

I am grateful for opportunity for me to outline the UK MOD position regarding Unmanned Aircraft Systems within the context of Information Dominance. However, in the tradition of '...if you don't like the question, then change it...', I am going suggest that we UK are beyond the point that we can realistic predict or afford to aspire to information **dominance** in all contingent scenarios.

Why do I say that?

Dominance is akin to "**Overmatch**" over all operational possibilities. When dominance occurs, nothing done makes any difference. There is sufficient knowledge to stop anything we don't want to occur, or do anything we want to do.

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For the UK in today's information age, we see that as an unaffordable condition. We see Information Superiority being more appropriate; it could be defined as the achievement of better **understanding** than an adversary of the battlespace and the ways in which it could be influenced. I think of superiority as being "better than". If the adversary scores 10, we need to achieve 11. I still think that this is still a considerable challenge but it is a more realistic target to aim at.

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The key word for me in the definition is 'understanding'. My early career was typified by counting equipments and understanding equipment capability – typified by the picture in the top left, not a person in sight. For the contemporary conflicts and for those we see in the future, the human dimension has become the dominant factor as evident in the other scenes – you focus on the people rather that the equipment.

So today's understanding only comes together one fuses the equipment capabilities together with the people dimension which comprises their history, geography, religion and beliefs.

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So now we have the doctrine and the English language lecture complete, what am I going to discuss over the next 20 minutes. I will outline the UAS

assets that sit within my portfolio provide the UK with critical capability and then focus the future challenges that faces the community for the future.

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This slide illustrates the reasonably comprehensive portfolio of UAS capability that the UK currently operates today. The Royal Air Force has achieved 34,750hrs MQ-9 *Reaper* hours since October 2007 (as of 31 May 12) and it is now providing up to approx 1000 hours per month depending on factors such as weather, in support of the Afghanistan operation. The British Army operates 3 tactical unmanned aircraft systems in theatre, the *Class II Hermes 450*, an interim solution until *Watchkeeper* enters service in late 2013, and the mini-size *Class I Desert Hawk 3* and *T-Hawk*. The *Hermes 450* has achieved good results, with the Army passing 60,000 operating hours

However, with the exception of **WATCHKEEPER** all of these Unmanned Aircraft Systems have been procured or leased under the Urgent Operational Requirement process to meet an immediate operational need in Afghanistan rather than any long-term endorsed capability requirement. We are now in a place whereby we need to consider what will happen to these systems following the transition of Security of Afghanistan in to the hands of the National Security Forces and the UK's combat role ends.

One could argue that this need to consider which of these systems we wish to bring into our core programme and which ones we don't provides us with an opportunity to rationalise our UAS capability roadmap by identifying what future capability could be delivered by unmanned aircraft and the consequences for those organisations that will be required to operate them.

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Looking to the future, one could argue that from the Unmanned perspective, the UK's strategic direction has been clearly articulated. The Strategic Defence and Security Review of 2010 concluded that the UK was to assume an **adaptable strategic posture**. From this one can draw several threads:

- The use of Armed forces to protect National interests and focus our armed forces on tackling risks before they escalate .
- Maintain our ability to act alone where we cannot expect others to help but we will work more with allies and partners to share the burden of securing international stability.

When these gets translated to capability requirements, they will succeed or fail on the level of tactical to **strategic intelligence** that we can gather in order that we can make decisions based on good **understanding**. Our current and future family of UAS' have got a critical role in generating that understanding.

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Additionally the strategic headmark for the UK with regards to unmanned has been articulated in the foreword to *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, where the Prime Minister and Deputy Prime Minister noted that *'by the 2020's..... The fast jet fleet will be complemented by a growing fleet of Unmanned Air Vehicles in both combat and reconnaissance roles.'*

The Strategic Defence and Security Review further stated as one of its principles that, *'we will invest in programmes that will provide flexibility and advanced capabilities, and reduce legacy capabilities which we are less likely to need in a world of precision weaponry, and where the battlespace increasingly involves unmanned and cyber operations'*.

So what is the **popular** motivation for moving to unmanned systems? It is a desire to deliver enhanced capability while primarily reducing costs of equipment and people required to operate systems and also threats to personnel.

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But there are challenges to this premise:

Expectations are that UAS' should offer an opportunity to reduce force structure size as we should be able to reduce the requirement for airframes to conduct pilot and sensor operator training as this should be conducted in a synthetic environment. This could lead us towards moving towards a boxed round concept, where unmanned aircraft would only be used on operations. We are not there today with the provision of aircraft being a key dependency to achieve the training requirement and thus operational capability. The ability for the UK to deploy the WATCHKEEPER Capability is dependant upon us achieving the Release to Service so that we can train with live assets before we deploy the asset. In addition, each operational sortie of Reaper requires **around 36 personnel** in order to operate it and even with Watchkeeper, which benefits from a great deal of automation, there are some **14 personnel** involved. However, please note that these figures are not absolute, varying with on the scale of effort and number of aircraft being operated from one location.

In addition, the advantage of unmanned systems being simple is being eroded. Mirroring a long standing manned aircraft trend, the discussion on UAS remain largely fixated on platforms, rather than the capability the aircraft provides as part of a systems. Without the sensors, connectivity, dissemination capability and where appropriate weapons, the system is worthless. This total capability requirement drives towards high complexity/high cost solutions. As an example, one US Global Hawk with supporting hardware is quoted in a recent flight international article as costing from \$215M. I accept that true costs are going to be hard to compare but If current trends continue, it is likely that the cost of complex unmanned aircraft will increase to converge or even overtake with those of manned aircraft. A particular issue in the UK as we move toward full airworthiness certification of unmanned aircraft, rather than the limited clearances upon which we rely at present.

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When considering the affordability of the unmanned solution, we also need to acknowledge that typical losses of unmanned aircraft will be high; during NATO's engagement in Operation ALLIED FORCE in the former Yugoslavia in 1999, 15 unmanned aircraft were lost to the Serbian air defence system versus 2 manned aircraft (F-117 and F-16CJ). Even in the uncontested airspace of Afghanistan and Iraq, significant numbers of unmanned aircraft have been lost. The last open source analysis that I could find which was published in 2010 reported 38 Reaper and Predator had been lost in Iraq and Afghanistan and 9 more during training on bases in the US. Altogether, it has been reported that the total number of accidents is 79.

So where do I see the future and what are the challenges we collectively face in getting there.

In order that Air Power remains capable and credible in the future, it will continue to need to deliver control of the air, mobility and lift and contribute to information superiority. In addition, the fundamental heart of any independent airforce is the ability to deliver hard power through attack. I suggest that the the attributes that are important to the airman those indicated in red.

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Considering attack and assuming that 5<sup>th</sup> generation manned platforms can deliver all of the capabilities described, the fundamental characteristics of an 6<sup>th</sup> generation unmanned platform could provide us with step changes in capability.

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Equally for the capability necessary for mobility and lift together with those for providing information superiority, I consider that there is significant potential for unmanned aircraft to deliver much more than we enjoy today.

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So I could envision a time when technically air power could be completely delivered by unmanned aircraft, but by when? With Joint Strike Fighter approaching its introduction service and a 30+ year life, could it be the last manned combat aircraft. I think that the time for the evolution of the air power roles of attack and mobility and lift being conducted by unmanned systems, will be reliant on advances in technology, cost effectiveness and in public acceptance. We may be some time away from asking soldiers to trust unmanned aircraft to move them around the battlefield,

So how is the UK addressing these challenges:

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A UK MOD roadmap for UAS was produced in 2005, but has not been updated since. As we plan for transition from Afghanistan with an equipment programme that is financial constrained we need to refresh our strategy to show how UAS' will be developed from a tri-service with joint oversight, over the next 20 years. From a Combat ISTAR perspective, the strategy is broadly as depicted here.

Our Tornado fleet will be replaced by JSF and in due course the Typhoons that we are operating today will run out of life. At that stage the typhoon will be replaced by a Future Combat air system, which is likely to feature both a manned and unmanned component. What are we doing to determine that mix and to ensure that we both understand and can generate the necessary technology?

For a number of years assisted by industry, we have been running technology demonstration programmes that have produced products such as Taranis and mantis. These types of programmes will continue as mature the FCAS concept. In addition the UK's requirement for a Medium Altitude long endurance UAS, is captured in the SCAVENGER programme

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This programme is designed to provide UK forces with a theatre-wide, persistent ISR capability and an ability to attack land and maritime time-sensitive targets. The initial Gate for later this year will consider a range of proposal that will need to be narrowed down to take into an assessment phase leading to a Main Gate in late 2013. The capability is expected to enter service toward the end of the decade. Extensive operational analysis, and decisions made at the Anglo-French Summit of November 2010 has lead to exploring further the option of an Anglo-French jointly funded, assessment phase. This proposal has considerable merit and not only could it lead to the sharing of development costs but equally ongoing support and training costs while enhance future interoperability.

So what are the challenges that will shape the SCAVENGER programme?

The geo-political environment has been fluid for the last 20 years and is expected to change considerably over the period 2020 – 2030 so any system delivered in the *Scavenger* timeframe, unless it can be easily updated or replaced, may well become less relevant as the threat and operating environment changes. In the UK, we have talked a lot about the need to make our acquisition process more agile; UASs could be a key area are where a new approach could be trialled such as late freezing of final specification, planning for and importantly funding in-service spiral development, or even limited buys that can be replaced at regular intervals with updated systems. In addition, we should be discussing more the potential use of unmanned aircraft with other government departments as a cross governmental collaborative approach could drive a more affordable solution.

The UK continues to place great store on sovereignty which in this case means the ability to deploy and operate a system at a time and place of the UK's choosing, together with the ability to upkeep, update and upgrade the capability. But although is remains an important strategic requirement, it will need to be balanced with associated through-life cost and risk and the practicalities of retaining sovereignty for key enablers,

such as communications and navigation systems, which are already unrealistic.

Today we see a great deal of automation with many UASs. Any or none of the functions involved in the operation of an unmanned aircraft may be automated: take-off and landing; navigation/route following; pre-programmed response to events such as loss of a command and communication link; even automated target detection and recognition. On the other hand Autonomous systems will need to be self-aware and their response to inputs indistinguishable from, or even superior to, that of a manned aircraft. As such, they must be capable of achieving the same level of situational understanding as a human. From this understanding and its perception of its environment, such a system will be able to decide on an appropriate action to bring about a desired state without depending on human oversight and control, although the overall activity of an autonomous unmanned aircraft will be predictable, individual actions may not be..

The distinction between autonomous and automated is important as there will be significant moral, ethical and legal implications regarding the use of autonomous unmanned aircraft and that will intensify the already considerable debate that exists today. So notwithstanding that the level of technology necessary for autonomous operations is not yet achievable, I see that the scavenger programme will remain within the bounds of automation however FCAS could be a different matter.

So what does the future hold? Between now and 2030s, we will see a slow but steady increase in the unmanned element with UAS' dominate tasks which require persistence and/or low cost tactical solutions. It is possible that developments in rotary unmanned aircraft, as well as fixed wing, make it likely that UAS will soon be able to contribute significantly to tactical mobility. However I sense that complex control of the air, attack and strategic air mobility missions will remain with manned platforms, though over time these will be increasingly aided by accompanying unmanned platforms providing *loyal wing man* or *swarming* services.

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Sometime after 2030, unlike the situation today depicted here where we have point to point connectivity and hence overlap, inefficiencies and lack of coherence, air effect is likely to be delivered from an *air cloud* from which end users will call down a service.

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The cloud is likely to be populated by a range of manned aircraft as well as smart and dumb unmanned platforms carrying a range of sensors, weapons. It will become largely transparent and irrelevant to the end user as to what kind of platform delivers a particular effect. Thus, while the 4 core air and space power roles discussed earlier will remain, they will be delivered simultaneously by single complex platforms, or a range of simpler platforms whose outputs are fused to deliver a capability.

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Ladies and gentlemen, a rapid canter through my thoughts on UAS development set against the challenges and issues of today and the future. I leave you with these two slides which, if you were a frequent traveller on the London underground this winter, you might be familiar with. I think that they capture the debate over the ethical issues that surround the use of UASs in a combat role. I will be glad to take questions in due course.