

**CAS – Air League Andrew Humphrey Memorial Lecture 2018 – 12 Nov 18 V1.3**

Thank you for those kind words of introduction. I'm delighted to have been invited to deliver this year's Andrew Humphrey Memorial Lecture. And to be given the opportunity – especially in the Royal Air Force's centenary year – to reflect on the unsurpassed contribution that the Air League, since its own formation in 1909, has made in championing the British air and space industry, civil aviation and, especially, British military air power.

May I especially congratulate the Air League in its wisdom in choosing such an auspicious date for this lecture. For the 12th of November is the anniversary of the adoption by the British air services in 1914 of the 'roundel'. I have to report that the idea was not ours, but borrowed from the French, with just the colours reversed. Apparently, the Union Flag which previously adorned British aircraft was being too easily confused at long range for a German cross.

From its earliest days, the Air League has been at the forefront of air and space power advocacy. But its enduring legacy is arguably most profound in the impact that its programmes have had on thousands of young people. Together with the 'Leading Edge' youth initiative, the Air League's scholarship and bursary schemes have produced legions of aircrew, engineers and aerospace leaders in what continues to be a thriving and innovative British air and space endeavour.

It is perhaps particularly worth recalling that this year marks the 80<sup>th</sup> anniversary of the foundation by the Air League of the Air Defence Cadet Corps, the forerunner of the Air Training Corps. I am personally deeply grateful for this bold step taken by the Air League in 1938. My father was in the Air Defence Cadet Corps and then the Air Training Corps, here in London

during the Second World War. The Air Cadets set him, me, and, I know, many others in this room on their paths to fulfilling their ambitions in flight and aerospace.

So I offer my most sincere thanks and congratulations to the Air League for all it has done, and continues to do - in its own endeavours and in partnership with the RAF Air Cadets. Inspiring young people through the thrill of flight and the amazing technology of aerospace. No wonder that inspiration has been a major pillar of the Royal Air Force's Centenary programme. And that it will remain the cornerstone of the remarkable legacy that RAF100 has forged for us.

I will return to this theme later, but first let me speak about Marshal of the Royal Air Force Sir Andrew Humphrey, my predecessor 13 iterations ago, and in whose memory this lecture is held. His attainment of the highest rank in the Royal Air Force, and his appointment to Britain's most senior military role as Chief of the Defence Staff, are achievements that might seem to eclipse all others. But I sense that Sir Andrew modestly derived greater satisfaction from the pioneering aviation feats he accomplished earlier in his career. It remains a grievous loss to the RAF, to Defence and to aerospace that he did not live long enough to apply his talents fully as CDS.

A clue to his supreme proficiency as an aviator is given by his membership of the vanishingly small group of airmen who have been awarded the Air Force Cross three times. A Battle of Britain veteran too, and in 1941 he shot down three enemy aircraft in a single night, earning the Distinguished Flying Cross in the process. He then went on to serve with equal courage and distinction in several other theatres of the War.

In 1953, he captained a Canberra which flew non-stop from Cape Town to London in the then record time of 13 hours and 16 minutes – an incredible accomplishment for the time. The following year, he became the first pilot to fly a jet aircraft over the North Pole, with all the navigational hazards that that entailed in an era before inertial navigation or GPS. His achievements continue to be remembered in the RAF through the Humphrey Gold Medal, awarded annually to the top performing student on our year-long Aerosystems course.

Through his pioneering endeavours, Sir Andrew recognised that in aerospace and air power alike, simply maintaining the status quo would condemn us to falling steadily behind our competitors and adversaries. Which is why he strived to push the boundaries of aeronautics, navigation and endurance to ensure that our country – and the Royal Air Force in particular – remained at the forefront of aerospace technology and innovation.

His legacy as an aviation pioneer is therefore every bit as inspiring as his achievements as a senior officer. And his example reminds us that our effectiveness, both as a deterrent and in combat operations, depends so much on us capturing and maintaining the technological initiative and advantage.

That principle remains as valid for the Royal Air Force today as it has ever been, because the range of risks, threats and challenges that now confront us are more serious than they have been for at least a generation. The menace posed by international terrorism persists and is constantly mutating, as the RAF's ongoing fight against Da'esh in Iraq and Syria reminded us every day - it might surprise you to know that we have conducted nearly 100 precision strikes there since the

beginning of September, with some 4000 precision munitions now used in the last 4 years.

But it is particularly the threats posed by state actors, especially Russia, that present the greatest strategic risk to our security, our national interests and our people. The use of military grade nerve agent to murder on our streets in Salisbury provides convincing evidence of malign intent. From the perspective of capability, the deployment of both the S-300 Surface-to-Air Missile system and the fifth-generation Su-57 fighter to Syria underlines that control of the air, and space, cannot be assumed in the way it has been for our joint operations over the last 3 decades.

We must now be ready and capable of fighting for it, because unless an Air Force succeeds in controlling Air and Space, the rest of the Joint endeavour will inevitably fail. We have seen just in the last 3 weeks our Quick Reaction Alert aircraft scrambled 4 times to intercept Russian aircraft approaching our airspace. And during our 4-month deployment earlier this year to Romania in support of the NATO mission, we scrambled 9 times to intercept approaching Russian aircraft, compared to just once on the same mission last year.

We are being challenged and placed under pressure, and threats are growing even more quickly than we planned for in the 2015 Strategic Defence and Security Review. It is because of these challenges that we must redouble our efforts to maintain our nation's combat edge – it is a perspective I am confident Sir Andrew Humphrey would share.

This imperative to continue as a World-leading air and space power, with the RAF to the fore, lies at the heart of the Government's Combat Air Strategy, published in July and launched by the Defence Secretary at Farnborough. Please note that from announcing that we would develop this

Strategy in February this year to its launch was only 5 months - a demonstration that we recognise fully that time is of the essence. The Strategy is, by design, bold and ambitious; it is an opportunity for us all across the enterprise, one which we must all embrace and adapt to.

Some have asked why we need such a strategy, why we don't just buy existing off-the-shelf products? In some cases, that is indeed the right approach. But it is our national intellectual property – the body of knowledge, as Sir Brian Burridge recently described it at RUSI – that explains why the UK is the only Tier 1 partner in the F-35 programme. It is this British body of knowledge that has delivered the UK's 15% stake in every F-35 sold. It's the body of knowledge which has placed us at the leading edge of Typhoon capability development, an investment on which we are reaping the reward every day on operations.

It is therefore self-evident that, in addition to delivering military capability, we must understand and respond to the needs of the aerospace industry which supports us today, as it has done throughout our one hundred year history. So through the Combat Air Strategy, Defence is committed to considering strategic objectives and outcomes such as national prosperity, industrial capability and the international dimension to future Combat Air decisions.

Perhaps most notably of all, the launch of the Combat Air Strategy allowed us to reveal our rapid progress with Project Tempest, the Future Combat Air System Technology Initiative. If the sight of that full-scale platform shape, and the concepts supporting it, did not excite your ambition to be part of this future enterprise, then I rather doubt there's much more I can offer you!

It is indeed bold and ambitious and a clear statement of UK intent and leadership, which I can guarantee you that others have noted very strongly. But whilst we have taken this first step across the line alone, we do not want to do the whole programme alone. We know the value of working in collaboration with other nations. It is one of UK aerospace's greatest strengths. We have, for example, collaborated very successfully in the Jaguar, Tornado, Typhoon and Lightning II aircraft programmes, and in the Meteor missile. I can see no reason why Tempest should not follow the same path.

Let me use this opportunity to underline again what are for me some of the key principles of the Tempest programme - indeed for all of our acquisition. Pace is vital. We cannot accept long gestation periods for new equipment, nor can we acquire the information capabilities which will be at the heart of all of our systems, using processes where even defining the requirement currently takes longer than a Moore's Law cycle, condemning us to falling ever further behind.

I then repeat what I said back in July - we need to think of Tempest in a different way, not least in the balance between platform, weapons, sensors and systems; on-board and off-board; manned and unmanned; live and virtual. As Richard Berthon, the MOD's Director of Strategic Programmes argued in his recent RUSI speech, platforms should not be treated as ends in themselves, but as sub-systems from and to which technology can be migrated.

Imagination, innovation and management - not avoidance - of risk is equally vital. Which speaks to the ground-breaking partnering arrangements we have initiated and are maturing with industry. And the need to accept that successful exploitation of commercial technology will become ever more important - in 2016, only £1.8 Bn out of a £33.1 Bn UK R&D commitment was spent by the MOD - so we should focus more

on how we extract greater benefit from others' R&D investment, especially in the information and data domain.

We need to break the mindset that this better technology can only come at ever greater cost. I don't accept, for example, that if I want Tempest then I will have to trade down numbers to be able to afford the technology that I need – dumbed-down solutions aren't the answer to deterring and defeating our increasingly high-tech adversaries. I want complex technology which gives me the decisive edge, and I want mass.

With all that in mind, Team Tempest is on track to deliver a Strategic Outline Case by the end of the year. To be followed by an Outline Business Case in 2020 and a full Business Case in 2025, with the delivery of a future combat air capability in the early to mid-2030s. An ambitious target, but necessarily so for the strategic reasons I've made clear - I am confident that, together, we will do it.

Importantly for the immediate future, the Combat Air Strategy provides an ongoing commitment to investment in Typhoon upgrades, including weapons, sensors and defensive aids, ensuring that this backbone of our combat air fleet will remain potent and capable of dealing with emerging threats throughout its planned lifespan.

But developments in Typhoon won't be limited to just that platform. Too often we have retired our aircraft at the peak of their capabilities. Instead, the baton of capability improvement must be passed to new systems, delivering rapid spiral development. This approach reduces risk and cost and generates the maximum return from our investment.

It also gives us greater headroom to research and develop brand new capabilities quickly – an approach the RAF's Rapid Capability Office is already exploiting through supercharging our processes and embedding expertise from all

stakeholders. Such has been the RCO's success that last month it was recognised with the 'Investor in Innovations Award' by the Innovation Council.

I have spoken quite a bit about the importance of our future combat capability and its relationship with our national prosperity – and I am proud that today combat air technologies account for well over 80% of UK Defence exports in a field worth £6 billion annually. But, for me, such measures provide too narrow a definition of Defence's contribution to national prosperity, because its principal contribution is in providing the very security needed to allow prosperity to flourish.

Which brings me to the Royal Air Force of today, and what we have been doing for our country in this remarkable centenary year. Since I last addressed an audience from this stage at the end of March, it's fair to say that a great deal has happened and that the RAF has been rather much in the spotlight.

From our actual 100th birthday on the first of April - and yes, we did get a special message from the Queen - through to the magnificent parade and flypast in London on 10 July; and the enormous range of activities that have taken place across the United Kingdom and around the world to mark this very special year; we have truly fulfilled our aim to commemorate, celebrate and inspire.

And we have connected with people and the public at large in a way which has far-surpassed even our most optimistic predictions. I mean, they even did a special dance for the RAF on 'Strictly' last Saturday - strangely, one particular RAF100 event which I wasn't asked to participate in!

But across the RAF Family and to all our sponsors and supporters, whether in industry or more widely, can I just say

again a most sincere thank you for what you have done to make RAF100 such an outstanding success. [add comment]

But while RAF100 has been so very important to us, it's not actually been the most important thing that the RAF has done this year. Our primary task has remained, as ever, to deliver the nation's air and space power. That is what defines us, and we remain at our busiest for a generation.

So whilst we all looked on in awe as 22 Typhoons flew that '100' formation over London, the Typhoon Force was simultaneously deployed to the Middle East, the Falklands and Romania, as well as providing persistent defence of our national airspace.

But it's far - very far - from just being about our Combat Air capabilities. The contribution made by our Reaper, Hercules, Atlas, Voyager, C17, Sentinel, Shadow, and Rivet Joint crews to operations in the Middle East is no less outstanding. Sentinel for example has provided almost 40% of all Coalition Synthetic Aperture Radar and Ground Moving Target Indicator capability. And on the ground too - at one critical juncture this year, Number 1 Intelligence Surveillance and Reconnaissance Wing provided more than 35% of all Coalition forensic intelligence products used in target development and operational planning. It has been a stunning effort all round.

We remain committed in Afghanistan, and in Africa we have continued our Force Protection training in Nigeria, medical support to the United Nations Mission in South Sudan as well as deploying a Chinook helicopter detachment in support of French operations in Mali. And to the far South, our maintenance of the airbridge to the Falkland Islands and our Quick Reaction Alert capability there remain robust.

To East Asia, in response to the recent earthquake and subsequent tsunami in Indonesia, an Atlas rapidly deployed to the region, transporting 61 tonnes of much needed aid. On top of all that, of course, we maintain our commitments to NATO and the defence of the UK's sovereign airspace against all potential adversaries.

These are just some of the operational highlights, of course, but in summary, since the start of the year, approximately 6,500 RAF personnel have been deployed abroad in support of 15 operations in 23 countries and across 5 continents – defeating our enemies, protecting our interests and securing our skies. And that doesn't include Exercises, such as the recently completed Saif Sareea in Oman which I visited last week - nearly a thousand RAF people deployed on that, and the whole Exercise, and indeed virtually any UK operation anywhere would not happen without our extraordinary Air Mobility Forces and their unceasing activities.

Within a long list, perhaps the major capability milestone this year has been the re-formation of Number 617 Squadron – the Dambusters – on the 75th anniversary of their original formation in 1943. Their arrival at Marham in June with the game-changing F-35 Lightning marked a new era in UK air power, a fact only reinforced through the recent flight trials with HMS Queen Elizabeth off the East coast of America.

By the end of this year, the F-35 will have a declared operational capability from land bases, and we will be well on the way, together with the Royal Navy, to restoring our country's carrier strike capability. Furthermore, our combat air power will soon be being strengthened through the formation of two new Typhoon squadrons, and we eagerly await the restoration of our sovereign Maritime Patrol capability with the delivery of the first P-8 Poseidon next year.

The arrival of Protector, our next generation remotely piloted air system, at the Royal International Air Tattoo in July pointed to a future RAF equipped with the persistence, range and precision that will remain the cornerstone of our capabilities into the future. And we gave real meaning to our motto – *Per Ardua ad Astra, Through Adversity to the Stars* – through the launch of the Carbonite 2 low-earth orbit full motion video small satellite and the Defence Secretary's confirmation that the RAF leads the command and control of UK Space operations.

On the first of November, we put command and control right at the heart of our business by re-forming 11 Group - of Battle of Britain fame - at RAF High Wycombe, providing a multi-domain operations nerve centre that will direct and co-ordinate how we truly integrate across the air, space and cyber domains and put rapid, agile C2 at the heart of our next generation Air Force. And finally, we have restored our radar capability in the Shetlands, helping secure our airspace to the North.

So, overall, it has been an incredibly busy year – organisationally as well as operationally. And complementing all of that has been the magnificent series of events to mark our Service's centenary. Throughout, our people have been outstanding, and so too have all those who have supported us from across our diverse society. We genuinely seized the opportunity presented to us by RAF100, reaching over 2 million children through initiatives such as our School Science Technology Engineering and Mathematics days – the largest programme of STEM-focussed Youth Engagement ever undertaken by the Armed Forces.

Our national aircraft tour visited cities across the length and breadth of the United Kingdom, bringing the RAF to the doorsteps of people who rarely encounter us - over 165,000 attended. In short, we have sought to inspire people across the whole of our society, and I am confident that the impact of

RAF100 will extend into our 'Inspire' legacy, for which we are now busy building upon the foundations laid.

We aim to inspire partly, as you would expect, to help us to continue attracting the best people towards a career in the RAF – and we have just had our most successful recruiting year for a decade. But our ambition is also to connect with society at large, securing benefit not just for the RAF, but for the entire aerospace.

Our technologies may have changed immeasurably since our formation, but our people essentially haven't - they continue to be the very best - confident, capable, committed. Our apprenticeship scheme, perhaps Lord Trenchard's greatest legacy, continues to shine - earlier this year, we won the Macro Employer of the Year at the National Apprentices' Awards. We also won the annual Women of Achievement award; and a Special Recognition Award at the Pride of Britain award. I could go on - we have been consistently recognised as an leading-edge employer. And we even won the Inter-Services rugby.

But let's talk about an individual as an example. Last month, I had the privilege of reviewing a joint graduation of officer cadets and recruits at the Royal Air Force College Cranwell. I met young men and women like Aircraftwoman Stevie Cook – who, aside from representing her county at hockey, netball and athletics, had also been a professional footballer before joining the RAF. She also holds a First degree in International Politics and a post-graduate degree in Psychology. And this very day, she started her professional training as an Intelligence Analyst and Linguist.

She is not unique in bringing such talent into the Service – she and all those entering the Royal Air Force today, either in the Regulars, Reserves or in the wider Whole Force – are the worthy inheritors of the legacy passed to them by the

generations of airwomen and men who have created and maintained the RAF's unsurpassed reputation for excellence over the past century. Who could fail to be inspired by the people who join our ranks today, or by those who preceded them?

Which brings me back to the RAF's creation one hundred years ago. Yesterday, we marked the centenary of the end of the First World War. The whole country paid silent tribute to the sacrifice made by the men and women who gave their lives in that bloody conflict – not least the 9,378 members of the Air Services who died. We will always remember that sacrifice.

But we also reflect on the Royal Air Force as being one of the legacies of the First World War. As King George the Fifth said in his message to the RAF on the eleventh of November 1918, 100 years and one day ago, 'the birth of the Royal Air Force, with its wonderful expansion and development, will ever remain one of the most remarkable achievements of the Great War'.

In his final dispatch of the War, Lord Trenchard wrote of the men and women under his command:

'They were imbued with the feeling that whatever their casualties were, if they could help shorten the war by one day ... they were only doing their duty. I never saw, even when our losses were heaviest, any wavering in their determination.'

That same spirit imbues the men and women of the Royal Air Force today, and I am extremely proud of each and every one of them. We are now in our second century, an era in which we will expand even further our reach – beyond the limits of our atmosphere, beyond today's horizons of technology and beyond the limits of our imagination.

I know that throughout that journey, the Air League will be at our side, as it has been consistently since the Royal Air

Force's birth a century ago. I think that Sir Andrew Humphrey would be rather proud of us all.