have been raised about the US drone programme and in particular with the legality of the US’ covert drone assassination programme, its lack of transparency, and reports that it has resulted in the deaths of hundreds of civilians. Indeed, the UN has warned that it may violate international law. While the UK – and the RAF in particular – is keen to be seen as a responsible operator of armed drones, its joint working with the US inevitably means that UK operations and involvement with the US deserve proper scrutiny.

This report has been written using a variety of public as well as defence and security sources and interviews with those who have a detailed understanding of the UK’s Reaper drone programme (see Appendix 1). Drone Wars has long argued that many of the legal and ethical issues which arise from armed drone operations can only be examined and answered by having a greater understanding of their day-to-day use. We hope this report shines some much-needed light on US-UK drone operations.
**UK ARMED DRONE OPERATIONS – A BRIEF TIMELINE**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2005</td>
<td>October: Ministry of Defence signed a joint order for US MQ-1 Predator drones.</td>
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<tr>
<td>2006</td>
<td>February: MoD reveals that a US MQ-1 Predator drone was shot down over Afghanistan.</td>
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<tr>
<td>2007</td>
<td>January: RAF 39 Squadron reformed to operate Reaper drones from Creech Air Force Base in the US.</td>
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<tr>
<td>2008</td>
<td>April: First RAF Reaper strike in Iraq takes place.</td>
</tr>
<tr>
<td>2009</td>
<td>November: First RAF Reaper fires a weapon for the first time in Afghanistan.</td>
</tr>
<tr>
<td>2010</td>
<td>December: First RAF Reaper flight takes place in Afghanistan.</td>
</tr>
<tr>
<td>2011</td>
<td>April: RAF Reapers receive a new operational capability.</td>
</tr>
<tr>
<td>2012</td>
<td>October: Ministry of Defence announces the UK will deploy RAF Reapers for operations in Iraq against ISIS. First RAF Reaper flight in Iraq takes place.</td>
</tr>
<tr>
<td>2013</td>
<td>September: RAF 13 Squadron reformed to operate from RAF Waddington.</td>
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<tr>
<td>2014</td>
<td>February: MoD reveals that RAF Reapers were not deployed from Afghanistan for operations in Iraq against ISIS. First RAF Reaper flight in Iraq takes place.</td>
</tr>
<tr>
<td>2015</td>
<td>November: RAF Reapers begin armed flights in Afghanistan.</td>
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<tr>
<td>2016</td>
<td>December: RAF Reapers begin armed flights in Iraq.</td>
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<td>2017</td>
<td>August: Cardiff-born Reyaad Khan was assassinated in a UK Reaper strike in Syria.</td>
</tr>
<tr>
<td>2018</td>
<td>February: MoD reveals that RAF Reapers were not deployed from Afghanistan for operations in Iraq against ISIS. First RAF Reaper flight in Iraq takes place.</td>
</tr>
<tr>
<td>2019</td>
<td>December: Royal Air Force announces UK Reapers have reached 100,000 flight hours milestone.</td>
</tr>
<tr>
<td>2020</td>
<td>October: David Cameron announces the UK will double the number of armed drones in its inventory through purchasing a new version of the Reaper.</td>
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8. Craig Hoyle: ‘RAF Reaper fires a weapon for the first time in Afghanistan’. [https://www.raf.mod.uk/aircraft/mq-9a-reaper/](http://www.raf.mod.uk/aircraft/mq-9a-reaper/)
15. Iraq/Syria/UK, Drone Operations against ISIS: ep:op cit
3.1 Beginnings

RAF pilots first began operating armed Predator drones in 2004 as part of a newly formed USAF/RAF Combined Joint Predator Task Force (CJPTF) based at the Indian Springs Air Force Base (now Creech Air Force Base) in Nevada, undertaking missions in Iraq as part of Operation Telic.\(^2^3\) This was seen to be to the advantage of both nations, as at the time the USAF itself had a limited number of trained Predator pilots available for operational duties, while the UK had limited experience of operating such aircraft.\(^2^4\)

The UK acquired its own armed drone capability after procuring three US Reaper unmanned aerial vehicles under urgent operational requirement rules in October 2006. The RAF’s first Reaper Squadron, 39 Squadron, was set up in January 2007 and UK Reaper operations began in Afghanistan in October 2007, following which the CJPTF was gradually wound down. Additional Reapers were purchased bringing the number of Reapers owned by the UK up to five and eventually, in July 2014, to ten.\(^2^5\)

Over much of this early period, RAF pilots also flew US Reaper drones on a regular basis. According to then defence minister Philip Hammond, the RAF operated a “combined fleet with the US”, with “US aircraft backfilling for the unavailability of UK remotely piloted aircraft.”\(^2^6\)

Arrangements for shared operations between the two air forces were set out in a Memorandum of Understanding (MoU) covering Reaper operations in the US CENTCOM area of responsibility (the Middle East and Central Asia).\(^2^7\) A copy of the Memorandum was provided to the All Party Parliamentary Group on Drones (APPG Drones) for its 2018 investigation into the UK’s use of armed drones. The MoU specifies that when operating US drones, “RAF personnel at all times are to

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\(^{23}\) Craig Hoyle, op cit.

\(^{24}\) Information from expert informant 2.


https://publications.parliament.uk/pa/cm201314/cmhansrd/cm140210/debtext/140210-0002.htm#140210-0002.htm_spnew17

\(^{27}\) ‘Memorandum of Understanding between the Department of Defense of the United States of America as represented by the United States Air Force (USAF) and the Ministry of Defence of the United Kingdom of Great Britain and Northern Ireland as represented by the Royal Air Force (RAF) regarding USAF and RAF personnel conducting Launch and Recovery Element (LRE) and performing Mission Control Element (MCE) operations in the US CENTCOM AOR on MQ-9 Reapers.’
http://appgdrones.org.uk/memorandum-of-understanding-usaf-raf/
comply with the mutually determined aspects of the participants’ ROE [rules of engagement] and Targeting Directives.\textsuperscript{28}

3.2 Afghanistan

Along with other UK military forces, the Royal Air Force participated in Operation Enduring Freedom – the US-led invasion of Afghanistan in 2001 – and subsequently contributed to NATO’s International Security Assistance Force (ISAF) mission in Afghanistan. The RAF’s use of armed drones dates back to January 2004, when 44 personnel from 1115 Flight began operating US Air Force Predator drones in Iraq and Afghanistan as part of the Combined Joint Predator Task Force (CJPTF). This steeped UK personnel in US Predator operations, building up what Air Chief Marshal Jock Stirrup described as “a reservoir of UAV experience within the RAF on which we intend to capitalise in years to come.”\textsuperscript{29}

As the next step in the development of the RAF’s own Reaper programme, RAF Reaper crews began training with the USAF’s 42nd Attack Squadron in October 2006 as preparation for launching their own stand-alone operations.\textsuperscript{30}

39 Squadron was reformed in January 2007 to fly the RAF’s own Reaper drones remotely from Creech Air Force base as part of the USAF 432nd Wing, with the aircraft based at Kandahar Airfield in Afghanistan and launched and recovered by personnel deployed there.\textsuperscript{31} Although the Squadron’s pilots were qualified aircrew, it initially comprised of personnel from all three-armed services, with mission intelligence co-ordinator roles undertaken by crew from the Army and Royal Navy.\textsuperscript{32} At the same time, CJPTF operations were gradually wound down.

\textsuperscript{28} Ibid., Paragraph 2.3.3, page 3.
\textsuperscript{30} Craig Hoyle: ‘UK cheers the Reaper UAV’, op cit.
\textsuperscript{32} Ministry of Defence: ‘RAF Reaper fires weapons for the first time’, op cit.
Three drones and two ground control stations were initially purchased through a two-year urgent operational requirement, although one of the drones was lost in a crash in April 2008. The final five aircraft, ordered in December 2010, eventually entered service in July 2014, just four months before the last RAF Reaper flight in Afghanistan. In the period before the five new Reapers entered service RAF pilots were granted the use of US aircraft to cover the shortage of their own aircraft. Although details are sketchy, a Freedom of Information Act request to the Ministry of Defence revealed that between 2006 and 2012 UK personnel flew a US Reaper drone on 271 missions when a UK aircraft was unavailable. During these missions in Afghanistan UK personnel released 39 weapons. According to a response to a parliamentary question in late 2014, by the end of operations in Afghanistan, the RAF had borrowed US Reapers more than 500 times (see Table 1).

Table 1 Number of UK Reaper sorties undertaken using a USAF aircraft in Afghanistan, 2008–14

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of UK Sorties utilising a USAF Air Vehicle</th>
</tr>
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<tbody>
<tr>
<td>2008</td>
<td>2</td>
</tr>
<tr>
<td>2009</td>
<td>21</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>64</td>
</tr>
<tr>
<td>2012</td>
<td>180</td>
</tr>
<tr>
<td>2013</td>
<td>56</td>
</tr>
<tr>
<td>2014 (Jan-Aug inclusive)</td>
<td>192</td>
</tr>
</tbody>
</table>

While the agreement allows the US Air Force to request the use of a UK Reaper airframe, the government has repeated in responses to various parliamentary questions that outside of the launch and recovery phase, UK Reapers have always been operated by UK pilots. “I have never heard of a US pilot flying a UK Reaper” said one of our informants, going on to point out that the Ground Control Station container used by the RAF has a different layout to those used by the US Air Force, being set up for a crew of three rather than a crew of two.

During the war in Afghanistan, the RAF promoted Reaper’s role in public statements as providing a persistent intelligence, surveillance, and reconnaissance.

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33 Craig Hoyle: op cit.
34 Craig Hoyle: op cit.
40 Information from expert informant 3.
capability. In this capacity the aircraft was used to gather information for ‘pattern of life’ analysis in areas of interest and provide ‘overwatch’ duties to support coalition land forces. However, the drone also provided an armed strike capability for the units it was supporting, attacking ‘pop-up’ targets as well as tracking and conducting strikes against targets identified during surveillance missions and conducting opportunistic strikes against insurgents caught launching attacks as the aircraft returned to Kandahar.

However, while the MoD regularly spoke publicly about UK Reaper drones undertaking surveillance to protect UK troops in Helmand province and downplayed the role of Reaper’s strike role, statistics gathered by Drone Wars subsequently showed a very different picture.

While details of where UK Reaper drones were actually operating in Afghanistan were refused at the time, subsequent information released by the Ministry of Defence under the Freedom of Information Act revealed that RAF Reaper strikes occurred in 16 out of Afghanistan’s 33 provinces, covering the whole of the southern part of the country, over the period that the drones were deployed in Afghanistan. The drones were not flown only to cover Britain’s area of responsibility in Helmand province, but to engage in operations across ISAF’s whole area of command.

**UK drones launched strikes in many provinces across Afghanistan, not just in Helmand where UK forces were located**

1 Herat  
2 Farah  
3 Nimruz  
4 Ghor  
5 Helmand  
6 Daykundi  
7 Urozgan  
8 Kandahar  
9 Zabul  
10 Ghazni  
11 Maidan Wardak  
12 Logar  
13 Paktia  
14 Paktika  
15 Laghman  
16 Kunar

42 Information from expert informant 2.  
In addition, when statistics were examined, a clear picture emerged of the extent of Reaper strikes. At certain periods, Reaper drones were launching 80% of weapons fired by UK fixed wing aircraft. Overall, Reapers fired 510 weapons in Afghanistan while Harriers launched 355 and Tornados 142.

RAF operations in Afghanistan ended in late 2014, at which point Reaper aircraft commenced operations in Iraq as part of Operation Shader.

3.3 Iraq and Syria

The UK’s Reapers had originally been scheduled to leave service in 2015, but have since been heavily committed to Operation Shader – the UK’s contribution to the US-led war against ISIS in Iraq and Syria.

The RAF commenced surveillance and aerial refuelling operations in Iraq in August 2014 following the Iraqi government’s declaration of a state of emergency after ISIS forces occupied the city of Mosul. Following the release by ISIS of videos showing the execution of Western hostages, operations were extended to include air strikes following a vote in Parliament on 26 September 2014. In August 2013 Parliament had voted against taking military action in Syria, and the 2014 motion approved by Parliament argued that a request for military assistance from the Iraqi government gave a legal basis for such action in Iraq, although not in Syria.

Despite this, and the lack of any mandate in the form of a United Nations Security Council resolution or request for assistance from the Syrian government, Operation Shader rapidly began to include missions in Syria. Within six weeks of the September 2014 parliamentary vote, British drones were crossing the border into Syria, gathering intelligence to allow other Coalition forces to conduct air strikes in Syria. Although Ministers stated on several occasions that these flights were unarmèd, the MoD later admitted that this was not the case and that all RAF drone flights into Syria were armed. It was also revealed that UK aircrew embedded with coalition allies’ forces had been conducting air strikes over Syria against ISIS. About 20 personnel, including three pilots, had been embedded with other coalition nations’ forces, including the US and Canada, and had participated in attacks while in this role.

Finally, in September 2015 Prime Minister David Cameron announced that British-born ISIS fighter Reyaad Khan had been assassinated in a UK Reaper strike in Syria, although claiming that the operation to kill Khan was not part of coalition military action against ISIS.

From mid-2015, ministers began arguing that UK forces should undertake air strikes against ISIS in Syria as well as Iraq, with Defence Secretary Michael Fallon arguing that it was “an illogicality” not to do so. Parliament eventually voted in

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Reaper strikes during Operation Shader took place at a much higher intensity - almost twice the number - than during the war in Afghanistan, with 974 weapons being launched from Reaper drones in Iraq and Syria over the period 2014–2019 compared with 510 weapon launches in Afghanistan over the period 2008–2014.\footnote{Drone Wars UK: ‘UK Drone Strike Stats’. https://dronewars.net/uk-drone-strike-list-2/} At the time of writing the Ministry of Defence claims RAF air strikes have killed 3,964 ISIS fighters and injured 298, with only one civilian killed as a result of its air operations.\footnote{Note that the figures relate to strikes from crewed aircraft as well as Reaper drones.} The low claim for numbers of civilian casualties has been the subject of some controversy, with independent monitoring group Airwars critiquing the MoD’s methods of undertaking post-strike casualty assessments\footnote{Samuel Oakford: ‘Credibility Gap: United Kingdom civilian harm assessments for the battles of Mosul and Raqqa’. Airwars, September 2019. https://airwars.org/wp-content/uploads/2018/09/UK-Inquiry-into-Mosul-and-Raqqa-2018.pdf} and the USAF reporting evidence that civilians were killed during three RAF air strikes in Iraq and Syria\footnote{Jonathan Beale: ‘Islamic State: US military says RAF airstrikes may have killed civilians’. BBC News, 16 March 2020. https://www.bbc.co.uk/news/uk-51900898 Airwars, 17 March 2020. https://twitter.com/airwars/status/1239861824117489664}. In a 2018 interview with Drone Wars UK, former Deputy Commander Operations at RAF Air Command, Air Marshal Greg Bagwell, said "I don't think it is credible to the average listener that we have not caused any civilian casualties just because you have got no evidence to the contrary."\footnote{‘Interview of Air Marshall Greg Bagwell by Chris Cole, Drone Wars UK’. Drone Wars UK, 8 January 2018. https://dronewars.net/interview-of-air-marshall-greg-bagwell-drone-wars-uk/}

From December 2018 onwards there was a marked decline in UK aircraft and drone strikes in Iraq and Syria,\footnote{Chris Cole: ‘UK ops in Iraq and Syria: Reaper drones likely to play an increasing part says senior RAF officer’. Drone Wars UK, 9 May 2019. https://dronewars.net/2019/05/09/uk-ops-in-iraq-and-syria-reaper-drones-likely-to-take-an-increasing-part-says-senior-raf-officer/} with strikes ceasing altogether (at the time of writing) from September 2019.\footnote{Dan Sabbagh: ‘UK’s air war against Isis ends after five years’. Guardian, 16 March 2020. https://www.theguardian.com/world/2020/mar/16/uk-air-war-isis-ends-five-years} The Ministry of Defence acknowledged that RAF Reaper aircraft flew on operations other than those which were part of Operation Shader in 2019, but has refused to provide further details of those missions.\footnote{Deborah Haynes: ‘RAF ready to withdraw as Isis battle enters endgame’. The Times, 4 November 2017. https://www.thetimes.co.uk/article/raf-ready-to-withdraw-as-isis-battle-enters-endgame-j73b02v} Senior RAF staff have indicated that Reaper drones and other surveillance aircraft will continue to fly over Iraq and Syria to help local forces guard against the return of ISIS militias.\footnote{3.4 Targeted Killing Operations

The use of drones to carry out targeted killings from a distance is one of the most controversial aspects of drone warfare. The US has repeatedly used armed drones to carry out such killings in Pakistan, Yemen and elsewhere since 2004. While not outrightly condemning such operations, the UK government distanced itself from the practise and insisted it would not use its drones for such operations.}
However, in a high-profile statement to Parliament in September 2015, then Prime Minister David Cameron announced that two British citizens fighting for ISIS had been killed in Syria by a strike conducted by an RAF Reaper drone. The two, Reyaad Khan and Ruhul Amin were killed on 21 August with a Belgian man known as Abu Ayman al-Belgiki in an operation which targeted the vehicle they were travelling in. The Prime Minister admitted that the strike marked a “new departure” and an unnamed former RAF commander told the Daily Telegraph that it represented “the crossing of a Rubicon.”

The strike was significantly different to previous attacks conducted by Reaper drones. Not only was it conducted in Syria, where Parliament had, at the time, not given authority for military action, and against a British citizen, but as far as is known it was the first time that the UK had conducted an air strike in a country where it was not involved in a war. Critics argued that the strike signified a new policy of targeted killing - a position which the government initially denied, but has since appeared to tacitly accept.

The legal justification for the assassination was questioned in Parliament, and both the Intelligence and Security Committee (ISC) and the Joint Committee on Human Rights (JCHR) conducted investigations into the attack. The government was accused of providing vague and generalised answers to the two inquiries, and both committees concluded they had insufficient evidence to judge whether the attack was lawful. JCHR chair Harriet Harman stated that the government “[did not] begin to answer” the questions asked and were “refusing to engage,” and Dominic Grieve QC, the ISC’s then chair, expressed “profound” disappointment at the lack of access to evidence.

Information has since emerged about the targeted killings of other British nationals fighting with ISIS in Syria. Some of these have been killed by the RAF and others by the US Air Force, possibly on the basis of intelligence provided by the UK or with other support from the UK. There is clear indication that these are in many ways ‘joint operations. Information on this matter is sketchy and it is possible that there are others who have been killed in this way, with details remaining unreported.

In addition to Khan and Amin, British ISIS fighters said to have been killed in drone strikes with British involvement are:

- Junaid Hussain. When David Cameron announced the strike that killed Khan and Amin, he also stated that Cardiff-born Junaid Hussain had been killed in a separate strike. Hussain was killed by a US drone strike in Raqqa a few days after the attack on Khan and Amin.
- Mohammed Emwazi. Mohammed Emwazi, nicknamed ‘Jihadi John’ by the media, was killed in a targeted US drone strike in November 2015. In a statement on the killing, Cameron said “We have been working, with the United States, literally around the clock to track him down. This was a combined effort. And the contribution of both our countries was essential.”

65 Owen Bowcott: ‘MPs ask whether UK has drone ‘kill list’’. Guardian, 5 November 2015. https://www.theguardian.com/world/2015/nov/05/mps-ask-whether-uk-has-drone-kill-list
Two RAF drones are believed to have been present undertaking surveillance during the strike, with the US drone taking the shot because it was best positioned to do so.

• Naweed Hussain. No announcement was made when Naweed Hussain, an ISIS fighter from Coventry, was killed in the spring of 2017, but almost a year later the Daily Mail revealed that he had been killed by a missile from a US drone in a targeted strike led and directed by the RAF.

Although the government had issued a public warning that British citizens travelling to Syria to join ISIS ran the risk of being killed as a consequence of war, the strikes on these individuals raised the question of whether there was a British ‘kill list’ of targets for assassination. Despite initial denials by Ministers that there was any such list,

subsequent press reports concluded otherwise. Newspapers reported that the decision to kill Khan had been made in May 2015 by the National Security Council (NSC), the UK’s main forum for discussion of intelligence issues, which is chaired by the Prime Minister. The NSC was apparently briefed on the activities of several prominent British members of ISIS, including Khan, Amin, and Hussain. At the meeting several British ISIS fighters were identified for targeting and approval was given for further strikes if necessary.

In February 2017 the Daily Mail reported that RAF pilots had been “working their way through a ‘kill list’ of key targets” of British ISIS fighters. The claim, from an unnamed RAF source, was not denied by the MoD, which told the newspaper “if you are fighting for Daesh (Islamic State) in Iraq and Syria then you will be targeted, irrespective of nationality”.

Following the report members of the All Party Parliamentary Group on Drones wrote to Prime Minister Theresa May to enquire about the existence of a kill list.

In August 2017 the MoD published a new Joint Doctrine Publication on Unmanned Aircraft Systems which outlined how the UK’s military drones would be tasked and employed. The publication referred to “the recent UK, and other states, practice of targeting suspected terrorists outside of armed conflict itself”.

When Stewart MacDonald MP wrote to the Ministry of Defence to query whether this inferred that the UK has a targeted killing policy the publication was withdrawn by MoD and replaced with a new version from which the relevant section had been removed, claiming that there had been a drafting error in the earlier document.

The conclusion that many will draw is that the UK government has indeed pursued a practice of using drones to conduct targeted killings in Syria, but does not wish to concede as much in public, presumably for fear of criticism over legal and human rights implications.

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3.5 Embedding

‘Embedding’ is a common practice which allows aircrew to take a tour of duty with the air force of an allied nation so that skills and tactics can be shared. RAF personnel have been embedded within the air forces of other nations for decades. The practice allows skill sharing and supports military partnering, helping each side to understand the other’s way of working. Not surprisingly, the RAF’s main partner for embedded aircrew is the US Air Force, although they have also taken part in tours of operation with other NATO partners and allies such as Australia, Canada, and France. Such exchanges take place on an ongoing basis and are highly valued by the RAF.

The RAF have benefited from exchange tours with the US Air Force in all kinds of sensitive areas, including flying F18, F22, F117, and B2 aircraft. The Ministry of Defence has said a “small number” of RAF personnel are embedded with the US Air Force’s 432nd Wing which flies Reaper drones from Creech Air Force Base, Nevada. In February 2016 it was reported that six RAF personnel from the Reaper force as a whole were embedded with the US Air Force, and in July 2018 four RAF Reaper qualified pilots and sensor operators were embedded with the US Air Force. By March 2020 this number had dropped to two, possibly because of stress on personnel numbers within the RAF’s own Reaper programme. The exchanges work the other way, too, with US Air Force personnel flying in RAF aircraft. In 2015 there were seven US Government personnel stationed at RAF Waddington, from where Reapers from 13 Squadron are flown, although it is not clear whether they were all based with 13 Squadron, which is not the only unit based at Waddington.

Embedded aircrew are considered part of the force they are embedded in, following the force’s chain of command and operating as if they were the host nation’s personnel. RAF pilots embedded with allied forces were engaged in conducting air strikes in Syria in the period after Parliament had voted against taking military action in Syria, but before 2015, when authority for military action was eventually given. Around 20 personnel, including three pilots flying crewed aircraft, were embedded with US, Canadian, and French forces and had been authorised to participate in coalition operations under those forces’ chain of command.

Nevertheless, embedded personnel are also meant to follow UK rules of engagement and UK law. If the host nation has less restrictive rules than the UK, the embedded personnel are required to comply with UK law and the laws of armed conflict and will be held liable if they engage in unlawful activity.

However, this does not mean that if an RAF crew refuses to undertake a strike, the strike will not take place. In his book, ‘Predator’, US drone pilot Matt J. Martin gives an account of a situation where a US Predator drone with the call sign Skybird, operated by a British crew, was patrolling the Afghan-Pakistani border in 2006. The crew spotted a group of four armed men and was asked to attack them by special operations forces on the ground. The British pilot “wavered”, concerned that the strike was outside the UK’s rules of engagement. “As far as I was concerned” writes Martin, who was commanding the mission, “those four men down there had painted bull’s eyes on their own butts by shooting at our guys. I dispatched an American crew to take over Skybird’s controls and settle the refined British conscience.”

The use of US drones flown by RAF pilots embedded with US forces during NATO’s intervention in the 2011 Libyan civil war proved to be particularly controversial. During the conflict the government had insisted that no British drones were involved in military action over Libya, but ten months later the disclosure that three British pilots had flown American drones was slipped out in answers to parliamentary questions. It is not known how many missions were flown by British pilots, or how many weapons were released by them. However, on 24 April 2013, in response to a parliamentary question from Rehman Chishti MP, Defence Minister Andrew Robathan stated that RAF pilots had also flown approximately 2,150 missions using US Predators and Reapers in Iraq, Libya and Afghanistan between

October 2006 and December 2012 – an average of almost once a day. While this included 271 missions in Afghanistan when UK personnel utilised a US Reaper because a UK Reaper was unavailable (see table 1 above), it gives some indication of the number of missions embedded pilots have undertaken.

As well as participating in embedding and exchange arrangements, British and American Reaper aircrews may cooperate closely with each other in combat situations. Peter Lee’s book, ‘Reaper Force’, gives an example of a situation from the early days of the RAF’s Reaper programme, before the aircraft was armed, where the sensor operator for an RAF Reaper operating in Afghanistan ‘flashed’ an infra-red target marker to attract the attention of aircrews in the vicinity to a group of Taliban fighters, subsequently using the laser to mark the target for attack by an Apache helicopter and an American Reaper. Information from Ministry of Defence reporting on air strikes in Iraq and Syria suggests that this has become a regular occurrence (See selected examples in Appendix 2).

The Ministry of Defence has told Drone Wars that “a UK Reaper will only laser designate for another nation’s aircraft where the UK’s rules of engagement are met. Therefore, a UK Reaper will not facilitate an airstrike by another nation outside the parameters for the RAF.”

3.6 Command and Control of Air Operations

Coalition air operations in the wars in Afghanistan, Iraq, and Syria have been directed by the Combined Air Operations Centre (CAOC) run by the US Air Force Central Command from a huge bunker at Al Udeid Air Base near Doha, Qatar. The US Air Force describes CAOC as the “nerve centre of the air campaign”, “which plans, monitors and directs sortie execution, close air support and precision air strike; intelligence, surveillance and reconnaissance; airlift; air refuelling; aeromedical evacuation; air drop, and countless other mission-critical operations.” The Centre is responsible for commanding all coalition air assets in the region – both crewed aircraft and drones. Although CAOC is US-led and the majority of its personnel are American, it works through joint teams drawn from all the various nations involved in the coalition military campaign. Around 10,000 US personnel are based at Al-Udeid, 800 of whom work on CAOC operations at any one time.

CAOC aims to bring together all intelligence, surveillance, and reconnaissance feeds to give a single air picture, then allocate and run strike operations as efficiently as possible among all the available coalition aircraft. It also has systems to allow dialogue and avoid conflict with Russian forces that may be operating in combat zones in Syria, for example. The system works in pre-planned situations, where there is time to analyse data, turn it into actionable intelligence, and draw up a careful strike plan. It is less effective in dynamic combat situations involving rapid change and time pressures, as this may cause disruption to planned operations. It is important to note that the vast majority of air strikes against ISIS were undertaken under dynamic targeting processes. The MoD told Drone Wars UK that out of the 414 UK strikes launched in 2015, only 19 strikes (5%) were pre-planned.
The following section relies heavily on our expert informants’ understanding and experience of CAOC operations. CAOC has built-in arrangements to check whether a strike might cause collateral damage, and whether it complies with a nation’s rules of engagement and the law of armed conflict or crosses any national ‘red cards.’ Air assets from different nations are allocated their targets by joint terminal attack commanders (JTACs) according to that nation’s rules of engagement.\textsuperscript{91}

Personnel at CAOC use map-based software to cross-reference targeting with known no-strike locations, such as hospitals, bridges, and sewage works, with the aim of minimising humanitarian impacts. The system automatically flags up target locations if they are on a no-strike list, although it is possible to override this if there is a military necessity.\textsuperscript{92}

Intelligence information is used to prepare an ongoing schedule of pre-planned air tasking orders which assign aircraft and weaponry to targets as appropriate. CAOC also controls responses to dynamic combat situations. Such situations may arise if, for example, if a Reaper crew spot something which they think requires a strike, they will pass the information back to CAOC to co-ordinate the attack.\textsuperscript{93}

RAF Reaper drone operations in Iraq and Syria are co-ordinated and commanded by CAOC, and each mission is conducted according to a tasking order issued from Al Udeid, often for an area the crews are familiar with. This may be surveillance to identify targets in a particular area, or overwatch duty for personnel on the ground in hostile territory. Reaper drones are unlikely to be reassigned to dynamic tasking far from their location in an emergency as they do not have the speed to travel rapidly to a new field of combat, so fast strike jets are usually assigned to such tasks.\textsuperscript{94}

\textsuperscript{91} Information from expert informant 1.
\textsuperscript{92} Information from expert informant 1.
\textsuperscript{93} Information from expert informant 1.
\textsuperscript{94} Information from expert informant 1.
The UK is also able to assign its own specific targets to RAF Reapers in the Middle East, as well as responding to coalition-designated targets assigned by CAOC. The UK has its own dedicated targeting personnel at CAOC who use intelligence to generate targets. There is also a targeting cell at Permanent Joint Headquarters at Northwood which can provide information to CAOC. Intelligence provided by other nations, notably the United States, may also contribute towards making these decisions (see section 4.1 below).

Air tasking orders for RAF Reaper strikes should always comply with the laws of war and the UK’s rules of engagement for the conflict. Rules of engagement define the circumstances, conditions, degree, and manner in which force may be used by armed forces during a conflict. Although rules of engagement are not published, it is generally understood that the US’ rules of engagement in recent and current conflicts in Afghanistan, Iraq, and Syria are broader and more permissive than those of the UK.

If a target is allocated by CAOC to an RAF aircraft through the CAOC chain of command, the targeteers would assess the intelligence information, check that the strike complies with the UK’s rules of engagement, and devise the practical arrangements for the attack such as time of day, direction of attack, and the type of weapon to be used. A lawyer would check that the objective of the attack is a legal target and at the end of the process a British ‘red card holder’ will give authority for a particular strike to take place with a particular weapon.

CAOC is a US-led operation and its fundamental role in directing RAF Reaper strikes was described by one of our interviewees as “another natural area of complicity” between the RAF Reaper programme and US forces. However, this does not necessarily mean that RAF Reaper crews are bound to follow targeting instructions from US commanders. The UK red card holder has the authority to veto a strike which is considered to fall outside the UK’s rules of engagement, and the MoU on Reaper operations between the RAF and USAF states in relation to command and control that: “RAF Personnel are not to perform duties on behalf of USAF that conflict with policies, procedures, laws and regulations of the UK.”

One of our expert informants told us “with absolute confidence” that UK aircrew always have the final say on a Reaper strike. “The US can beg, plead, or threaten, but for any weapon fired by a British source, Britain has the final say”, and British Reaper crews cannot be ordered to conduct an attack by personnel from the US armed forces or any other nation. If necessary, they can call on legal advice to help in making their decision.

Author Peter Lee, who has written extensively about the RAF’s Reaper programme, has described in detail a situation where a RAF Reaper crew decided not to engage with a target when directed to do so by a non-UK JTAC in his book ‘Reaper Force’.

Despite this, if the RAF will not undertake a strike ordered by CAOC there is nothing to stop commanders at CAOC from calling in an aircraft from the US Air Force or another nation with more permissive rules of engagement to attack the target. Indeed, under such circumstances it would be "likely" that the target would be reallocated to an American crew according to one interviewee.

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95 Information from expert informant 3.
96 Information from expert informant 3.
97 Information from expert informant 4.
98 ‘Memorandum of Understanding’, op cit Paragraph 5.1, page 5.
99 Information from expert informant 3.
100 Peter Lee: op cit Pp280-4
101 Information from expert informant 3.
British personnel may also take on JTAC and other commanding roles at CAOC where they may find themselves in situations whether there is a conflict between UK rules of engagement and the reality of coalition operations. According to Air Marshal Greg Bagwell, a former Deputy Commander (Operations) at RAF Air Command, “[at] the far end of the spectrum, and it happens now, a British officer could well be authorising an American or Iraqi aircraft to prosecute an attack within the wider coalition mission.”

Of greater concern, perhaps, is the degree of intelligence sharing that goes on between the US and the UK at CAOC. Information from UK sources, including RAF Reaper surveillance operations, is used to prepare air tasking orders which can be assigned to any potential target, regardless of the UK’s rules of engagement. As one of our interviewees said: “You can’t argue logically that when you share information, you are sharing no knowledge on how it might be used. It is impossible to practically share information if you don’t know what it will be used for, for example in deducing the location of a potential target, which it might be illegal for the UK to attack but which could be attacked within the US’s rules of engagement”. This matter is discussed further in the next section.

4.1 Intelligence sharing

The topic of intelligence sharing between the UK and the US in relation to drone use has been covered in other reports such as Amnesty International’s ‘Deadly Assistance: The Role of European States in US Drone Strikes’ and the APPG on Drone’s ‘The UK’s Use of Armed Drones: Working with Partners’. While it is right therefore not to repeat that work, it is nevertheless important to include this issue when addressing US-UK links in regard to drone operations.

Drone operations are directed and led by intelligence, and the results of their flights, which gathers further information, is fed back into the intelligence-collation process. As drones have the ability to ‘loiter’ in the same area for an extended period, they spend a lot of time watching and building up a ‘pattern of life’ to try to obtain an understanding of what happens in a particular location of interest to the military. The information gathered from these missions can then be combined with information from other sources, such as observations by patrols or signals intelligence from intercepted communications, to put together a larger picture which will be used to make decisions on targeting.

During coalition operations intelligence is commonly shared between partners and systems exist which enable information to be passed on when necessary. CAOC is organised according to a standard military operating structure for joint operations, which includes a dedicated joint operational intelligence element (J2). However, not all intelligence is automatically shared with all partners and sensitive material may be held back, but nevertheless there is “widespread sharing of general intelligence” within the coalition.

Under these arrangements US forces will have access to intelligence gathered by the UK, and so intelligence sharing is another fundamental source of collaboration which underpins the drone operations of the two nations. Although UK drone operations are conducted within certain policies and

105 Information from expert informant 3.
rules of engagement, these are widely understood to differ from US rules of engagement. It is assumed that the sharing of UK-derived intelligence with the US assists the US to select and strike targets which would be beyond the UK’s own rules of engagement.

Air Marshal Greg Bagwell told the All-Party Parliamentary Group on Drones in 2016:

“We already prosecute targets in a coalition that may well have come from a different intelligence feed or another nation’s aircraft, and vice versa. We often provide intelligence to one nation which they can use to prosecute targets. As long as that is within the agreed Rules of Engagement and Principles, then that is absolutely fine. This gives you maximum flexibility. So, collaboration generally is a good thing.”

The UK and the US have a long history of co-operation on intelligence matters dating back to World War II, and intelligence sharing is a key element in the US-UK ‘special relationship’. Under the co-operation arrangements US and UK agencies have agreed to share both raw intelligence and intelligence-gathering methods and techniques. Intelligence sharing is further extended through the ‘Five Eyes’ alliance, which includes Australia, Canada, and New Zealand and creates a surveillance network with global coverage.

Government Communications Headquarters (GCHQ), which generates signals intelligence by intercepting all forms of electronic communication, plays an important role in the US-UK intelligence relationship. GCHQ works closely with the US National Security Agency (NSA), which operates from bases in

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the UK, notably RAF Menwith Hill. In 2010 news reports based on information from official sources revealed that GCHQ had located suspected Al-Qa’ida and Taliban fighters in Pakistan and Afghanistan by intercepting telephone communications and shared this intelligence with the US for targeting in drone operations.\(^\text{108}\) Other evidence presented by NGOs and in the media has suggested that intelligence provided by the UK may have been used by the US to locate suspected targets for drone strikes in Iraq, Syria and Yemen as well as in Pakistan and Afghanistan.\(^\text{109}\) Before Parliament gave authorisation for UK forces to undertake strikes in Syria, the then Foreign and Commonwealth Office Minister Tobias Ellwood admitted that the UK was “providing intelligence and surveillance to support coalition partners, who are carrying out air strikes in Syria against ISIL.”\(^\text{110}\)

The UN Special Rapporteur (2011–2017) on the promotion and protection of human rights and fundamental freedoms while countering terrorism, Ben Emmerson, has argued that the closeness of the UK-US relationship makes it “inevitable” that intelligence shared by the UK contributes to US targeting decisions in places such as Pakistan and Yemen, and that “it would be absurd if it were not the case.”\(^\text{111}\)

In a March 2014 report on the use of drones, the House of Commons Defence Committee acknowledged “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.” The Committee suggested that “there should be greater transparency in relation to safeguards and limitations the UK government has in place for the sharing of intelligence.”\(^\text{112}\) In response to these concerns, the government merely stated that “All activities of the UK intelligence community are subject to careful oversight to ensure that they comply with obligations under national and international law.”\(^\text{113}\)

Intelligence sharing, and the secrecy over which information is shared with the US and what it may be used for, is a major issue which undermines efforts by the RAF to operate its Reaper drone programme to standards which comply with international humanitarian and human rights laws. As one of our interviewees told us, “You can’t argue logically that when you share information, you are sharing no knowledge on how it might be used... We are on a slippery slope. Intelligence sharing is a fundamental source of complicity.”\(^\text{114}\)

4.2 Satellites and communication networks

To fly a Reaper drone remotely from a ground control station located in a different continent, the crew need to be able to communicate with the drone using a satellite link which is used to relay commands and responses between the GCS and the drone. Live video images and sensor information received

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\(^\text{114}\) Information from expert informant 4.
from the drone are used both to control the drone itself, as well as providing the raw data needed to develop an intelligence picture of what is happening on the ground below and the means of targeting the drone’s weapons.

Large quantities of electronic data are exchanged via the drone and the control station through a complex network of communications. To provide an ‘over-the-horizon’ link from bases in the UK and US, data travels via an uplink dish to the satellite, then on to a data link system in the drone. The data must travel a distance of some 25,000 miles into space to reach the satellite, and even travelling at the speed of light this is far enough to cause ‘signal latency’ – a delay of around one second between the signal leaving the transmitter and reaching the receiver. This lag period becomes longer if the signal needs to travel through a relay of more than one satellite to reach its destination. Delays of longer than a second or more are problematic when piloting a drone, so to keep the lag to a minimum, signals are transmitted through fibre-optic cable networks where they can be (through which they travel faster than via a satellite connection). In the case of the drones operating in the Middle East controlled from the continental US, the data travels through fibre optic cable across the Atlantic Ocean to an uplink transmitter base in Europe in order to reduce the delay period.

This uplink transmitter is located at Ramstein Air Base, a major US Air Force base in south west Germany. Because of this, Ramstein is said to be involved in virtually every US Air Force drone attack. According to Brandon Bryant, a former US Air Force drone crew member, Ramstein is “absolutely essential to the US drone programme.” The video feed and the control feed of the drones flying over Afghanistan and the Middle East travel via satellite to Ramstein since there is no decent fibre optics connectivity into most war zones. From Ramstein the signals travel via fibre optics cable to the US and vice versa. It should be noted that a ‘back-up’ uplink facility is located at the US base at Sigonella in Italy, to reduce the US dependence on Ramstein.

One of the reasons the RAF Reaper programme was first set up at Creech Air Force Base was that the US already had all the necessary communications and satellite systems set up there, and it was easier to piggyback on their arrangements than set up a new system. The Ministry of Defence’s Joint Doctrine Publication on Unmanned Aircraft Systems, published in 2017, explains how “a RAF mission crew could be connected via fibre-optic link to a satellite ground station in Germany that is connected, via satellite link, to a Reaper launched from a base in the Mediterranean and which was employed over the Middle East,” suggesting that the US-based RAF Reaper operations are dependent on the Ramstein uplink for its drone operations. A slide from an RAF presentation on RAF Reaper drone operations also shows that UK Reaper operations controlled from RAF Waddington (rather than from the US) also use the Ramstein uplink, but this is less clear and it may be that satellite ground station at RAF Colerne in Wiltshire is used instead. As we shall now see, how the UK utilises satellites to communicate with and control its drones is far from clear.

117 Information from expert informant 2.
Skynet and MoD satellite capabilities

The UK Ministry of Defence has its own sovereign military satellite system providing secure, long-range communications to the armed forces and NATO allies. The system is known as Skynet and consists of a family of satellites launched in different series over the past fifty years. Seven satellites from the most recent launch series, Skynet 4 and 5, are currently in use, with Skynet 5 transmitting in the X-band frequency range (see below). The satellites and their ground stations are operated on behalf of the Ministry of Defence by Airbus Defence and Space through a private finance initiative contract, which also provides for spare capacity on the satellites to be sold to NATO and Five Eyes users.

As well as having its own sovereign satellite capability, MoD also uses systems owned by the UK’s NATO allies, notably the US, and also buys ‘airtime’ from commercial satellite service providers such as Inmarsat and Iridium.

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is a user of US military satellite constellations like the Advanced Extremely High Frequency and Wideband Global Satcom systems, and negotiations are under way to become a partner in the US Navy’s Mobile User Objective System (MUOS).\(^{121}\) However, government policy is “to make maximum possible use of SKYNET, and to minimise commercial usage.”\(^{122}\)

Under the private finance initiative contract four Skynet 5 satellites were launched over the period 2007–2012. The contract ends in 2022, and MoD is currently investigating options for continuing the Skynet service after it has expired. Airbus is to be awarded a contract to provide one replacement satellite, Skynet 6A,\(^{123}\) but in September 2019 MoD announced that it was putting out a tender for other elements of the Skynet 6 programme, which would cover operation of the satellites and ground stations and the provision and management of ground terminal infrastructure.\(^{124}\) The Skynet 6 contractor would provide satellite network coverage to the MoD through a ‘system of systems, managing the Skynet system and also managing the UK’s contribution and access to systems owned and operated by the UK’s allies, and negotiating MoD’s access to commercial satellite services.

**Satellite control and RAF Reaper drones**

Conflicting information has been published about the satellite links used by the RAF to control its Reaper drones. According to a BBC news article from 2008 about the MoD’s then-new Skynet 5 satellite system, commands to RAF Reaper drones are sent over Skynet 5’s high-bandwidth connections.\(^{125}\) However, responding to a Freedom of Information Act request about the use of unmanned vehicles through the UK’s Skynet 5A satellite, the Ministry of Defence stated: “Skynet 5A has not been used to operate unmanned vehicles of any kind.” The reply confirmed that “the Skynet 5 satellite constellation provides services in X-band and certain UHF satellite frequency ranges. The Ministry of Defence does not operate any unmanned systems of any kind on these frequencies.”\(^{126}\)

To get to the bottom of this matter, it is necessary to understand how satellite communications operate on different radio frequencies.

Communication with satellites takes place using radio frequencies in the super high frequency band. These are a form of microwave, with frequencies between 1–40 GHz. Within this range, frequencies are labelled as different bands which are used for particular purposes (see diagram). Satellite communication with military drones takes place using various bands within the radio frequency spectrum: X-band (8-12 GHz), Ku-band (12-18 GHz), or Ka-band (26-40 GHz) frequencies. Reaper drones are fitted with beyond line-of-sight SATCOM data link controls which operate on Ku-band frequencies.\(^{127}\)

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123 Sandra Erwin: ‘UK MoD still undecided on how to procure satellite communications’, op cit.


According to a 2016 source, the US Department of Defense “procures a significant portion of its SATCOM bandwidth from commercial vendors.” The MQ-1 Predator drone, Reaper’s predecessor, utilised Ku-band communications alone, limiting it to commercial satellite communications [COMSATCOM] only. There were “plans to upgrade the MQ-9 to operate in both Ku-and Ka-band, which would allow use of both COMSATCOM and MILSATCOM.” A January 2013 report by the US Defense Business Board argued that demand for commercial satellite bandwidth by the US military would increase as a result of “expanded presence into varied geographies” and an “increasing reliance on surveillance” platforms such as drones. The report estimated that by 2020 around 68% of all US military satellite communications would be handled by commercial entities. However, the UK military is said to use a considerably lower proportion of commercial satellite services than the US in meeting its bandwidth needs.

In response to an enquiry from Drone Wars UK, MoD told us that, in relation to communication systems with drones, “the RAF use a combination of Ku-band satellite links, line of sight Radio Frequency communications and telephone networks. These are used across UK, US and NATO military systems, dependent on requirement, the area of operations and the specific task.”

It therefore appears that, contrary to the BBC’s news report, the Skynet satellite system is not used for communication with RAF Reaper drones as it transmits in the X-band range, rather than the Ku-band range on which Reaper operates. It is likely that satellite communications with RAF Reaper drones currently take place using either US military satellite networks, or perhaps more likely, through

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networks operated by commercial Ku-band satellite suppliers such as SES, Intelsat, and Inmarsat, all of whom supply bandwidth for communications with UAVs.\(^{131}\) The choice of network will depend upon security considerations and the satellite communication footprint available for the area of operations. The much-publicised transatlantic flight of a SkyGuardian MQ-9B drone to the 2018 Fairford Royal International Air Tattoo, for example, was directed through Ku-band satellite communication from L3 Technologies Communication Systems, with Inmarsat providing backup L-band satellite communications in the event of a failure.\(^{132}\)

However, the next generation Protector drones will be able to work with any satellite communications system, whether it be Skynet, a military satellite system belonging to a NATO ally, or a commercial system.\(^{133}\) Protector is to be fitted with modems for its on board communications systems designed by Hughes Network Systems which are able to work with a range of satellite systems. X-band frequency systems have been fitted specifically to allow the drone to use UK Skynet satellites.\(^{134}\) The modem is designed to work with many other frequencies and will also function with Ku-band and Ka-band systems from both military and commercial satellites. This increases the range of communication options with the aircraft, and potentially the range of locations in which it can be operated - as well as decreasing dependence on US satellite systems.

**Proposed Protector communications link network**

![Diagram of Protector communications link network]

Source: Adapted from redacted slide presentation given at RAF RPAS Conference, February 2020

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4.3 Launch and recovery and on-base maintenance

Although US pilots do not routinely fly RAF Reaper drones (or vice versa) on operational missions, this is not the case for launch and recovery operations.

Due to the delay in the signal (the ‘latency’) between a drone and operator who is remotely controlling the aircraft from overseas, it is not possible to launch and land Reaper drones operating in the Middle East from the UK or the US. For this reason, take-off and landing is currently controlled by a locally based ‘launch and recovery element’ (LRE) which operates from where the drone is actually based.

The Memorandum of Understanding between the USAF and RAF on Reaper, which enables RAF personnel to control and employ RAF or USAF Reapers from the continental US and RAF Waddington in support of approved operations tasked by CENTCOM, also allows personnel from each air force to undertake LRE operations for aircraft owned by the other air force. It also allows for the exchange of classified information needed to undertake these duties.

Answers to parliamentary questions have confirmed that RAF personnel “routinely” provided support to US Reaper operations in Afghanistan as part of the launch and recovery element for NATO missions. Likewise, US personnel flew RAF Reapers during the launch and recovery phase of flights in Afghanistan. Launch and recovery operations for both US and UK aircraft which were flying from Kandahar airfield were apparently run by the United States Air Force 62 Expeditionary Reconnaissance Squadron, which was crewed on a 24-hour basis by both RAF and USAF personnel. Similar arrangements almost certainly apply at Ali Al Salem air base in Kuwait, where USAF and RAF drones operating missions in Iraq and Syria are understood to be based.

According to one of our expert informants who had visited Kandahar airfield, RAF launch and recovery operations at Kandahar “relied heavily on the US.” This was in part because of the different scale of operations between the two air forces: the RAF’s 39 Squadron was a far smaller operation that the RAF’s Reaper programme. The informant told us that “The launch and recovery element at Kandahar had 80 or so people: only two of these were RAF. This wasn’t because the RAF was a junior partner; it was just that they could only spare two people.”

The logistics of the situation required launch and recovery aircrew to pilot aircraft belonging to either air force. “If, say, the mission has a 9 am start, and the flight is 18 hours long, it will be landing again at 3am the next morning” said our informant. “It won’t be the same crew that lands it - that wouldn’t be a good use of their time. So, the two RAF people in the launch and recovery element would work on a certain shift, in a certain window, and act as the launch and recovery element regardless of who the aircraft belonged to, UK or US, on a ‘next cab off the rank’ principle.”

As well as taking-off and landing the Reaper drones, the 62 Expeditionary Reconnaissance Squadron was also responsible for maintaining and arming the

135 Memorandum of Understanding’, op cit, Paragraph 2.4.
136 Ibid., Paragraph 2.10 and 2.11.
137 Ibid., Paragraphs 4.1 and 4.2.
139 ‘Afghanistan’. Parliamentary Written Question, Hansard, Column 402W, 4 September 2013: http://www.publications.parliament.uk/pa/cm201314/cmhansrd/cm130904/text/130904w0001.htm#130904w0001.htm_snpnew82
aircraft at Kandahar and ensuring they were ready to fly when needed, working
alongside civilian contractors where necessary. Our informant believed that
"the majority of the ground maintenance is probably done by the US, and they
probably do it for the UK as well."

“UK Reapers had a UK weapon load-out, not a US weapon load-out”, he told us.
“There are minor technical differences in the airframe and software between
the US and the UK – it’s not a situation where a US weapon can be put on a UK
aircraft. The practice was that UK aircraft had a UK weapon load. Maintenance
and refuelling went on pretty constantly; I would imagine that would be US
aircrew.”

The extent to which co-operation between the RAF and USAF on launch and
recovery operations will continue over the longer term remains to be seen. The
RAF’s ‘Protector’ drone, scheduled to replace Reaper around 2024, is intended
to have an automatic take-off and landing capability, meaning that in future it
should be possible to undertake launch and recovery functions over a satellite
communications data link. This can be expected to reduce the deployment
duties of a local launch and recovery team, although ground personnel would
still need to be present at the deployment location to undertake tasks such as
security duties, maintenance, refuelling, and weapons loading.

4.4 Contractors

Although they are often invisible to the public at home, significant numbers of
contractors have been involved in the military campaigns in Afghanistan and
Iraq, providing essential support services such as engineering, communication
and transport. Their work tends to be focused on maintenance, logistics, and
security rather than directly involved in combat.

In a news article on support services for air operations at Kandahar Airfield,
Lieutenant Colonel Joel Bolina of the US Air Force explained that his squadron
had teams of “engineers, defenders, logisticians, aerial porters, services,
personnelists [sic] and communications specialists,” who supported not only
US Air Force missions but operations by coalition partners. “A majority of
our squadron is made up of contractors, and without them, we would not
be able to provide a lot of the capabilities we do now,” said Bolina.

Our informants told us that maintenance and logistics support for Reaper
operations depend heavily on support from contractors. As US and UK
aircraft are deployed together, it is likely that the same contractors work on
aircraft belonging to different air forces, even though the work done may be
specified by different contracts. Civilian contractors operating on US Reaper
drones operating from Kandahar included personnel from General Atomics,
Raytheon, L3 Communications, and Sierra Nevada Corporation.

US Reaper drones may be flown by contractors in certain circumstances. Pilots
from General Atomics, manufacturer of the Reaper, are reported to have flown
Predator drone intelligence surveillance missions for the US Department of
Defence since at least 2015, with up to ten flights per day flown by the General
Atomics pilots. Contractors are reported to fly US Air Force Reapers based at Mirosławiec Air Base in Poland, and the US Navy flies contractor owned / contractor operated Reapers involved in Task Force Southwest and Marine Corps ISTAR operations in Afghanistan. However, these contractors are not flying in combat roles. It is likely that they are undertaking less sensitive missions and overseeing transit flights between the drone’s home base and the combat zone.

One of our informants told us he would be “astonished” if a contractor ever flew an RAF Reaper drone - except, conceivably, a test flight after extensive maintenance - and that a contractor would never be at the controls during any operational flight. Contractors have tended to be used by militaries at locations where there is a low threat level. At locations away from the theatre of combat they are used extensively, but rarely on the battlefield itself. Reaper Launch and Recovery operations are well suited to the use of contractors because the home base for the aircraft is usually located well away from the combat zone, and often in a different country.

As the US has used contractors to support its Reaper operations, it can be speculated that in due course the UK may do the same. Launch and Recovery operations would be an obvious place to start. Contracting out the Launch and Recovery work would free up RAF Reaper personnel, of whom there are limited numbers, for military operations, although the longer-term plan for Protector is to eliminate totally the launch and recovery function and rely solely on a remote crew operating via a satellite link.

4.5 Key Bases

A number of military bases in the UK and overseas support the RAF’s Reaper drone operations, some of which are operated by US forces. Although Ministers have regularly stated that “the US does not operate RPAS [remotely piloted aircraft systems] from the UK,” evidence suggests that certain US military bases in the UK are involved in activities which support US drone operations, notably intelligence analysis and sharing.

Bases in the UK

RAF Waddington, Lincolnshire

RAF Waddington is one of the RAF’s most important flying bases in the UK, and the hub for the air force’s Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) operations. It is the main operating base for airborne intelligence aircraft and in 2012 became the operating base for 13 Squadron, the second of the RAF’s Reaper squadrons, with combat flights controlled from Waddington from April 2013.

149 Information from expert informant 3.
150 Information from expert informant 2.
Waddington is planned to be the home base for 31 Squadron, which from the mid 2020s will fly the new Protector drone. Investment of £93 million is planned at the base to construct a new purpose-built hangar for Protector as well new facilities and accommodation for crews. The new facilities will allow the drone to be flown from inside a permanent building, rather than from transportable containers as at present. Following the arrival of Protector, the RAF plans to centralise its Protector operations at Waddington, resulting in the UK presence at Creech Air Force Base being scaled down. It is the intention of the RAF, in due course, to launch Protector drones directly from Waddington for flights in UK airspace, for example on maritime surveillance or possibly training operations.

Permanent Joint Headquarters, Northwood, London

The Permanent Joint Headquarters (PJHQ) at Northwood, London, plans and commands all overseas operations involving British military forces. As the name suggests, it is a joint headquarters responsible for controlling operations from all three services, bringing together intelligence, planning, operational, and logistic staff. In addition to exercising operational command over UK forces assigned to overseas operations, PJHQ also advises MoD headquarters on policy matters relating to military deployments.

PJHQ has planned and overseen UK military involvement in Afghanistan, Iraq, Syria, and Libya. When UK forces are acting as part of a coalition led by another nation, PJHQ exercises operational command of UK forces deployed on the operation. The RAF’s senior officer at CENTCOM’s CAOC is responsible to PJHQ for the control and direction of RAF aircraft supporting Operation Shader in Syria and Iraq.

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PJHQ undertakes advance planning for going to war before military action commences and reviews intelligence assessments to identify targets while hostilities are under way. Lists of potential targets are exchanged between CAOC and PJHQ. PJHQ gives approval for attacks by UK forces on targets nominated by CAOC and on targets which it has identified of its own accord, seeking endorsement from legal advisers and Ministers if necessary, and selects the weapons considered most suitable for each attack. CAOC is then requested to execute the attacks.\textsuperscript{157}

**RAF Wyton, Cambridgeshire**

RAF Wyton is the location for much of the British military’s Defence Intelligence work, conducted under the auspices of Strategic Command (formerly Joint Forces Command).\textsuperscript{158} Defence Intelligence has the role of providing predictive, dynamic, and deployable intelligence to the Ministry of Defence, the wider government, and certain of the UK’s military allies. Intelligence is shared with members of the ‘Five Eyes’ alliance, which includes the USA.

RAF Wyton undertakes ‘intelligence fusion’ work to provide intelligence to support UK military deployments around the world. Intelligence fusion combines pieces of information from various sources to produce higher-quality intelligence and knowledge that can be used to direct combat operations, and often involves the analysis of large quantities of data using high powered computing techniques. Wyton base brings together a number of former Defence Intelligence units relocated from other bases in the new ‘Pathfinder Building’, which is intended to be a multi-intelligence, open plan environment aimed at improving collaboration and innovation. Much of the activity that takes place in the Pathfinder Building is highly classified.\textsuperscript{159}


\textsuperscript{159} Information from expert informant 2.
A large part of the work at Wyton is based around the analysis of imagery of all kinds, including video images and high resolution long range photographic images collected from drones, satellites, and aircraft. This is combined with material from other sources through pattern-of-life analysis and preparation of three-dimensional models to assist in making targeting decisions. It is likely that image analysts at Wyton can observe sensor feeds directly from Reaper aircraft during a mission, and communicate in real-time to the drone’s crew using secure chat rooms to provide advice and expertise and flag up items of interest that warrant a closer look.

As well as traditional photographic analysis, RAF Wyton’s role includes measurement and signature intelligence and geospatial intelligence analysis. These technical disciplines are based on the use of data from remote sending techniques to build up a picture of activities in a particular location. Wyton is the home of the National Centre for Geospatial Intelligence. Much of the imagery and data which is analysed at Wyton is derived from satellite sensors, and the MoD is keen to increase its capabilities in this field. In January 2018 the RAF launched a technology demonstrator satellite, Carbonite-2, capable of delivering high quality photographic images and three dimensional video footage from space, with the future intention of launching a network of low cost imagery satellites. Data from Carbonite-2 is processed and interpreted at RAF Wyton, as is imagery provided through intelligence agreements with the United States and purchased from commercial satellite providers – possibly with the assistance of commercial contractors.

**RAF Digby, Lincolnshire**

The RAF’s website describes RAF Digby as “an important signals site for all three services,” and home to the Joint Service Signals Organisation, which is said to provide specialist communications information systems to the UK’s armed forces. Documents released by Edward Snowden indicate that it is a signals interception base, tasked by GCHQ, and hosting US civilian personnel from the NSA who work alongside UK colleagues to produce near-real time intelligence to support military operations. RAF Digby conducts surveillance and geolocational tracking across the Middle East and North Africa, including a number of countries where the UK and US conduct drone strikes such as Iraq and Syria. This includes the analysis of geolocation data gathered from mobile phone signals via surveillance equipment known as ‘Airhandler’ attached to Reaper drones. RAF Digby is one of a limited number of sites capable of processing Airhandler data and, according to the Snowden documents, has the capability to perform “(near) real-time co-location” of GSM cell phones.

During the NATO military intervention in Libya in 2011 GCHQ staff at RAF Digby targeted “Libyan regime command and control use of mobile satellite phones”, and subsequently focused on gathering intelligence about the command and control structure of opposition forces. In 2013 GCHQ staff at Digby were monitoring the Syrian government’ security services in the country’s coastal region.

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164 Ibid.
The RAF’s 591 Signals Unit is also based at Digby\(^{165}\). This unit undertakes both defensive and offensive communications, cyber, and electromagnetic warfare activities, including securing military communications and cyber defence work. According to the Daily Telegraph, the RAF has advertised for computer security experts to carry out “cyber vulnerability analysis and investigations on air platforms and air systems” as part of 591 Signals Unit.\(^{166}\) This includes analysing attempts to hack into RAF systems. As drones are considered vulnerable to hacking through their data link connection to the crew, it can be speculated that Digby has been involved in work to protect the RAF’s Reaper force from cyber attacks.

RAF Digby is also the site of a joint British and American Navy Maritime Cryptological Integration Centre, encompassing signals intelligence, cyber operations, and electronic warfare to support military forces in the North Atlantic Ocean, the Barents, Baltic, and Black seas, and across North and sub-Saharan Africa.\(^{167}\)

**RAF Molesworth, Cambridgeshire (US base)**

Molesworth is the location of the US European Command’s Joint Intelligence Analysis Centre (JIAC), which is responsible for processing intelligence from European countries and countries in the Middle East and West and Sub-Saharan Africa. Computer servers at the JIAC store intelligence imagery, which can be called up remotely,\(^{168}\) and job adverts and employment resumes published online show that personnel and contractors working at the base have been involved in co-ordinating intelligence for US Reaper drone missions and in undertaking targeting operations.\(^{169}\)

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167 Ryan Gallagher: op cit.


RAF Croughton, Northamptonshire (US base)

RAF Croughton, near Milton Keynes, is a US communications hub involved in the transfer of military, diplomatic, and intelligence information to and from the United States. It acts as a relay station between the USA, Europe and nations further afield, passing information on through secure satellite links and fibre optic cables.170 Around a third of all US military communications in Europe are said to pass through Croughton.171

Croughton is linked to Camp Lemonnier in the Horn of Africa (see below), which is involved in US drone operations in Yemen and Africa by a secure high-speed fibre optic communications link which has been specially set up by BT. It is has a similar high-tech link to the GCHQ listening centre at Cheltenham, and another high-capacity link to the US Naval Air Station at Sigonella in Sicily, where NATO’s new Alliance Ground Surveillance (AGS) drone base is located, and which is believed to be the operating base for US drone strikes conducted in Libya.172

In 2014 it was announced that European Command’s Joint Analysis Centre at Molesworth, and the intelligence operations at nearby Alconbury, together with the intelligence functions of Africa Command, would be merged into a new Joint Intelligence Analysis Centre at USAF Croughton.173 However, these plans now appear to have been placed on hold.174

RAF Menwith Hill, Yorkshire (US base)

Much has been written elsewhere about the role of Menwith Hill – said to be the largest facility operated by the National Security Agency (NSA) outside the United States, and a key part of the Agency’s global surveillance network.175 The bases uses signal interception technology able to collect data from more than 300 million emails and phone calls each day. Although the base is run by the NSA, work at Menwith Hill is carried out by teams of UK and US personnel, aided by supercomputers which process the colossal amounts of data which are captured.

Work at Menwith is highly secret, but a 2016 investigation by The Intercept176 revealed that Menwith Hill operates two main spying techniques: ‘FORNSAT’, which uses antennae located in golf ball-like domes to intercept communications between satellites; and ‘OVERHEAD’, which locates and monitors wireless communications such as mobile phone and Wifi signals using US satellites orbiting above targeted countries. This data is used to provide intelligence for US ‘capture-kill operations’ across the Middle East and North Africa.

Menwith Hill is deeply involved in the USA’s ‘Global War Against Terrorism’ in Afghanistan, Iraq, Yemen, and Somalia and targeted killing of terrorists. Questions remain over the extent to which intelligence from the base is used in targeting drone strikes, although Menwith has certainly conducted operations which relate to countries where the US conducts drone strikes.

171 Jamie Doward: op cit.
175 See, for example, Menwith Hill Accountability Campaign: https://themhac.uk/
Selected key locations UK-US drone operations

- Creech AFB
- Holloman AFB
- Ramstein AB
- Ali Al Salem AB
- CAOC, Al-Udeid AB
- Kandahar Airfield
- CAOC, Al-Udeid AB
- PJHQ Northwood
- Croughton
- GCHQ Cheltenham
- Menwith Hill
- Waddington
- Digby
- Molesworth
- Wyton
- Croughton
- Colerne
- Oakhanger
- PJHQ Northwood
- Waddington
- Digby
- Molesworth
- Wyton
- Croughton
- Colerne
- Oakhanger
- PJHQ Northwood

Legend:
- Red: Bases from which crews fly drones remotely.
- Green: Crew training location.
- Purple: Communications node.
- Blue: Command and control of drone operations.
- Dark blue: Bases where drone aircraft are or have been located.
- Brown: Intelligence processing.
4.6 Maintenance, training, and contractual arrangements

Logistics and maintenance support

Reaper aircraft are built by the American company General Atomics Aeronautical Systems Inc, which ultimately means that the RAF is dependent upon General Atomics for the supply and, to large extent, maintenance of the system. Only General Atomics, its approved contractors, or suitably trained personnel can replace and fix particular components of the Reaper aircraft and its control system. A list of major contractors who undertake work relating to RAF Reaper aircraft is shown in Table 2.

<table>
<thead>
<tr>
<th>Table 2 Companies used for maintenance and / or support of RAF Reapers</th>
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<tbody>
<tr>
<td><strong>General Atomics Aeronautical Systems Inc.</strong></td>
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<tr>
<td><strong>Honeywell International Inc.</strong></td>
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<tr>
<td><strong>Raytheon Company</strong></td>
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<td><strong>MAG Aerospace</strong></td>
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<tr>
<td><strong>Cobham plc</strong></td>
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<td><strong>L3</strong></td>
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The UK government has signed a number of contracts with General Atomics for “contractor logistics support” for the UK Reaper programme (see below). In 2018 the US State Department approved a major $500 million contract between the UK government and contractors General Atomics and MAG Aerospace for continued follow-on support to the RAF’s Reaper programme. The arrangement covered “contractor logistics support, manpower and base support, publication and technical documentation, depot and organizational level maintenance and equipment, minor modifications and upgrades, software support, spare and repair/return parts, program studies, U.S. Government and contractor engineering and technical support, and other related elements of program support.” The contract was considered necessary to maintain the operational readiness of the UK’s Reaper programme and enable the UK to continue to operate its fleet of Reapers in support of coalition operations. MAG Aerospace, General Atomics’ partner as prime contractor, is an American company which specialises in outsourced ISR services and provides “all aspects of technical management, training and logistics to support the full-spectrum of Unmanned Aircraft Systems.”

In some cases, General Atomics subcontracts out maintenance work on Reaper systems to other contractors. General Atomics has a contract with Cobham Special Mission, a British defence contractor, for the provision of maintenance support for Reaper Ground Control Stations located at RAF Waddington. Cobham’s technicians were required to complete formal training with General Atomics and then undertake on-the-job-training before they are moved to Waddington to deliver the service to the RAF.185

Crew training

Much of the training for RAF Reaper crews takes place as part of the Foreign Military Sales package which the Ministry of Defence has purchased from the US government. Training takes place through standard US Air Force courses.

According to the RAF website, training for Reaper pilots who are not already experienced military pilots begins in the UK with Elementary Flying Training, including learning to fly the RAF’s ‘Tutor’ aircraft.186 For the next stage in the programme the pilots are sent to the US Air Force’s Reaper Formal Training Unit at Holloman Air Force Base in the USA, which acts as a hub for training all new Reaper crew members. As well as USAF and RAF personnel, students at Holloman AFB include student Reaper crews from other European nations which operate the drone.187 The course lasts for six months and includes ground school classes and learning how to operate the aircraft and its weapons and sensors. Classroom based training covers aircraft systems, engine, communications links, weapons and aircraft limits. Live flying and simulation-based training covers operation of the aircraft, general handling, emergency handling, basic tactics, basic mission sets and weapons employment.188

Training at Holloman Air Force Base is provided by a mixture of US Air Force personnel and contractors. A small number of RAF instructors are embedded with the USAF at Holloman and assist in delivering training to students of all nationalities on the training courses.189 CAE USA Inc. is the prime contractor on the aircrew training program at Holloman and provides the majority of classroom and simulator training, and some live flying instruction for student pilots and sensor operators, as well as assisting in course development.190

Launch and recovery training covering all aspects of launching and landing the Reaper is provided at Creech Air Force Base by both US and UK trainers for crews assigned to this task. Some further training, for example instructional support in Reaper tactics and procedures, takes place using flight simulators at RAF Waddington and Creech AFB through the RAF’s own contract arrangements.191 A local Lincoln-based company, Inzpire, has been contracted by the RAF to deliver a RPAS qualified weapons instructor course.192

187 Information from expert informant 2.
The US Air Force has long had a shortage of personnel for Reaper operations and is keen to train up more crews for its drones. The number of slots available to foreign allies at the Holloman AFB training school is limited because the USAF is prioritising its own needs, and the RAF believes it may not be able to fulfil its future training needs through the US school. As a result, it would like to set up its own domestic training arrangements. CAE has been awarded a contract by General Atomics to develop a comprehensive synthetic training system for the United Kingdom’s Protector programme. The training system, similar to a flight simulator, will include desktop and high-fidelity mission trainers that will be based on the Protector ground control station. CAE will also provide brief/debrief and scenario generation stations as part of the training system. The first deliveries of the synthetic training system are scheduled for delivery in 2020 to RAF Waddington. If the new Protector drone gains certification to fly in UK airspace, it may eventually be possible to extend training in the UK to include live flying.

Training of RAF Reaper personnel “was, and continues to be, carried out by the US Air Force through a Foreign Military Sales (FMS) agreement with the US government” and the MoD insist they are not aware what contractors or sub-contractors are used to carry out the training.
Sale and contractual arrangements

As is the case with other military equipment programmes, the RAF’s existing Reaper drones have been purchased from the US government through a Foreign Military Sales (FMS) agreement, rather than purchased directly as a commercial sale from the manufacturer, General Atomics. As well as providing the aircraft and ground control stations, General Atomics also undertakes maintenance of the equipment and provides training for RAF Reaper personnel. Hellfire missiles, which currently arm the RAF’s Reaper drones, are also procured from the USA through a similar arrangement.\(^{196}\)

The Foreign Military Sales programme is the US government’s process for transferring military equipment, services, and training to selected international partner nations. The programme uses the US Department of Defense’s own acquisition system to procure items on behalf of partner nations. The programme provides contract arrangements that may not be available through normal commercial sales channels and also helps lower unit costs by linking orders for FMS customers with the Department of Defense’s own purchases. They are also intended to nurture long-term relationships with the US military, increase opportunities for interoperability with US forces, and provide access to joint training, doctrine, and infrastructure construction.\(^{197}\) The scheme allows the RAF to specify particular equipment it wants on its Reaper aircraft to meet its own needs as a bespoke package, rather than just buy an off-the-shelf product.

The US government is clear that the FMS programme is designed to work in its own interests: it is funded by administrative charges to foreign purchasers, rather than from US government funds, and serves the US’s own security interests. The FMS contract announcement for logistics support for the UK Reaper programme explains that “this proposed sale will support the foreign policy and national security policies of the United States by helping to improve the security of a NATO ally which has been, and continues to be, an important partner on critical foreign policy and defense issues.”\(^{198}\)

Some of the various FMS contracts awarded by the US government in relation to the RAF’s Reaper programme are shown in Appendix 3. The majority of them relate to contractor logistics support provided by General Atomics: activities such as the repairs, maintenance, and servicing of Reaper aircraft and their onboard systems and software; on-base support; and the provision of spare parts. General Atomics and MAG Aerospace have also been contracted to develop and manage Reaper Operations Centres – the operations rooms from which the squadron’s activities are overseen – for the RAF at Creech Air Force Base and RAF Waddington.

Arrangements for the new Protector drone are a little more elaborate. Although the system is largely being acquired and developed through FMS arrangements with the US government, the RAF also has a number of Direct Commercial Sales contracts with General Atomics.\(^{199}\) This appears to be, at least in part, because the core FMS contract for Protector when originally negotiated did not include a detect-and-avoid capability – essential to allow the aircraft to

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fly in non-segregated airspace where civilian aircraft can operate. Arrangements for provision of the necessary capabilities have subsequently been negotiated directly with General Atomics.

It is not possible to use the information in Table 2 to obtain a precise figure for the cost of the RAF’s Reaper programme as some of it may relate to contracts which ‘overlap’, and the information published by the US government is not considered to be a full list of contracts. For the purposes of comparison, in response to a request made under the Freedom of Information Act, MoD told Drone wars UK that capital costs of the RAF’s Reaper programme totalled £162.7 million pounds over the period from October 2006 until the end of the 2019/20 financial year, with revenue costs over the same period totalling £349.2 million, giving a total of £511.9 million. In contrast, the estimated costs of the new Protector drone programme are £1,141.8 million.

The RAF is currently working closely with General Atomics to shape the development of the Protector drone. A Protector Combined Test Team consisting of pilots, sensor operators, and engineers from the RAF, the various contractors involved, and the US Air Force, has been established to act as a liaison hub for co-ordinating testing and evaluation of the new aircraft to pave the way for its entry into service. This is consistent with a history of conducting test and evaluation work for the RAF’s Reaper programme in the USA. In late 2013–early 2014 the RAF’s Air Warfare Centre Unmanned Air Systems Test & Evaluation Squadron conducted trials and live firing tests against a variety of targets at the US Naval Air Weapons Station at China Lake, California, to evaluate the use of the Brimstone missile on Reaper aircraft.

Certain elements of the Protector programme have been contracted out to British arms companies by General Atomics. For example, BAE Systems has signed a memorandum of agreement with General Atomics to support development of a concept of operations for Protector in UK airspace. MBDA and Raytheon UK have been contracted to integrate the Brimstone 3 missile and Paveway 4 precision guided bomb on Protector.\(^{204}\) Other subcontractors include GKN, Leonardo, Ultra Electronics, Abaco Systems, Cobham, Daco Hand Controllers and the Defence Electronics and Components Agency.\(^{205}\)

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Conclusion

The United Kingdom is a trusted and privileged partner to the United States across all areas of military co-operation, but particularly so in relation to drone operations. Through its Reaper programme, the RAF has been granted access to a highly sophisticated technological package which remains far in advance of rival systems. Development of the new Protector drone is helping to advance the technology still further to allow its use in a broader sphere of operations.

Because of its reliance on American technology, this partnership clearly imposes some degree of dependence on the US government, armed forces, and contractors by the RAF. The degree of dependence has evolved as the RAF’s armed drone programme has itself developed. At its inception the RAF’s programme was an operation entirely located within the US Air Force’s Predator programme. Although it worked under its own rules of engagement and soon developed its own operating protocols, it depended heavily upon US bases, control structures, and infrastructure for its viability – and remains so to a significant extent. The RAF Reaper programme continues to mature, though, and it is apparent that the Air Force hopes that the entry into service of Protector will provide opportunities for increasing independence from US operational and support frameworks.

The UK’s partnership with the US over Reaper provides the RAF with state-of-the-art drone technology which, the government would claim, is invaluable in fighting the type of war which is currently underway in the Middle East. But it has its costs as well. Harmonisation of equipment and concepts of operation with the US helps to tie the UK into ‘coalition’ wars led by the US which have the hallmarks of interoperability between forces and a single centre of command and control. Drone Wars UK and others have criticised the very concept of remote warfare conducted by drone, which governments might be tempted to see as an easy, risk-free, technology-based approach to resolving conflict through the use of force. Britain’s traditionally close military relationship with the US, in providing bases on UK territory, sharing intelligence information, and pursuing policy options which closely align to those of the US government, increase the likelihood that the UK’s Reaper drone operations will be led by the US to a greater extent than the government might care to admit. For these reasons, as much as the commonality in aircraft and equipment, the UK’s Reaper programme is unlikely ever to become a fully independent, stand-alone programme.

It is clear that the UK government is working closely with the US on military drone operations but there remains a high degree of secrecy about this. This is problematic, because the US government’s approach to some aspects of its drone operations, such as conducting targeted killings and undertaking covert operations in countries with which it is not at war, is widely seen as being at odds with acceptable international standards. The UK government’s ambiguity over whether, or how, it may be involved in such is undermining its professed desire to be seen as a responsible operator of armed drones. Intelligence sharing, in particular, is a murky area where there are lingering suspicions that the UK may be assisting US drone operations which cross the line on what is lawful.

But the close relationship between the UK and the US in relation to drone operations is not just dangerous because the UK is being drawn into supporting problematic US drone operations. As we have seen, while the UK is the junior partner, it is without doubt a joint enterprise and the UK is learning and adopting many of the fundamental policies and ways of operating drones from the US. The very DNA of US drone operations has been transplanted into UK air power doctrine and political decision resulting in UK drone targeted killing operations and the adoption of ‘kill lists.’

The Ministry of Defence is in a position to address these concerns by taking a more open approach to decision-making on drone operations and routinely publishing key information on decisions, drone strikes, and joint operations. MoD could also demonstrate its commitment to being a responsible drone operator by increasing the transparency of its drone operations, logistics, and procurement processes. This would provide evidence to demonstrate that the UK is operating an independent military programme which complies with international law, and result in increased confidence in the UK’s armed forces from the public and international community.
## List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AB</td>
<td>Air Base</td>
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<tr>
<td>AFB</td>
<td>Air Force Base</td>
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<tr>
<td>AFRICOM</td>
<td>United States Africa Command</td>
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<tr>
<td>AGS</td>
<td>Alliance Ground Surveillance</td>
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<tr>
<td>AOC</td>
<td>Air and Space Operations Centre</td>
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<tr>
<td>CAOC</td>
<td>Combined Air Operations Centre</td>
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<tr>
<td>CENTCOM</td>
<td>United States Central Command</td>
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<tr>
<td>CJTPF</td>
<td>Combined Joint Predator Task Force</td>
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<tr>
<td>COMSATCOM</td>
<td>Commercial Satellite Communications</td>
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<tr>
<td>DIFC</td>
<td>Defence Intelligence Fusion Centre</td>
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<tr>
<td>FMS</td>
<td>Foreign Military Sales</td>
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<tr>
<td>GCGQ</td>
<td>Government Communications Headquarters</td>
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<tr>
<td>GCS</td>
<td>Ground Control Station</td>
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<tr>
<td>JTAC</td>
<td>Joint Terminal Attack Controller</td>
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<td>JHRC</td>
<td>Joint Human Rights Committee</td>
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<tr>
<td>JIAC</td>
<td>Joint Intelligence Analysis Centre</td>
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<tr>
<td>MILSATCOM</td>
<td>Military Satellite Communications</td>
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<tr>
<td>ISTAR</td>
<td>Intelligence, Surveillance, Target Acquisition and Reconnaissance</td>
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<tr>
<td>ISC</td>
<td>Intelligence and Security Committee</td>
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<tr>
<td>ISR</td>
<td>Intelligence, Surveillance, and Reconnaissance</td>
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<tr>
<td>LRE</td>
<td>Launch and Recovery Element</td>
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<tr>
<td>MCE</td>
<td>Mission Control Element</td>
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<tr>
<td>MoD</td>
<td>Ministry of Defence</td>
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<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>MUOS</td>
<td>Mobile User Objective System</td>
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<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organisation</td>
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<td>NSA</td>
<td>National Security Agency</td>
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<td>NSC</td>
<td>National Security Committee</td>
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<td>PJHQ</td>
<td>Permanent Joint Headquarters</td>
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<tr>
<td>plc</td>
<td>Public Limited Company</td>
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<tr>
<td>RAF</td>
<td>Royal Air Force</td>
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<tr>
<td>ROE</td>
<td>Rules of engagement</td>
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<tr>
<td>RPAS</td>
<td>Remotely Piloted Aircraft System</td>
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<td>SATCOM</td>
<td>Satellite communications</td>
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<tr>
<td>SDF</td>
<td>Syrian Democratic Forces</td>
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<tr>
<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<td>USA</td>
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</tr>
<tr>
<td>USAF</td>
<td>United States Air Force</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 1

Expert informants

During this study Drone Wars UK conducted interviews and received advice from four expert informants with knowledge and experience of the UK’s Reaper programme. Some of these interviewees requested to remain anonymous.

Expert 1 A researcher with an interest in military air systems at a UK-based think tank. Interview conducted by Peter Burt on 4 March 2019.

Expert 2 A defence journalist specialising in reporting on RAF air operations. Interview conducted by Peter Burt on 2 April 2019.

Expert 3 An academic whose research has extensively covered drone operations. Interview conducted by Peter Burt on 13 March 2019.

Expert 4 A senior academic in the military studies field who has conducted in-depth investigations on drone operations. Interview conducted by Peter Burt on 6 April 2019.
### APPENDIX 2

Selected examples of cases where RAF Reaper drones have supported other coalition aircraft in conducting strikes in Iraq and Syria.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 Feb 2015</td>
<td>A Reaper used Hellfire missiles to attack a group of terrorists and a heavy machine-gun position. The aircraft then supported coalition fast jets striking additional terrorist positions nearby.</td>
<td>Western Iraq</td>
</tr>
<tr>
<td>4 Sept 2015</td>
<td>A Reaper patrol supported two coalition air strikes on terrorist positions on Friday 4 September, then conducted its own attack on an ISIL team.</td>
<td>Anbar, Iraq</td>
</tr>
<tr>
<td>14 Sept 2015</td>
<td>A Reaper operating over Anbar province, struck a pair of terrorists who had been spotted preparing a booby-trap, then supported two further coalition air strikes in the area.</td>
<td>Anbar, Iraq</td>
</tr>
<tr>
<td>23 Oct 2015</td>
<td>The Reaper then supported another coalition aircraft in a successful strike on a second terrorist vehicle which had been identified nearby.</td>
<td>Anbar, Iraq</td>
</tr>
<tr>
<td>26 Dec 2015</td>
<td>On Saturday 26 December, another Reaper patrolled over northern Iraq, where it destroyed a terrorist vehicle with a Hellfire, then supported a coalition air strike on a Daesh tunnel entrance.</td>
<td>Northern Iraq</td>
</tr>
<tr>
<td>1 Jan 2016</td>
<td>On Friday 1 January, an RAF Reaper supported coalition air strikes in Ramadi.</td>
<td>Ramadi, Iraq</td>
</tr>
<tr>
<td>19 Feb 2016</td>
<td>Our Reaper assisted in one coalition air strike, then used a Hellfire to destroy an Daesh improvised armoured vehicle.</td>
<td>Near Raqqa, Syria</td>
</tr>
<tr>
<td>28 Oct 2016</td>
<td>The Reaper also supported a follow-up attack by coalition aircraft which destroyed an ammunition truck nearby.</td>
<td>Eastern edge of Mosul, Iraq</td>
</tr>
<tr>
<td>23 Nov 2016</td>
<td>The Reaper directly supported one coalition air attack on an armed vehicle, and used three of its own Hellfires to destroy two Daesh mortars and a recoilless anti-tank gun.</td>
<td>South East of Mosul</td>
</tr>
<tr>
<td>5 Oct 2017</td>
<td>[A Reaper] also supported two further strikes by coalition aircraft.</td>
<td>North East of Dayr az Zawr, Syria</td>
</tr>
<tr>
<td>9 Oct 2017</td>
<td>A Reaper spotted a concealed truck-bomb, which allowed a coalition fast jet to destroy it with an accurate strike.</td>
<td>North East of Dayr az Zawr, Syria</td>
</tr>
<tr>
<td>13 Oct 2017</td>
<td>The Reaper’s crew then provided surveillance support to a coalition air strike on another position in the area.</td>
<td>North East of Dayr az Zawr, Syria</td>
</tr>
<tr>
<td>14 Oct 2017</td>
<td>A Reaper successfully engaged one small group of terrorists with a Hellfire, then provided support to two air strikes on further extremists operating on foot nearby.</td>
<td>North West of Abu Kamal, Syria</td>
</tr>
<tr>
<td>1 Dec 2017</td>
<td>A Reaper worked very closely with two flights of coalition aircraft, some fifteen miles north-west of Abu Kamal. The Reaper supported seven attacks by the coalition jets against several groups of terrorists, an armed truck and a Daesh-held building.</td>
<td>North West of Abu Kamal, Syria</td>
</tr>
<tr>
<td>3 Dec 2017</td>
<td>Our [Reaper] aircraft provided surveillance support to a successful coalition air attack; then used a Hellfire missile to eliminate a group of terrorists.</td>
<td>North East of Abu Hammam, Syria</td>
</tr>
<tr>
<td>23 Dec 2017</td>
<td>A Reaper remotely piloted aircraft worked closely with coalition jets on Saturday 23 December near Abu Hammam. The Reaper’s crew provided surveillance support to a coalition air strike on a Daesh-occupied building.</td>
<td>Near Abu Hammam, Syria</td>
</tr>
<tr>
<td>7 Jan 2018</td>
<td>Sunday 7 January saw a Reaper once again working with coalition fast jets over the Euphrates, in support of the SDF. The Reaper observed a group of terrorists assembling under a tree, around twenty miles south-east of Mayadin, allowing a prompt and effective strike by another coalition aircraft.</td>
<td>South East of Mayadin, Syria</td>
</tr>
<tr>
<td>10 Jan 2018</td>
<td>Another Reaper worked closely with coalition surveillance aircraft and fast jets in a series of strikes in support of the SDF advance. Our aircraft supported coalition air attacks on a Daesh-held building and a mortar position.</td>
<td>South East of Mayadin, Syria</td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Location</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>13 Jan 2018</td>
<td>A Reaper worked very closely with another coalition armed reconnaissance aircraft on Saturday 13 January, again to the north of Abu Kamal. Our aircraft spotted a second terrorist drone team launching a quadcopter from a rooftop, and kept close watch on them whilst the coalition aircraft manoeuvred into a suitable firing position from which it successfully attacked the drone team. The Reaper supported a further two successful attacks by its coalition companion.</td>
<td>North of Abu Kamal, Syria</td>
</tr>
<tr>
<td>18 Jan 2018</td>
<td>As well as conducting their own attacks, the Reapers also provided targeting and surveillance support to seven attacks by coalition aircraft, against a range of terrorist positions, including two engineering vehicles being used by Daesh, and a large group of terrorists mounted on motorcycles, whom our aircraft tracked to a compound, where they were successfully targeted by a fast jet.</td>
<td>North of Abu Kamal, Syria</td>
</tr>
<tr>
<td>20 Jan 2018</td>
<td>[A Reaper] provided targeting and surveillance support to four coalition air strikes, including one which destroyed a munitions stockpile detected when the Reaper spotted terrorists delivering weapons to the building.</td>
<td>North West of Abu Kamal, Syria</td>
</tr>
<tr>
<td>21 Jan 2018</td>
<td>The Reaper then conducted a further two Hellfire attacks on terrorist positions, and supported a successful coalition air strike.</td>
<td>Euphrates valley</td>
</tr>
<tr>
<td>1 Feb 2018</td>
<td>Several coalition aircraft, including an RAF Reaper and two Tornados, supported the SDF as they cleared a village of terrorists on 1 February. The Reaper spotted an anti-tank gun team firing at the SDF, and guided the strike on the weapon team by a coalition aircraft.</td>
<td>Syria</td>
</tr>
<tr>
<td>9 Feb 2018</td>
<td>A Reaper provided surveillance support to a series of coalition air strikes on terrorist targets.</td>
<td>Syria</td>
</tr>
<tr>
<td>10 Feb 2018</td>
<td>The Reaper’s crew then tracked a local terrorist command team as it moved between locations, supporting a successful attack by coalition fast jets.</td>
<td>Syrian Arab Republic</td>
</tr>
<tr>
<td>3 June 2018</td>
<td>An RAF Reaper remotely piloted aircraft patrolled over eastern Syria on Sunday 3 June. It provided surveillance support to a coalition air attack on a terrorist vehicle.</td>
<td>Eastern Syria</td>
</tr>
<tr>
<td>15 Dec 2018</td>
<td>A Reaper supported a coalition airstrike, then employed Hellfire missiles to engage three groups of terrorists.</td>
<td>South East of Hajin, Syria</td>
</tr>
<tr>
<td>16 Dec 2018</td>
<td>The following day, a Reaper spotted a large group of extremists advancing towards the SDF. The Reaper helped disrupt this attempted attack with a series of three Hellfire and one GBU-12 engagements and also provided surveillance support to other coalition aircraft.</td>
<td>Syria</td>
</tr>
<tr>
<td>1 Jan 2019</td>
<td>Surveillance support was given to a coalition air strike on a Daesh strong-point, and the Reaper’s crew then tracked terrorists as they attempted to take up new positions, engaging them with a Hellfire missile.</td>
<td>South East of Hajin, Syria</td>
</tr>
<tr>
<td>6 Jan 2019</td>
<td>The Reaper tracked a Daesh group to a compound some miles north of Abu Kamal, and provided targeting support to coalition fast jets as they subsequently delivered an attack.</td>
<td>North of Abu Kamal, Syria</td>
</tr>
</tbody>
</table>

**Note:** This table is based on excerpts from published government sources and does not claim to be a full record of cases where RAF Reaper drones have assisted air strikes undertaken by other nations.

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## APPENDIX 3

Contracts awarded by the US government and won by American companies for support to the Royal Air Force Reaper programme.

<table>
<thead>
<tr>
<th>Contract duration</th>
<th>Type</th>
<th>Contractor</th>
<th>Value</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaper programme</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Dec 2012 – 31 March 2015</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$42.9 million</td>
<td>Phase 1 and 2 contractor logistics support to the British MQ-9 fleet.208</td>
</tr>
<tr>
<td>31 Dec 2013 – 31 March 2015</td>
<td>Foreign Military Sale</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$31.9 million</td>
<td>United Kingdom contractor logistics support phase 1 and 2 effort consisting of urgent repairs and services, logistics support, field service representative support, contractor inventory control point and spares management, depot repair, flight operations support and field maintenance.209</td>
</tr>
<tr>
<td>20 Jan 2015 – 31 Oct 2015</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$34.6 million</td>
<td>United Kingdom contractor logistics support programme.210</td>
</tr>
<tr>
<td>28 Dec 2015 – 31 March 2017</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$57.4 million</td>
<td>Contractor logistics support.211</td>
</tr>
<tr>
<td>Awarded 5 April 2018</td>
<td>Approval of possible Foreign Military Sale</td>
<td>General Atomics Aeronautical Systems Inc. and MAG Aerospace</td>
<td>$500 million</td>
<td>Continued follow-on support to the UK MQ-9 Reaper programme including: contractor logistics support, manpower and base support, publication and technical documentation, depot and organizational level maintenance and equipment, minor modifications and upgrades, software support, spare and repair/return parts, programme studies, US Government and contractor engineering and technical support, and other related elements of program support.212</td>
</tr>
<tr>
<td>21 March 2019 – 30 September 2021</td>
<td>Foreign Military Sales</td>
<td>MAG Aerospace</td>
<td>$11.3 million</td>
<td>Ongoing sustainment, management, development and network administration of the United Kingdom MQ-9 Reaper Operations Centres.213</td>
</tr>
<tr>
<td>26 March 2019 – 30 June 2019</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$9.2 million</td>
<td>Contractor logistics support effort for ongoing sustainment of the UK MQ-9 fleet.214</td>
</tr>
<tr>
<td>17 June 2019 – 30 September 2021</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$90.9 million</td>
<td>Contractor logistics support phase IV programme providing for depot repair, life cycle sustainment, and software maintenance services.215</td>
</tr>
</tbody>
</table>

**Protector programme**


<table>
<thead>
<tr>
<th>Contract duration</th>
<th>Type</th>
<th>Contractor</th>
<th>Value</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 November 2016 (Possible sale)</td>
<td>Approval of possible Foreign Military Sale</td>
<td>General Atomics Aeronautical Systems, Inc</td>
<td>$1.0 billion</td>
<td>Sale of: Up to 26 Certifiable Predator B Remotely Piloted Aircraft (16 with option for additional 10); 12 Advanced Ground Control Stations (8 with option for additional 4); 4 New Launch and Recovery Element GCSs; 4 Upgrades to existing Block 15 Launch and Recovery Element GCSs (2 with option for additional 2); 25 Multi-spectral Targeting Systems (12 + 2 spares, with option for additional 10 + 1 spare); 25 AN/APY-8 Lynx Ile Block 20A Synthetic Aperture Radar and Ground Moving Target Indicators (12+ 2 spares, with option for additional 10 + 1 spare); 86 Embedded Global Positioning System/Inertial Guidance Units (3 per aircraft) (48 + 5 spares, with option for additional 30 + 3 spares). This sale also includes communications equipment, Identification Friend or Foe equipment; weapons installation kits; TPE331-10YGD engines; unique and common spares package; support equipment; US Air Force technical orders; country specific technical orders; contractor logistics support for two (optional three) years; contractor provided aircraft components, spares, and accessories; personnel training; and other related elements of logistical and program support.</td>
</tr>
<tr>
<td>Awarded 6 April 2018</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$81 million</td>
<td>Integration and component level testing for UK specific enhancements to support the MQ-9B Protector programme.217</td>
</tr>
<tr>
<td>Awarded 12 September 2019</td>
<td>Direct Commercial Sale</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>Not stated.</td>
<td>Complete the test and evaluation activities required to certify the Protector RG Mk1 Remotely Piloted Aircraft system to fly in civil airspace. The contract also funds additional Protector programme elements, including X-band SATCOM system verification, training material development and logistics planning.218</td>
</tr>
<tr>
<td>23 October 2019 - 31 August 2021</td>
<td>Foreign Military Sales</td>
<td>General Atomics Aeronautical Systems Inc.</td>
<td>$21.7 million</td>
<td>Design, development, integration and component level testing of additional capabilities being added to the baseline program for UK MQ-9B Protector programme.219</td>
</tr>
</tbody>
</table>

Notes: This table does not provide an exhaustive list of contracts or contract modifications relating to the RAF Reaper programme. Costs shown are not necessarily additive: they may in some cases represent modifications to previous contracts or elements of broader contracts.
