



All Party Parliamentary Group on Drones

Oral evidence: APPG Inquiry into [‘The Use of Armed Drones: Working with Partners’](#)¹

Wednesday 7 December 2016

Members present: Kirsten Oswald MP; Lord Hodgson of Astley Abbots; Baroness Stern; Lord Macdonald of River Glaven; Douglas Chapman MP

Chair: Professor Michael Clarke

Witnesses: General Sir Richard Barrons; Air Marshal Greg Bagwell; Air Marshal Iain McNicoll

Q1 Prof Clarke (Chair): the APPG on Drones is running an inquiry into the use of armed drones, particularly looking at working with partners. I am the independent chair for this inquiry, Professor Michael Clarke. Members of both Houses are represented around the table. This is our first evidence session and we thank the witnesses for agreeing to give evidence. Please note that we are not operating as a select committee of the House. I’d like to begin with a question to General Barrons. In terms of the MOD policy review that is being conducted and is expected to conclude in early 2017 on remotely piloted but also on wider highly automated systems, I wondered if General Barrons might be able to give us some idea of what you feel is the direction of travel.

General Barrons: there are some things that are certain, and some things that are becoming inevitable which I don’t think we have thought enough about. The things that are certain are the sort of capability represented by remotely piloted air systems that have become a normal part of the business of gathering intelligence and conducting precision strike operations. They are now clearly integrated into the intelligence, surveillance and military operations of a number of countries that have this capability. However, we should also recognise that what we have seen so far are remotely piloted air vehicles, where there is a man, in fact there are a lot of people, making it fly and taking the crucial decisions about where it goes, what it does and when it applies lethal force. Although these things have become very common in the campaigns in Iraq and Afghanistan and in counterterrorism theatres, we have become used to using them in an environment where no one is contesting the airspace, and so to some degree they have bred an alliance which is not possible to conceive of having in settings where people are contesting the same airspace. Therefore

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there is a balancing act there. It is also clear that there is a trend in investment away from manned aircraft towards unmanned aircraft. I would be surprised in future if refuelling aircraft are necessarily manned, for example.

However, just behind there are already advances in land, on the sea and under the sea. These so far have taken less attention but of course the principles and the law governing such an operation should be the same. So although I think these are things that will become normal business, what I think we now will see remarkably quickly are how the constituent parts of what is called the fourth industrial revolution are going to change not only how we live and work in our normal lives but also how military capability is perceived and operated. By which I mean, as led by the civil sector, advances in big data, connectivity, processing, artificial intelligence, robotics and autonomous systems, will lead to us seeing rapid acceleration of capability that is autonomous and unmanned, and we will see a decline in platforms that are manned. That is going to produce for the military a range of challenges, such as command and control and logistics. The questions I think that will come round really quite soon are what are the permissions we are prepared to grant to autonomous systems - to machines acting in accordance with an algorithm - and in particular at what point are they to apply lethal force without there being a man or woman in the loop. In having that discussion it's important to remember that there is no single rule book for this evolutionary capability. Whatever we might like to think in the UK or in NATO, we should be very interested in how other states and non-state actors that acquire similar capabilities feel about a capability that is autonomous, acting in accordance with an algorithm that results in the use of lethal force. We should recognise that there are enormous advantages in the evolution of unmanned and autonomous capabilities. It takes people out of the equation. It reduces the exposure of individuals to risk. You may provide some scope for more deniability, though I doubt that. It should increase the effectiveness and cost effectiveness of platforms in the air, on land and at sea because they are no longer driven by a human being with the need to stop every now and again to sleep, eat and get outside. And therefore in defence budget terms they are a significant capability. So I think conducting this inquiry without having a firm eye on what is about to happen inevitably as military capability, riding on the back of the fourth industrial revolution, transforms rapidly into a much greater reliance on unmanned, and genuinely autonomous systems.

Prof Clarke: you seem to be implying that the technological revolution may change the basis upon which permissions may be granted?

General Barrons: I think the challenge comes when you move from an unmanned system, where you have a man who is controlling what the system does, and when it does or does not apply lethal force, for which the rules are very clear. The world that is coming is how you will mix manned, unmanned and genuinely autonomous systems to build the most effective military capability at a price you can afford. The issue that is coming is where you have a machine driven by an algorithm, where there is not a man driving it, that is

capable of applying lethal force. In what circumstances will that be acceptable? What I urge is that we will have very clear views based on our values, but many people we may confront or conflict with will have a different rule book. We must know, on our view of international law and the law of armed conflict, how we are going to respond to it. Obviously North Korea is going to think very differently about machines, perhaps in the demilitarized zone, that kill on the basis of an algorithm without the need for a human being.

Prof Clarke: do the other witnesses want to comment on how the technological revolution may affect the environment in which these permissions are created?

Air Marshal McNicoll: I agree with almost everything General Barrons said. This important distinction between remotely operated and autonomous is very important. We have been operating remotely piloted air systems (RPAS) with a person very firmly in charge, and also in a pretty benign, in air defence terms, environment. I think moving to autonomous operations is relatively easy for intelligence, surveillance and reconnaissance purposes, but is going to be much more problematic in terms of lethal operations. I think the MOD policy review needs to address some of these aspects. On the technical side of things, we are still at the stage where doing more complex operations in a contested environment can probably not be done as well with a remotely operated system. When looking at doing operations such as control for air, we are still going to need a manned vehicle to do that. I think the timescales are probably longer than some people realise. It is probably decades not years to get to that stage, both because of difficulties inherent in autonomous capabilities, but also because of the developmental timescales for some of the capabilities we are talking about. For example, the future combat air system, which is a £1.5 billion programme between the UK and France, started off talking about remotely operated systems, and of course it is things like the Taranis and Neuron which are playing into that, but the sense from the latest thinking is that they are looking perhaps more towards manned systems.

Air Marshal Bagwell: in my view there is no difference between RPAS and a manned system. I would argue that the system that they operate in is more aware, more informed, more capable and in a much calmer environment because it's not in combat, that actually the decision-making process that goes into those are supremely better. So remotely piloted air systems are not a bad thing. Moving to autonomous, these systems already exist. Global Hawk is an autonomous system as once it takes off, it flies to a pre-programmed route and it will then Hoover up the intelligence it has been told to do, and it will come back and land at a place of your choosing. We have weapons systems that are autonomous today. It's not drones or platforms that kill people, it is the weapons systems. There are weapons systems today that can hone in on electronic data, they can hone in on an image that has already been programmed into the system. So you can if you like teach systems to prosecute attacks without someone literally guiding it into the last second. The guns on the back of royal navy ships, if you allow them to, will act autonomously to shoot down weapons systems coming towards those ships. So autonomy already exists and I don't

think we should kid ourselves that it is something for the future. But we can control when that autonomy is allowed to function, which is key. We control the permissions. Though the more intense a conflict and the more important it is to your own national survival, you would probably change the permissions/boundaries of when you would be allowed to deploy them. Because not to employ them would mean needing to get much closer to the enemy which means you may get shot down. The far end of the spectrum is the artificial intelligence part which is probably the conundrum we have all described. But we are already on that spectrum. The question is how far we will go and what permissions we will grant.

Prof Clarke: we want to move on to questions around collaboration which is one of the focus areas of this inquiry.

Q2 Lord Hodgson: is collaboration between the US, European States and other allies the model for future operations?

Air Marshal Bagwell: I will come at this from the perspective of drones because I signed the MOU that governs the operating of Reapers between the US and UK. The first thing you have to understand is that if you buy a different system from another country, to a degree you are already collaborating with them. In fact the very nature of that purchase agreement will attach certain restrictions on things such as what you can do with it. So collaboration, particularly in relation to international procurement programmes, is there by definition. In terms of deployment, that is a good thing. If you are buying common systems which use a common language, common data, and common procedures, that makes it far simpler for you to operate and co-operate together. In the air domain we have spent certainly in the last 30 or 40 years a lot of money on being able to cooperate with our allies. If you go into HQ currently conducting operations for Iraq and Syria, you won't see a lot of different flags, you will see a completely coordinated, international approach. It is seamless. Of course different nations may be doing different functions and performing different operations, but collaboration is absolutely part of it, and that includes Arab nations as well. So the collaboration already exists. Where the great advantage lies, particularly the MOU that I signed, is that if you have a system orbiting over a target and you happen to have a national need for use of that system, but it's owned by a different country, the big question is at what point could you, theoretically, take over control of that system and use it to fulfil your specific need. Technically we could do that today. But it depends on the fundamental question, and we have never actually got there yet, which is whether you would actually give permission to do that, either for us to them, or them to us. The MOU only sets a baseline; it never actually got to the specific requirements for a specific operation. Those would have to be negotiated on a case by case basis. But it's not new. 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. Where it becomes complicated is when you don't necessarily agree with someone using your system for their own need, which may or may not be under the rules that you would set for that particular mission.

Lord Hodgson: are there a simple range of different types of joint and assisted operations that you can outline?

Air Marshal Bagwell: there are degrees of cooperation. You can be operating in a common group, i.e. a coalition with common objective, but say, for example, in your lane or boundary, which could be determined by geography, or you may come with your own particular Rules of Engagement because national policy will not allow you to prosecute certain things in certain ways. So there will be either physical boundaries or potentially legal boundaries that you will negotiate, which is why you all have a national representative to ensure that those boundaries are observed and respected. But you can go all the way to the far end of the spectrum, and it happens now, where a British officer could well be authorising an American or Iraqi aircraft to prosecute an attack within the wider coalition mission.

Air Marshal McNicoll: just to move back to the start of this, in 2005 when the UK first starting using the MQ-1 at Creech and in 2007 when UK stood up the MQ-9 Reaper and 39 Squadron, the situation there was very straightforward. We were both, the US and UK, engaged in an identical operation in an identical theatre: Iraq and Afghanistan. In both there was either UN or host nation agreement, so the sovereign legal position was relatively simple. I think I would agree with Prof Clarke's outline that both the technology is changing but the environment is now changing to one that is more complex. If you are looking at counterterrorism operations outside the theatres I've described it becomes more complex.

General Barrons: I think there is an inescapable strategic imperative in our age of interoperability and collaboration. I think this is driven by the simple economics of the prices of these systems and the amount of money we choose to afford to defence. If you look at European members of NATO, the numbers they choose to afford to, for example, unmanned systems, is very modest. So if we are going to be in the world we are in, in order to manage the challenge of protecting the NATO area, or managing effective interventions overseas, at a scale that can be managed, you are going to collaborate with your allies, and it will become norm. That is perhaps a shock to militaries that for some centuries were used to operating independently.

You then have a choice about how you do that collaboration. You could choose just to take a slice for yourself. So for example the British 'ownership' of Basra in Iraq 2003 was seen as us taking our own slice of the operation. That is very inefficient because you have to duplicate all the overheads and there are seams and gaps with your allies about how you work together. As Air Marshal Bagwell has described, it's much more efficient to throw everything into one pot, but when you do that, you are subscribing to a common operational design and the

authority of a coalition commander who must be able to take the decisions he needs to take given the military challenges he faces. So he will use your equipment for purposes he is focused on at the time and place of his choosing. And yes you can box that in particularly in an operation when you own the airspace. You absolutely could not do that in a setting where the enemy was much more dynamic. You also have to frame that strategic discussion when you think about how you will protect the NATO area in the future where none of the European members will have the air, maritime or land capability to secure their own airspace independently, and so they will have to collaborate. To take decisions when you are faced with 5th generation equipment, you will need a system in which you have given national capability into the hands of a coalition commander. If you don't do that, you will fail.

Q3 Lord Macdonald: I'd like to turn to some legal questions. It's well known that in 2015 two British citizens were targeted and killed in drone strikes, Junaid Hussain and Mohammed Emwazi (Jihadi John). Senior US officials speaking to the New York Times on condition of anonymity said that the UK and US governments had met and decided that certain individuals in Isis should be targeted and killed. What is the position inside the services in terms of the legal framework? Is there a degree of anxiety? Is there a legal framework? If there is, by what means is that framework disseminated? There were some reports that RAF commanders have not seen some of the relevant legal advice. So it's a question about how you perceive the legal framework and whether you think there are sufficient legal safeguards, and if there should be more.

Air Marshall Bagwell: I'll speak to that first because I was the operational commander in the Air Force at the time of that strike. That particular strike, and I can't go into too much detail, partly because I wasn't fully aware of all the circumstances. When you put your mission systems into an operational theatre they are allocated to a variety of tasks. Some of those tasks are what we call compartmented. In other words, they are done in a relatively closed network because of the need to understand what's going on, the intelligence that's being used which could well if known wider actually put people at risk. In those circumstances, and this is one, not everyone in the command chain will be aware of what is actually happening. In fact because the systems are deployed into theatre, the operational commander actually responsible for those particular strikes would be in a different country, in this case in CENTCOM in Qatar. He will have overseen that operation and applied, as he would have seen it, the Rules of Engagement. He will have had a legal adviser and policy adviser sat next to him and absolutely will have been crystal clear as far as all the advice to him is concerned that it was a lawful target. Military people at the end of the day are there to follow orders, and as long as they can convince themselves that the legal and policy advice is met, then they carry out the operation. So the individuals in the cabin who are literally pulling the trigger at the time won't often have as much of that detail given to them. They probably will understand the nature of the target and the circumstances around it but the idea that everybody in the command chain will have oversight of every single aspect of the legal

advice is a) not practical, and b) we would never do that anyway because the advice only needs to go to those who need to know, and they would satisfy themselves that the operation is legal.

Lord Macdonald: what you said is very significant. There is a key individual who, as much as anyone, is authorising the operation that has satisfied himself that the operation is ok on the basis of the advice?

Air Marshal Bagwell: yes. In this particular circumstance because of the nature of unmanned systems that information could be passed to a number of people. Theoretically a lot of people could be watching the particular strike. If you have a link you can sit there and watch. But we do have an individual at any given time, 24/7, who sits in that operation centre who we call the national red card holder who will absolutely be assured, particularly in a case like this where there is a very specific target that has been thought through, and is probably a fleeting target, that all those requirements have been met.

Lord Macdonald: would you expect, in that situation, at the point at which the advice is given and the reassurance is given, that the meeting would in some way be noted? What is the chain of record?

Air Marshal Bagwell: you will be pleased to know we don't all bring our own lawyers. We are prosecuting targets on a daily basis where a lot of this information will not be anything like as detailed as this specific case, where it has been thought through by name by time by person. For 99.9% of the targets you won't have that much detail.

Lord Macdonald: if you are targeting a UK citizen in Iraq or Syria then there are all sorts of sensitivities.

Air Marshall Bagwell: sometimes you could be doing that without even knowing.

Lord Macdonald: of course, but if you are deliberately targeting a UK citizen, then some sensitivities arise and one would expect there would be some consideration of the potential legal liability of the people involved in an operation of that sort. Does the service reassure itself that the operation is lawful?

Air Marshal Bagwell: the individuals who were there at the time would have to speak for themselves. I was not there so I can't help you with what actually happened. If they had known, and I would have expected them probably to have known, that they were UK citizens, they still would have turned to the legal advice being given to them through their chain of command, and the policy adviser. In terms of what is written down or what is available is...

Prof Clarke: so there wouldn't necessarily be a written record that could be produced at some later date if required?

General Barrons: from the perspective of a military commander there are two important questions you want to be sure about. First of all, is the military operation you are engaged on lawful? I expect the government to have clear

advice on that and throughout my entire career that has never been an issue. Then there is the separate and related issue which is whether the application of lethal force is lawful. The source for that is the targeting directive. In any military operation, starting at the top of government, a set of rules will be set out which govern what you may target and under what circumstances. Within that set of rules, permissions will be granted to different levels of the chain of command. So we all have the inalienable right of self-defence, we don't need a lawyer to defend ourselves. But you might want a lawyer and a discussion with Ministers if you are about to prosecute a target that is restricted to them. And I think the best example anecdotally is how Obama reserves some decisions to himself on the application of lethal force because they are as much a matter of politics as they are law.

Lord Macdonald: that is the so-called kill list?

General Barrons: yes. In any military operation where you are looking at your enemy, people like me will develop a set of targets. Some of those targets I might be free to prosecute at a time and place of my choosing. Others, because of sensitivities or difficulties, may be reserved to a senior military commander or the government. From my perspective as a military commander, I would prosecute a target in accordance with the law of armed conflict – necessary, proportionate and discriminate – and I would expect to be held to account if I didn't do that, and I would be expected to explain if I prosecuted a target and it had unforeseen consequences. However, in the circumstances of recent campaigns where we generally hold tempo on the operation, and you can choose to do this or not do this, it breeds an approach which is more a lawyers' sort of discussion. That absolutely cannot apply in every set of circumstances, particularly where you are engaged in a higher tempo broader conflict where military commanders need greater permission and greater scope to exercise their judgment.

Lord Macdonald: other interesting legal questions arise when one gets into matters of algorithms and autonomous weapons, such as whether criminal liability may arise in those circumstances, but that might be for another day.

Air Marshal McNicoll: I speak with the luxury of having retired 6 ½ years ago and never having been presented with this sort of case. Three caveats apply here. First, this sort of situation is inherently complex and every case will be different and treated on its merits. Secondly, I recognise that the government shouldn't be obliged to articulate its position on all hypothetical questions in this area for the same reason that Rules of Engagement are not made public, because it potentially gives the enemy a possibility to exploit this and gain an advantage. The third proviso is that there is a distinction between the operational command and the single services full command. The operational commander obviously deals with the situation on the ground or indeed at PJHQ or the MOD. The full command of an individual always resides with the single service that is contributing the individual to the operation. I have an anxiety there because I think the full command responsibility should not interfere in the

operational chain of command, but I do think it should be aware of the legal framework in which they are operating. So I remain unclear as to whether the law of armed conflict does apply to all of these circumstances, or indeed as the Joint Committee on Human Rights said, is it the law of armed conflict or human rights law that would apply to the government's policy to be willing to use lethal force outside of armed conflict against individuals suspected of planning an imminent terrorist attack against the UK. To answer the first question, is there anxiety, there may not be but I think there should be. And secondly, is there a framework, I don't know but I think there should be one.

Prof Clarke: if we are to live in a world in which counterterrorism operations are to be a feature for a long time, we can't apply the law of armed conflict to the whole world.

Air Marshall McNicoll: the Joint Committee on Human Rights took into account in its response the *Al-Saadoon* case, but I don't think and I don't agree with the government on whether that has actually cleared up whether or not the law of armed conflict or human rights law applies.

Q4 Douglas Chapman MP: in terms of the legal position and oversight when engaged in operations with, for example, America, will there be a greater need for that clarity in the law, procedure and oversight come January 20th?

General Barrons: this isn't a new problem. From a military perspective what is helpful is convergence. If conducting a coalition operation, ideally every participant would conform to the same rules and that would make command very straightforward. What has actually happened in the past in some cases is that targets and missions have been apportioned to nations on the basis of their restrictions and permissions. It has mattered a lot on a few occasions but it's often easy to work around this. What is absolutely vital is clarity about what your position as a military commander is. That is for UK forces a well-oiled machine and we understand where the differences are, for example, with the US or with France. It's much more complicated where you are working with a partner you haven't worked with before and on short notice, whether that is a gulf partner or an African nation or Asian nation, where you wouldn't have this experience and preformed set of rules. Of course to echo the point from earlier, when you transition from taking your inventory and applying it to your bit of a coalition that is one thing, but when you put your inventory into a common pot and common command and control, you really need one set of rules. So I think much of this is now normal business but it will never be always entirely straightforward because our partners may change.

Air Marshal Bagwell: at the operational level you will know, you will have that resolved, otherwise you would stop until you could resolve it. If there is a different policy or different strategy above you, that has to solve itself before that then comes down to an operational directive. By the time we get to the actual operational decision, we make sure any conflicts are resolved.

Air Marshal McNicoll: I would agree. The difference between the UK and US on the so-called 'global war on terror' is well understood. I don't think for attack

operations that there is any difficulty caused by that understanding because we simply don't get involved with things that we don't agree with. But I do think that is much more complex in relation to the intelligence picture which is being generated to support that activity. It is such a joint and integrated intelligence network that it would be almost impossible to suggest that a bit of intelligence the UK contributed was not part of an overall attack by the US. I think that's potentially a problem, but disentangling it in practice is possibly not realistic.

Air Marshal Bagwell: but just to reassure you, even today we would have differences in policy or Rules of Engagement that will sometimes say that we can't do a specific thing, or that another nation can't do something because it is operating from our airfield. That happens on a regular basis.

Q5 Kirsten Oswald MP: could you give a brief outline about what the MOU is about, what sort of operations it covers, and who is in charge of tasking and commanding joint or assisted operations?

Air Marshal Bagwell: the first reason for the MOU is that when you buy the US system off the shelf, you do it through a foreign military sales arrangement. They are bilateral arrangements between the US and UK. It's a very binary approach. It does require you to have quite a bureaucratic process to ensure that you have agreed how you are able to operate the system, but more importantly if you are to operate it together, under what principles will you do that. It's fair to say that we would prefer this process to be simpler, but the American foreign military sales procedure does require it and there are good reasons about why they have to follow this when selling arms to foreign nations.

The second reason is that we absolutely saw the value of being able to operate and cooperate together. The MOU doesn't define the specific circumstances in which you could do this. To give a practical example, the Reaper requires a crew to get it airborne, and the reason you have to have a crew nearby to do this is just because of the speed of light. If you were flying the plane from 3000 miles away, the landing and control system would mean you wouldn't be able to control it properly as there would be too much lag. So you have to have a crew and system to do that locally. If we had to put one of our own crews and cabins locally to do that, that's one less cabin and crew for us to have in the UK to operate our systems where we really need to operate them which is close to the theatre of operations. So we have collaborated with the Americans to launch and recover the unmanned systems together. So we can either use a US contractor or US serviceman to do this. We also take off their systems and land their systems. And you literally just hand them over. You flick a switch and hand them over, and you do that on a daily basis. That is relatively uncontentious. There would be an issue if it crashed, but the MOU is there to resolve those issues.

Where the MOU takes you to the far extreme is when you are able to fly each other's systems and able to prosecute targets using that system. Now if we were to do that, then we would have to specifically identify the operation you would do that in, and the legal requirements. This MOU does not cover that. It

would require a separate agreement to identify the principles under which you would do that.

Kirsten Oswald MP: The MoU states that RAF personnel are not to perform duties for the US 'that conflict with the policies, procedures, laws and regulations of the UK.' Could you expand on this?

Air Marshal Bagwell: I can't remember every clause of the MOU, but some of that is just to cover things as basic as just because an individual has been transferred, it doesn't mean they can sweep the mess hall. So it governs the issue of how much the individuals have transferred effectively to the ownership of the other nation. So I think that could be what that clause refers to, because we absolutely allow our personnel to operate the systems.

Q6 Prof Clarke: could we talk about the way in which the red card process works?

Air Marshal Bagwell: if a national commander in the targeting chain thinks that something is about to be done that either was another nation using one of our systems or airfields or fuel to get to a target that we did not believe met our own Rules of Engagement, legal advice and policy advice, then we would use the red card process to say no you can't do that.

Lord Macdonald: so this is a very important mechanism to avoid abuse?

Air Marshal Bagwell: yes, to absolutely ensure that somebody can't use our information or support

Lord Macdonald: what is the legal advice available to a red card holder?

Air Marshal Bagwell: they will have an MOD lawyer and policy adviser available

General Barrons: that sort of discussion goes on not just at the level of the operation, but at the level of PJHQ and the MOD. If you are having a difficult discussion about a high profile target then that will be not only about the law but also about policy.

Lord Macdonald: is there any monitoring of the use of the red card?

Air Marshal Bagwell: there is no physical red card. And General Barrons is right, sometimes these decisions are taken long before someone has to intervene. Therefore it will often never come to pass that someone has to say stop. The red card holder as we know it is normally someone very close to the operational decision making chain who will see things evolve that he may not have predicted either at the operational level or strategic level.

Lord Macdonald: but is there any monitoring of the extent to which these sorts of problems arise?

General Barrons: it would feature in the routine operational reporting. Whether it's counted as a statistic I don't know. But the fact that it has occurred is a big

deal. The aim is to avoid ever being in a situation where you would have to use it. So it would be recorded.

Lord Macdonald: how often would it happen?

Air Marshal Bagwell: I would say it's quite rare, the reason being that the teams involved in operations every day intimately know a) the personalities and b) the circumstances of the operations. They have a very close working relationship and they know where the boundaries are. So actually everything is done to avoid ending up in a position where someone actually has to say stop. So it is quite sophisticated in terms of how you know what you are able to do. To take an example, if someone was looking at a particular target in a particular area that requires either clearance that would be too quick for a UK system to react to, or wasn't within the targeting directive, then you would task a different nation to avoid the circumstance of a conflict actually arising. So everyone is very aware of their legal requirements and ensure that they ideally don't get themselves into the situation in the first place.

When targets evolve very quickly, that is when a red card holder would have to pay a lot closer attention. What you would see is a very quick huddle where the commander, lawyer, and policy adviser would sit there quite quickly and look at each other to decide whether to back off.

Q7 Lord Macdonald: is it technically possible for UK pilots to launch Reapers and then to transfer control of them to US operators. If it is possible, what reassurances would the British part of the operation have as to the nature of the US operation?

Air Marshal Bagwell: it's technically feasible which is why the MOU was written. But we never got to the point where we ever had to sanction that. What would happen would be a complete discussion about what operations would be allowed to take place under what targeting directive, what Rules of Engagement and what remit. So effectively a US commander would have to sign up to the UK legal and targeting position in order to prosecute the target.

One thing to remember as these systems are evolving is that the US has just upgraded theirs, we are about to, and so they are not compatible currently. As the software changes and the systems change, suddenly you can't just flick the switch and take control of the other's system. So right now there is a lag in our ability to operate each other's systems and to collaborate effectively. When we buy the new systems, that will recover.

Q8 Baroness Stern: is it your view that this sort of warfare or this sort of activity puts unique stresses on the mental health of those involved? And if so, is it being properly dealt with?

Air Marshal Bagwell: it is a concern for a number of reasons. Where we deploy to operational theatres we very carefully control the time and exposure that an individual will be subject to: tour lengths, rest bites etc., so commanders have quite a lot of latitude to ensure that people don't take themselves beyond the

human sort of limits. We are still learning lessons on that in terms of combat stresses etc.

The challenge with the drone community is that for a start their minds are very different to being in theatre as they are not actually at risk, which itself poses an interesting dilemma. They are a long way from the operation. Because they are not being stressed in operational theatre they can stay engaged in a particular operation for 7 or 8 years. In fact we have several drone operators who have spent 7 or 8 years constantly engaged in operations. At the end of the day they are prosecuting with lethal force. They are killing people. And that is a stress to the individual who is involved and that is on a regular basis. What makes this doubly worse is that when they finish their shift after 8 hours, they get in their car and drive home to their families. So there are some incredible moral dilemmas here and stress factors that we absolutely monitor extremely closely. There is a very good system where we look at the stress to the individual, there is very open dialogue between the crews and their supervisors, and we try to ensure that we give people rest bite breaks when they need so that they can get away.

I think it's fair to say that the UK has probably done this slightly better than the US. We saw a period in the US a few years ago where they were suffering high levels of stress among their reaper pilots. The Americans had to change their training programme to increase the number of crews such that the revisit rate for crews on an operational sortie is less.

We have held the line on the number of sorties that can be flown in a given period, which ensures, as we hope, that the stress is manageable. But there is absolutely no doubt that this type of warfare for those individuals that, on the face of it, is quite remote, but actually at the end of the day is prosecuting lethal force over a prolonged period of time.

Kirsten Oswald MP: have there been studies? What lessons have been learned from the US?

Air Marshal Bagwell: we did one study in my time into the stresses and strains of this particular problem. The Americans have done one in parallel which is why they changed their manual to ensure they have a better ratio of crews to sorties. There are a number of things we began to try to enforce in terms of how long you should spend operating in an operational theatre before you have a career break and move on to a different system.

The problem we have, and I think it's fair to say where we haven't learned any lessons, is that in 7 years of constant operations we haven't been allowed that break point to step back and take stock without having to keep pushing crews. The demand for these systems to operate is relentless, as with the demand to keep growing and training these crews. It's fair to say we have had some crews who have left because they'd had enough. Some of them through mental stress or sickness, or some who have just done their time and want to move on. We try to ensure we get the balance right because it's obviously not in our interest to push them so hard that we break them and are not able to replace them. So

we have taken in to account as many lessons we have learned to date to try to get things right.

One of the hardest things for me as a commander was stopping pressure from others above who wanted more and were asking why we couldn't do more. The reason we couldn't do more is because it would have broken the machine. But actually that was respected, and we were supported from above when we said no that's too much. We were allowed to hold the line.

Lord Hodgson: when we went to Waddington we were told that all Reaper pilots had operational flying experience. Is that still the case?

Air Marshal Bagwell: no. Pilots come from all cross-sections. We have taken people straight from training who have never flown an aircraft other than in training. We have taken policemen. And we do have some who have flown manned aircraft. The skillsets actually complement each other, because in order to be a very good reaper operator you need that 3D view of what's going on around you even when you are thousands of miles away. You are playing 3D chess in your mind so that you can understand how the pieces fit together in terms of prosecuting, because you will use information from one aircraft or another in order to build that picture of what you're trying to do.

My personal view is that one of the things we have to test harder is whether we can take a young 18/19 year old out of their PlayStation bedroom and put them into a reaper cabin and say right you haven't flown before but that doesn't matter, you can operate this. That's something we haven't yet tested, nor has any other nation, but I think it will come in time in order to generate more efficiently, as long as we can guarantee they've got the broadest experience as possible.

Q9 Lord Hodgson: regarding the USAFRICOM MOU, could you tell us a little more about the nature of the UK's involvement in Germany or Djibouti, and whether they could be involved in direct hostilities?

Air Marshal Bagwell: I actually asked the Americans to expand the Reaper MOU to include Africa because it was obvious to me, this was a few years ago, that operations were just as likely to extend there. At the time the Americans didn't want to go down that route because the bureaucracy would have slowed it up too much.

Were we to end up in a situation where we could be close to operating in an area the UK was not signed up to, the individuals concerned know that they would have to sit back and step away. Only if you were actually going to do a joint operation that was in accordance with UK Rules of Engagement would you engage in further discussions.

General Barrons: as a matter of principle, it's worth discussing why you may want to fly a drone over Africa. Firstly, it could be part of your government's counterterrorism campaign. There is also another dimension which is much less well developed. There are I think 13 UN peacekeeping operations in Africa. One of the things that the UK and others have to think about is how if you have this

high end capability, in order to make UN military operations successful they are going to have to be enabled in the same way with this capability. This may be for ISR, but it could at some point in future also be for strike operations. We therefore need to have thought through that a capability like Reaper could be deployed in a UN operation acting under UN authority. That is a natural evolution.

Lord Hodgson: what safeguards exist?

General Barrons: whatever a member of the UK armed forces does must be in accordance with UK law

Q10 Prof Clarke: more generally, do you have any concerns? Is the current legal and operational framework adequate? And do you have any concerns for the future?

Air Marshal McNicoll: my concern in this area started on 7 September 2015 when the then Prime Minister gave one explanation to the House of Commons and the UK Permanent Representative at the UN gave a different explanation for the killing of Reyaad Khan on 21 August 2015. I don't think I can do any better than quote myself and in fact you Professor Clarke, in which you were quoted as saying that a shift towards American style assassinations had caused disquiet. I said I remained unpersuaded that the strikes were legal. I do accept that the Joint Committee on Human Rights has put forward the view that in fact international humanitarian law did apply, but I do still think it would be enormously helpful to members of the armed forces to have a single, clear and compelling legal basis for this so called new departure.

Air Marshal Bagwell: I don't have any concerns that would cause me to be concerned about whether we are doing things correctly or legally. I think it is fair to say that in these particular circumstance it does focus the mind as to your individual position, how you stand in terms of the law, particularly as the individual prosecuting the target will be based in Lincolnshire and therefore may be subject to UK law quite quickly.

So there are some things that need to be resolved in terms of giving the individual crews the confidence that the information they have, and the things that they are doing, are not going to be subject to questioning later. I spoke to the individual crews concerned with that strike to ensure they were comfortable with their position and the support they were given, and I do think that it may place people in difficult positions particularly in this world where we are giving out this information and things are quite freely discussed. Particularly for crews who have been engaged in operations now for over 2 years, being constantly subject to articles in the press about whether something you did or didn't do was legal is not good for the brain, nor to do the job in hand. So there are some real concerns about how we resolve that and ensure that people are comfortable. But actually in my own mind everything we have done to date I am comfortable with.

General Barrons: my view is that in terms of everything we have done to date we are operating well within our comfort zone. What I am much less confident about is that we have thought through about the application of current

capabilities in situations that are much more dynamic, contested and higher tempo, where you can't necessarily have such a high level of control on the targeting process which demands rigour and advice at every stage, which you can do when you are prosecuting identified targets in a particular timescale, but if you try to apply that in a setting where you are in a much more dynamic conflict it won't work. That needs to be thought through. I also think there is nothing like enough thought into applying the same principles to what might happen on the sea, under the sea and on land, and that capability already exists. And I think we need to set ourselves up for a future where a combination of robotics, autonomous systems and artificial intelligence may create capabilities which our enemies may have: where machines kill on the basis of algorithms, without a human in the loop. That isn't science fiction and it won't be very long before western armed forces are acquiring capabilities like that and they need to be absolutely clear about the rules we have and in what circumstances they apply.