

**DSEI 2015 – KEYNOTE ADDRESS BY THE CHIEF OF THE AIR STAFF
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Thinking to Win

Ladies and gentleman, thank you for your warm welcome. I am delighted to be back with you again at DSEI; where did the last 2 years go?

And what a week for the Chief of the Air Staff to address you. It was this week in September exactly 75 years ago that the Luftwaffe launched its biggest raid of World War 2 on London. On the 15th over 1,000 German sorties were flown over the UK and these were met by 750 sorties from the Royal Air Force in what was to prove the decisive period of the Battle of Britain. It was defined by a contest for control of the air, the core business of the Royal Air Force then and now. Where we are gathered today, the Eastern dock area of London, was probably not the safest or most welcoming location to be in 1940 as high explosive ordnance rained down. I hope you are finding DSEI a little more convivial. DSEI offers us the opportunity to explore the global defence and security industry from an Air Power Perspective, and I am delighted to be here to do just that.

However, before I start let me return briefly to the significance of today in history - the 17th September - by way of hinting at my views on the subject matter. On this day in 1936 the first full trial of a radio direction finding system, or radar as we now know it, was conducted at Bawdsey on the Suffolk coast; a year later it became the world's first operational radar station 3 years before the air defence system it served proved decisive in the Battle of Britain. On this day in 1940, a Royal Air Force Beaufighter flew the first operational patrol by a night-fighter equipped with the first truly-effective Air Interception radar only 4 years after radar had proved to be a viable proposition in a ground-based system. And on this day in 1963, the UK's Ballistic Missile Early Warning System at Fylingdales in North Yorkshire was declared fully operational. The clues as to what faces today's generation of UK airmen and influences the next and the defence aerospace industry are all there, hidden as they so often are in the events of history.

It is clear that air power offers great utility to the Nation and this dynamic will not change. But I suggest the role of Industry in its delivery is changing; subtly, perhaps gradually, but it will be significant to the extent that the future of the UK defence aerospace industry and the Royal Air Force is now as one. We must therefore adapt together and make a single journey if we are to be successful.

Let me first look into the 2nd century of air power development, the challenges that we foresee and the opportunities we may have, before setting my vision for the Royal Air Force in this context.

The Development, Concepts and Doctrine Centre is well known to most of you. They do not predict the future, merely identify key global thematic trends and consider how that may impact on this Nation's defence and security thinking. Their goal is to inform capability planning.

Global Strategic Trends 2040, Future Operating Environment 2035 and a *Primer* for the new *Future Air and Space Operating Concept* are 3 key documents now informing the UK's ongoing Strategic Defence and Security Review. The picture they paint is one of complex global challenges on the horizon with no simple solutions for their resolution.

Reading them it is difficult to resist a natural sense of almost overwhelming foreboding...but that, of course, is the point. They force us to think about potentially wicked problems somewhere in our future, consider what we might do about them and identify the decisions we might have to take today to have some capacity to respond should they occur. Following implementation of Lord Levene's Defence Reform report of 2011, more of those decisions in the Air Domain now fall to me.

'So what' for air power? Principal amongst the challenges we are likely to face is a redefinition of the word contested. You might say this term is not new – I agree, nothing has fundamentally changed in its nature – but its characteristics are likely to morph significantly. It will no longer just be the physical space that is contested but the virtual space also, and the latter contest may even come to dominate proceedings. This has implications for the Royal Air Force, and you, the defence aerospace industry.

The term anti-access, area-denial operations, or A2AD, is a case in point. One could successfully argue this is exactly what the Battle of Britain was but set against its potential fully-developed future form, one might also convincingly argue otherwise. Gaining control of the electro-magnetic environment may become synonymous with our understanding of control of the air today and hence take on vital importance too.

Another significant theme is the blurring of the overseas and domestic threat. In fact, we are already seeing its emergence today in forms such as violent extremism on UK soil and attacks through cyber-space. This will affect all of Defence but perhaps it is particularly acute for air power whose rapidity of response and long-reach can create global effects direct from the home base – this naturally identifies it as a viable target for such hostile action.

These changing characteristics are fuelled by globalisation. The concerning theme which emerges is one where advanced technology proliferates rapidly and widely because it is increasingly affordable. Defence's 'crystal ball' envisages a potential outcome where '*proliferation...means that our key systems are vulnerable to technological exploitation or capability overmatch*'. It also suggests that '*technological change will accelerate, serving to highlight inadequacies in less adaptable procurement*

processes within Defence' and 'very long-term, inflexible equipment plans will no longer be sustainable.' If these characteristics develop then they are very significant for both the Royal Air Force and the Defence Industry.

So what can be done? Air power, by its very nature, has been at the forefront of technological development since its birth. And technology will inevitably have a part to play in our solutions but there is something much more fundamental that we can do first - think. To be more specific, that is to demonstrate *'thought leadership'* – our ability to think through new and difficult problem areas to identify innovative solutions.

The challenge for air power to effectively counter rapid and diverse proliferation of technology is a real one. However, I am not convinced by the argument which suggests that the technological edge of Western air power will be irrecoverably lost. Eroded? Certainly and, perhaps in some circumstances, challenged effectively in some scenarios. But I see this as more of a transitory and tactical condition, not a permanent or decisive one at the Operational level if we maintain the overall air power vector that has hitherto proved so successful.

One emerging opportunity in this regard is the potential to harness other capabilities – military and civilian – to reinforce the air power dynamic, or vice versa. We rarely undertake operations as a single Environment but Joint, so why should it be any different with respect to Space and Cyber? The US Air Force calls this a multi-domain approach to operations, where the harnessing of several parts produces an overall outcome greater than their individual sum. And although the UK does not yet have a doctrinal term for it, I would argue that this is exactly where we are heading. Its early days but its potential is significant.

Why do we need to make this distinction over the levels of warfare? Because success is defined by more than just availability of advanced technology, it is defined by its application, and that is determined by the quality of your human capital. History shows us time and again its value. Witness the contribution of Ashmore, Watson-Watt, Wilkins, Newall, Park and Dowding to the outcome of the Battle of Britain. They imagined and created an air defence system, perfected through multiple evolutions over time, which brought together new technologies for decisive effect. People thus 'won' the Battle, aided by technology.

And this brings me to my third 'so what can be done?' point. Western militaries must ensure that the conditions exist where the 'people' I have just mentioned can flourish, and the systems they serve have the necessary agility built in to enable them to rapidly adopt and adapt to new thinking. And it will be this continuous experimentation - in every aspect of the 'business' - without fear of failure that is absolutely key. By appropriately nurturing creativity within the right conditions, the system can harness their thought leadership into decisive operational effect. Air power has a pretty good

pedigree when it comes to the need for rapid adaptation but it is now time to take it to the next level and fully institutionalise it.

The three things I have just described - harnessing the output from 'new' Environments, preserving the quality of one's human capital and nurturing their creativity to promote rapid organisational adaptation - are the elements that can make the difference for air power. So with that in mind, what are my own plans for the Royal Air Force as we approach the SDSR?

It will come as no surprise to you that I want to shape a Royal Air Force future that can be as effective and successful in its next 100 years as it was in its first century. I envisage an Air Force that is continuously engaged on global operations, is a leader in its field, and which offers credible military options to our political masters in times of crisis.

Those historians with a more contemporary focus will not have failed to notice that since 1990 a discernible trend has begun to emerge - air power is the first line of defence and also increasingly the Nation's likely first tool of response. We have certainly felt it in the Royal Air Force - contributing to well over 50 operations since the end of the Cold War - and I do not foresee a waning of its utility in the short-to-medium term. This trend continues today over the Baltic, Iraq and Syria.

It seems to me that multiple small-scale, limited interventions running concurrently could become more likely in the UK's future and this requires an Air Force configured differently to the one I currently command. But transforming while 'in contact' globally presents a leadership and organisational challenge; success today is always the highest priority but preparing for tomorrow cannot - and will not - be far behind.

Let me expand on what I mean by a 'leader in the field'. The Royal Air Force has a proud heritage as the World's first independent air force but today, in pure volume, we are not comparable to the US Air Force and, indeed, some others. But nor does volume define capability, it is but one strand. I want the Royal Air Force to be recognised as the natural first reference point for other air forces, a Force where they come to see our ideas in action and test their own thinking against ours. There are many facets to this: equipment; organisation; training and people to name but a few. Let me expand on just two aspects which have implications for this audience.

Earlier this year, I approved the official launch of a programme to refresh the Royal Air Force's Conceptual Component - *'Thinking to Win'*. Its goal is to embed the *Conceptual Component of Fighting Power* at the heart of the Royal Air Force of 2020. After a period of self-reflection following 15 years or so of counter-insurgency operations, the Board and I have established a way forward and we are doing something about it. This is the start of the Royal Air Force's next journey.

Thinking to Win is not a desirable activity, it is essential. It is simply not enough that our warfighters will do what is asked of them consistently well. Far more, an effective Conceptual Component is about how the Royal Air Force inspires its people to fulfil strategic goals. This is true in operations and equally in the business space so that our decisive advantage – all of our minds – can be brought to bear upon our challenges. In this way, we will unlock and harness the full potential and performance of the Royal Air Force, especially at the Operational and Strategic levels. At the forefront of *Thinking to Win* is prioritising the means to create and deliberately apply ideas, new to the Royal Air Force, which will deliver step changes in power and performance; this is the conceptual innovation that we require.

My second point is, in essence, an extended lead into the second part of my presentation. The issue is that of affordability. The Government's recent announcement that it is to spend 2% of GDP on Defence and Security for the life of this Parliament is welcome news. This gives the Ministry and Service Chiefs a clear financial baseline against which to plan our capability development.

This most recent period of recapitalisation of Royal Air Force equipment has proceeded at pace since it began in 2010. We now operate fewer yet more modern fleets than at any time in recent history, and many of those fleets are now 'delivered' in non-traditional 'contracting for availability' ways. All 3 factors have saved Defence money, with the Royal Air Force equipment portfolio now the envy of many. However, there is still some work to do within the ongoing Review which has some key decisions to make on the Future Combat Air System and persistent wide-area surveillance over land and over water, to name but two.

Its affordability must also be seen in its broader, more appropriate context. Air power equipment is relatively expensive but it is not the cost but the capability it offers the Nation during times of crisis that is important. And perhaps it is only when air power is viewed against its potential contribution to Grand Strategy that its true value for money can be clearly seen.

Thinking to Win should not however be misinterpreted as a cost-saving activity. We are investing in our people to deliver the decisive edge as equipment superiority is never guaranteed. And we will do this in everything we do in both peacetime and on operations because it promotes national security, freedoms and prosperity.

Having offered you my views on air power's development and my plans for the future of the Royal Air Force, I now turn to the second part of my presentation and consider the part the defence aerospace industry can play in that future.

It seems to me that accepting the changed context in which we will now do business is fundamental if we are to go forward. If we can do that, then our options to work better together - that is within the Industry and between industry and its customers - will

become much clearer. And then we can start *Thinking to Win* together on some of the more abstract issues that we will likely soon face. My message to you is essentially this: we must adapt and take the journey together, and now is the perfect opportunity for us to do so.

This is the time for a critical analysis of our situation, for what has worked well previously may no longer do so. The world is moving on, and so must we.

Across UK Defence there is less money to spend than 20 years ago in relative terms. The equipment that we do buy must remain a viable front-line capability for longer than it perhaps once did. And yet, this seems paradoxically at odds with the throw-away society that we have all become. Whether you subscribe to the vernacular of offset strategies or not, technology is advancing rapidly and proliferating widely thus eroding competitive advantage on equipment alone. Inevitably the Royal Air Force will need to again adapt while in contact, but adapt we must.

For the Defence industry this may mean fewer orders and fewer aircraft, factors which drive up the unit cost. Companies have to work harder and compete more fiercely for each order which in turn is driving rationalisation across the sector. Non-Defence companies are increasingly the commercial lead for exploitation of innovative technologies, and thus it is they that are attracting the brightest and the best from a pool of qualified people that is itself not increasing fast enough. With a few exceptions, Defence industries have to adapt commercial products for their military customers, and make their money through expansive support arrangements or product integration services.

The picture to me is clear. Our shared context is changing quite fundamentally and we need to recognise that, accept it, and make plans for our future. We then must commit to the journey we will need to take to get there, and it is vital we acknowledge that we will need to change as we do. There are opportunities available to the UK defence aerospace industry today; we will need you to fully embrace them together for our shared future.

I suggest that it will be how successfully we can blend a new art and science of capability development that will ultimately be decisive. As ever with these things, it will be about making the right decision at the right time. But this is not something that will come from moments of insightful leadership, rather, as the result of an evolutionary capability process that informs the decision-takers of the optimal time to act.

One such 'process' we may adopt for capability development is based on a 'lead, watch and follow' strategy. This recognises that for some technologies only the military can lead primary investment in order to achieve a disruptive effect. However, for the majority of emerging technologies, Research and Development will occur independently and the military can follow these technologies in order to adapt and adopt related

capabilities. But where there is not a clear exploitation pathway or such a pathway is unaffordable, the military can continue to watch until the situation becomes more favourable. Such proactive horizon scanning might then allow adoption of the philosophy 'as civil as possible, as military as necessary' to fully assess the implications of technology developments and improve affordability whilst hopefully retaining an advantage for UK air power.

Another 'process' we can pursue is to build-in upgradability and/or spare capacity within the design from the outset, recognising that such an approach will offer better value-for-money in the medium term. And we must be disciplined not to erode it as and when we inevitably look for short-term savings. I note the Pentagon recently announced that upgradability will be at the heart of the USAF's Long Range Strike - Bomber programme, and that the right to carry out upgrades will be subject to open competition.

Having created the upgrade capacity we need to find a smart way of exploiting it. Spiral development plans - for the system, the platform or both - may offer utility in this regard. We have talked a lot about this in the past but now is perhaps the time to really commit to it. Rapid exploitation of new developments in technology will help us to maintain a combat advantage. This is where the portfolio approach pursued by the Defence Science and Technology Laboratory can excel as a technology breakthrough in one area can be read-across to other users and its full utility exploited. A develop once, use widely approach is a natural extension of what we have already done with the Team Complex Weapons initiative. And it is the potential for multiple near-simultaneous technology breakthroughs to be harnessed by one end user where real competitive advantage lies.

At the core of these 'processes' is cultural transformation. Our first instinct must be to collaborate, not compete, in everything we do. This notion is at the heart of the UK Government's Defence Growth Partnership launched in 2012. The DGP is our opportunity to evolve together for a successful future; the Air Capability staff within the Royal Air Force will be fully engaged with it. I see DGP as entirely complementary to existing capability development efforts such as Niteworks. I note that the UK Defence Solutions Centre has been running a conference within DSEI to outline the 'meat on the bones' of the DGP Implementation Plan announced in mid-2014 and I look forward to reading the detail of its thinking.

For the many Small and Medium Enterprises here represented, it is through DGP that I firmly believe we will bring more capabilities across the so-called 'Valley of Death' and therefore be 'faster to market'. There is no inherent right for the major Industry players to monopolise the good ideas and, in my view, DGP is the vehicle through which you can demonstrate that. The UK's DGP is new, ambitious and bold, but it needs to be. The UK-based Defence Industry has an opportunity to forge a path others will wish they too were on.

Before closing I wanted to highlight to you a few of those more abstract issues that I alluded to earlier. These are the potential third or fourth order consequences of setting the course that we have as a Nation. If their associated risks are realised they will directly affect you and me.

The first of these is the notion that increasingly in the future the UK defence aerospace industry will need to act as a sort of Operational Reserve. Not of course in the traditional sense that one might associate with the execution of military campaigns but in a new, non-traditional manner. The outcome will however need to be the same - sufficient forces available to be committed at the right place and right time to be decisive. What I am talking about is the role of industry in the ability of the Royal Air Force to reconstitute capability should this be necessary. Fewer types and fewer numbers mean I lack depth if an unexpected situation occurs. We will therefore need to work together to develop contingency plans that consider this. It takes 3 years to train a fast-jet pilot from *ab initio* and many months, or even years, to roll new aircraft off the production line but there are things that can be done, perhaps using advanced synthetics or novel production techniques, which can change the paradigm. Timely decisions will be the key to making viable plans. Reconstitution is a key work-strand of the ongoing Review.

The second abstract issue I will touch on is the notion of Industry as flank protection to military forces. For those of you listening in this Air Theatre on Tuesday, you will have heard this discussed by Joint Forces Command during their Air Power in the Cyber Environment presentation. But it is important and I wish to reinforce their point. The Tornado, the Royal Air Force's first fly-by-wire platform, has a software dependency of 4%. Lightning, the latest, will have a 90% dependency. Today's remotely-piloted air systems depend on over 100 commercial and military network connections, miles of fibre-optic cable and millions of lines of code. All of this is potentially vulnerable to cyber disruption. As we take action to protect BLUE cyberspace, i.e., that we build, maintain and operate, we have realised that our operations are dependent upon commercial, GREY cyberspace. Thus the protection of our military flanks is provided by the private sector, national and international law enforcement, and diplomatic relations. So you, the defence aerospace industry, are in-part 'covering my 6' in this regard.

The final abstract issue is related to the one I have just covered. It is the notion that industry is now permanently 'deployed' on the battlefield. The cyber example is perhaps an obvious one but it is much more than that. Potential adversaries will seek to defeat strength by exploiting weakness, a view from Sun Tzu that I think we can all recognise. But where is that battlefield? And what form might an adversary's action take? I highlighted earlier that there was a blurring of the domestic and overseas threats, and that air power was a natural target because it could generate military effects direct from the home base. This has caused me to reconsider how I might better protect the Royal Air Force wherever it may be operating. But in a Whole Force

approach, you, your company and its supporting entities are *de facto* part of that operation, and so you also must consider whether your protection measures are adequate. Put simply, I am depending on you as much as you are me. Projecting power in support of the national interest will leave us with some interesting force protection challenges across the entire depth of any employment chain and breadth of any operating area. And that challenge may be virtual and physical; hence this notion of industry permanently deployed on the 'battlefield' is now a viable one.

In conclusion, as a Service Chief it is my responsibility to prepare the Royal Air Force for the challenges of tomorrow when responding to the defence and security interests of the Nation. But not many identified accurately the challenges we have faced in the last 25 years, and those looking at the next 25 see complexity and rapidity as their main themes. Globalisation is changing the defence and security paradigm. This has serious implications for governments, their military forces and the Defence Industry.

Air power has offered the UK tremendous utility over the last 100 years; I do not see that changing, in fact, I think it is only going to increase further. Advanced technology and credible air power are synonymous. So erosion towards technological parity with potential adversaries is significant but unlikely to be decisive for them on its own. Because it will be our application at the Operational level of warfare, where air power embraces natural synergies within new Environments such as Space and Cyber power, that will assure a combat edge remains.

My vision for the Royal Air Force sits within this context; needing to transform the organisation for tomorrow while engaged on operations today is the canvas I am working with. Recapitalisation of equipment is proceeding well but more needs to be done. From 1918 the Royal Air Force led the World in thinking on air power. Today, the context is different but I want it be a leader in its field again. That is why this year I have formally launched my *Thinking to Win* programme to embed the *Conceptual Component of Fighting Power* in the Royal Air Force of 2020. This is the way our decisive advantage – all of our minds – can be brought to bear upon our challenges and unlock our full potential.

I recognise this is a period of uncertainty for the Defence Industry. Fewer orders, fewer units and an increasing Commercial vice Military-lead on key technologies are making the sector a challenging place to be. We are affected by this as much as you. This is why I feel we must embrace the new paradigm, not fight it. This requires us to do things differently. For the UK-based Defence Industry our opportunity to do so is the Defence Growth Partnership. Two years after its launch, DGP is moving into delivery. The market analysis suggests that over the next 8 years, £82Bn of global military spending will occur in areas where the UK defence industrial base considers itself to be particularly strong – Air capabilities and Intelligent Systems; that is arguably worth competing for. A credible and successful Royal Air Force will help you do that.

My thesis was that the future of the UK defence aerospace industry and the Royal Air Force is now as one. And that we must therefore adapt together and make a single journey if we are to be successful.

I mentioned in my introduction the clues from history and trust that they have resonated with you in what I have said today: evolution is key, not revolution; hard-thinking about difficult problems; harnessing the Whole Force when doing so; creating the conditions for imagination and creativity to spawn innovation; the application of advanced technology in new ways to create battle-winning systems; being prepared to experiment and initially fail in order to achieve success.

For this is how together we will overcome abstract challenges such as reconstitution of an Operational Reserve, the provision of flank protection and operating effectively on a redefined 'battlefield'.

Thank you for your time and enjoy the rest of the presentations in the Air Theatre.