

UK AIR AND SPACE POWER IN A MORE DANGEROUS WORLD



10 PERSPECTIVES







COMPILED BY THE AIR AND SPACE POWER ASSOCIATION

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“The most fundamental paradox is that if we’re never to use force, we must be prepared to use it and to use it successfully.....

The purpose of our military is simple and straightforward: We want to prevent war by deterring others from the aggression that causes war. If our efforts are successful, we will have peace and never be forced into battle. There will never be a need to fire a single shot. That’s the paradox of deterrence.”

**US PRESIDENT RONALD REAGAN
RADIO ADDRESS TO THE NATION ON ARMED FORCES DAY,
21 MAY 1983**

“The lesson from 1938 and 1939 is that if aggression pays off somewhere, it serves as an invitation to use it elsewhere,”

**ESTONIAN PRIME MINISTER, KAJA KALLAS
17TH LENNART MERI CONFERENCE, TALLINN,
17 MAY 2024**

“Ukraine has bought us time. Will we put it to good use?”

**POLISH FOREIGN MINISTER, RADOSŁAW SIKORSKI
17TH LENNART MERI CONFERENCE, TALLINN,
17 MAY 2024**

"Two things, I confess, have staggered me, after a long Parliamentary experience, in these Debates. The first has been the dangers that have so swiftly come upon us in a few years, and have been transforming our position and the whole outlook of the world. Secondly, I have been staggered by the failure of the House of Commons to react effectively against those dangers. That, I am bound to say, I never expected. I never would have believed that we should have been allowed to go on getting into this plight, month by month and year by year, and that even the Government's own confessions of error would have produced no concentration of Parliamentary opinion and force capable of lifting our efforts to the level of emergency. I say that unless the House resolves to find out the truth for itself it will have committed an act of abdication of duty without parallel in its long history."

WINSTON CHURCHILL: 'THE LOCUST YEARS' SPEECH
HOUSE OF COMMONS, LONDON,
12 NOVEMBER 1936

FOREWORD

People who fly and fight understand that fighting without air and space freedom to manoeuvre and operate makes all military operations difficult.

When the electromagnetic domain is severely contested - as it is between Russia and Ukraine - and air superiority is not achieved, to fight by, with and through air and space is more difficult and complex. Many of the current generation of aircrew and aviators have only known precision navigation and timing signals. When they too are denied, spoofed or jammed, the lesson of reversionary navigation puts command, control and precision at risk. We do not yet know if that risk is here to stay, but if it is many of our procurement plans and programmes will need to be revisited - fast.

As will our approach to air-to-air and air-to-surface weapons in order to reduce regulation and complexity and increase stockpiles. There is plenty to discuss.

That is why this short book defining a decisive moment matters. We need to ditch military tribalism and work together: regular, reserves, civilians and industry to win! We have done it before and we can do it again; but win we must.

This volume provides the wake-up call. Are we ready?

Air Chief Marshal The Lord Peach KG GBE KCB DL

PREFACE

No matter your previous experience of military Air Power, you will not be alone if you are a little mystified by its true nature or purpose. The same is true of Space Power, which is even less accessible but no less fascinating. Both these forms of national power are such an integral part of our lives and cornerstones of our national security and defence, yet their character and value are little understood, with reference points that are often long-gone historical events.

Powered flight began in 1903 and less than a decade later the aeroplane was to establish itself as an indispensable instrument of war. Today, Air Power operates at supersonic and even hypersonic speeds, and we see technological advancements almost daily. And now, Space Power is both fundamental to our way of life and our military capability. But truly understanding the importance and complexity of both forms of power remains elusive to many. For some they are literally out-of-sight out-of-mind, for others they are either inaccessible or too secretive to really grasp - the stuff of science-fiction not fact.

Air and Space Power can be fascinating and frightening in equal measure. The fact that aircraft can get behind battlelines means that they can affect populations directly - from political leaders to the general public - where the threat

of attack from the air, unannounced and instantaneous, generates a unique fear. Our reliance on space and other critical national infrastructure means that our economies and way of life have never been more vulnerable to its assured use. But, owing to the post-Cold War 'Peace Dividend' and relentless down-sizing of Western armed forces, the UK and its allies find themselves at their most perilous state for several generations. So, it has never been more important to understand and invest appropriately in UK Air and Space Power to secure our skies and our nation against the deepening threats posed against us. If we fail in meeting this imperative, deterrence will fail and war – on the enemy's terms – will be the likely consequence.

Because we face a more dangerous world, which is both violent and unpredictable, this book focuses heavily on the hard power aspects of air and space, i.e. those elements that focus on deterring or defeating an adversary. However, there are far broader considerations, such as its utility to deliver humanitarian aid or disaster relief, or the benefits to national wealth, growth and prosperity through the creation and sustainment of high tech skills, knowledge and manufacturing. The UK's aerospace sector alone provides over 120,000 highly skilled, high paid jobs, and an annual turnover of £35Bn, of which the majority is from exports. UK Air and Space Power is so much more than just military strength.

The 10 short essays in this book address some key perspectives that make the case for Air and Space Power as a critically important tool of national power and security. But, because the UK has chosen to accept significant risk in the reduced shape and size of its defence over the last few decades, we address also the need to restore credible Air and Space Power capabilities in this country to deter and, if necessary, defeat our enemies. [At the end of some chapters there are links and QR codes to relevant content that complements that chapter. Also, the free e-book version of this publication on our website <https://airspacepower.com/> will continue to evolve by hosting and signposting additional information and ideas.]

In our final chapter we make some recommendations as to how best mitigate the current and future risks. But we have been very mindful of the financial situation that a new government will find itself, so it has attempted to do so in a series of measured steps that reflects fiscal reality. So, this is not a plea for a certain % of GDP to be spent by a certain time - economic stability and strength is a fundamental bedrock of national security, on which a credible military must be built. We fully acknowledge that a new government has years of neglect and long-overlooked threats to address, whilst under huge economic constraints. However, any analysis should start with a clear identification of the immediate threat, the identification of the best response

and return on our investment, followed by tough decisions on where the available budget is best spent. So better spending not necessarily more spending, where any 'sacred cows' need to make their case on merit not emotion.

The book is small enough to keep in your pocket, short enough to not take up too much time and straightforward enough to be easily understood. But don't be put off by the simplicity, shortness or size. It was created through a collaboration with numerous experts in international relations, national security, defence, industry, academia and journalism. Our thanks go to all their vital inputs, with a particular mention to the Freeman Air & Space Institute and the Royal United Services Institute for their own special contributions throughout.

Disclaimer - Whilst this publication has benefited from a wide and diverse input, including veterans from all branches of the UK armed forces, it has deliberately and meticulously avoided seeking input from anyone currently serving, or in any way connected with current policy formulation or delivery. Whilst we hope that much of what we say is both coherent and strikes a chord with contemporary defence thinking, it in no way reflects current or future policy, or has any official or unofficial endorsement.

INTRODUCTION

Today, the UK faces the dual and dangerous perils of an escalating threat meeting declining military strength. The threat is clear, present and increasing; it threatens democracy, our way of life and even our homeland, and we are the least prepared to deter or meet it since the end of the Cold war.

Our nearest allies face the same threats, but whilst our combined strength in numbers can provide some reassurance, alliances can be weakened or diverted. In any event, we have a responsibility to cater for our own defence; Russia, for instance, routinely singles out the UK as its principal object of hate. This more dangerous world is not some future state that we need to plan for, but a situation that demands immediate action if we are to not end up fighting the war we saw coming far too clearly. Recent debates about national military conscription have met with little appetite, but, if a period of gentle boot camp is a hard policy to sell, imagine living in Ukraine and having to send your sons and daughters into a real war.

The warning sirens have been sounding for some time, revealed through the use of chemical and radioactive materials to assassinate peaceful citizens on our shores, malign activity in space and cyber space (even against our NHS), or active interference in our media, politics and

government. These, and the most dangerous escalations yet - Russia's illegal invasion of Ukraine - and China's threat of the same against Taiwan, demonstrate that the threat is real, present and doesn't play by the rules.

Despite the clear signals over many years, the UK has continued to take risk in its national security by eroding the size, strength and depth of its armed forces - Winston Churchill would have called them 'Locust Years'. For example, the **RAF is just one third the size it was at the end of the Cold War**; and whilst it continues to invest and adopt leading edge technologies and employ brilliant people, higher quality can only mitigate so much lost quantity.

For many years, the UK Armed Forces endured unprecedented cuts in funding. As a result they have shrunk in size and stature, and, in trying to retain prestige and process, have become increasingly inefficient spenders. Misplaced optimism by policy makers, masked by more recent conflicts that have required limited conventional forces, have all served to increase and intensify risk. Those risks have now come home to roost, and the dangers are too great to ignore. It is time to invest in a strategic renaissance of our country's defence, in which Air and Space Power should be at the forefront.

1: THE PRECIPICE

The world is at its most perilous state for decades and we now face a multi-generational threat from Russia, and a rising one from China, neither of which have been deterred. After the Cold War we entered an era of intervention and wars of choice, secure in the belief that the home base was immune from attack from another state. The world has changed: the next war is much more likely to choose us and much sooner than we would like.

The world today is a more dangerous, unstable and unpredictable place – and worsening. We have seen the resurgence of undisguised state-on-state conflict or attacks, where malign states like Russia, China, North Korea and Iran are openly colluding. They intervene in cyber-space (including against our NHS), space, amongst our populations, and in our politics. They threaten us through large mobilizations of military forces in areas of high tension, or, in the case of Russia, have illegally invaded Ukraine. There is political chatter of us entering a “pre-war” era, yet we do very little in response and are most certainly not on a war-footing. And whatever the outcome in Ukraine, a wounded or “wronged” Russia is now a multi-generational problem, with China close behind and in many ways more challenging in terms of the pace and scale of its advancement and longer-term ambition.

As wars expand and leak across borders, so the chances of miscalculation increase. Where protagonists have lacked the ability or will to employ effective Air and Space Power, we see wars of attrition reminiscent of the start of the 20th Century rather than the 21st. Also, newer technologies have heralded the increased use of longer-range weapons fired with precision across vast distances, and, from Russia, we now see the regular, almost casual, threat of nuclear weapon use in their media and political statements.

Whilst some talk of our unique geostrategic position as a reserve or hub for NATO, the UK plays a far more vital and fundamental role due to some of its unique skills and competencies, especially in the air and space domains. We cannot duck our continental responsibilities as NATO comes under increasing pressure and scrutiny, no matter how strong the siren call for a "tilt" to the Indo-Pacific might be.

The UK's Air and Space Power, like its maritime and land cousins, finds itself under-invested and under-sized after decades of so-called 'efficiencies' and peace dividends, where a cost-saving mantra allowed our ability to deter conventionally to atrophy. But it can't conscript itself out of trouble, so recovery will be a long and painful affair, which will require difficult choices, ingenuity and an appetite for

risk, every bit as much as it needs increased investment. Indeed, even 2.5% of GDP spend won't fix the problem, so money isn't the only answer or constraint, but nor do we need prolonged debate or delay.

So, we face a Defence and National Security Review like none before it, which must address the challenges posed by a clear and present danger, a yawning affordability gap and little or no latitude for financial relief. There will be discussions about Continental versus Maritime Strategies, which Air and Space Power can bridge, but when resources are tight the only answer is ruthless prioritisation of those elements that give you the greatest return on your investment and are best placed to face the most immediate and dangerous threat - a threat that looks more like a bear than a dragon for now.

2: INDISPENSABLE

Air and Space Power is the UK's watchkeeper and first responder – its first line of defence and its quickest means of sustained offence. It keeps our nation and territories safe, and keeps our enemies at bay by projecting or threatening precise and swift military action well behind their borders or shores.

Military Air and Space Power is defined as the use of air and space to influence behaviours or outcomes. Whilst it is generally agreed that the Earth's atmosphere ends and space begins at what is known as the Kármán line (around 100km above the Earth's surface), they both possess unique qualities that make them very different to land and sea power:

Air Power has no real physical barriers to its movement, and its height and speed enables the highest possible perspective, with a response time measured in minutes or hours. A single aircraft can cover multiple tasks during a single mission, and by travelling faster and further than any other form of conventional power, it can swiftly deliver a concentration of effort.

Space Power provides an even greater vantage point that can cover or reach vast swathes of the Earth's surface due to its wide view or by traversing across the globe at high speed, and can do so repeatedly for years after

launch. Its persistent stare provides a 24/7 observation of our enemies, reduces or removes the chance of surprise against our surface forces, and provides the data and bandwidth to make and communicate informed decisions.

Air and Space Power together can observe and attack an enemy long before they can be brought to bear on our own surface forces. This not only creates time and space for our own forces to manoeuvre and operate without interference, it also can strike an enemy far behind its front-line, at places of greatest weakness or concentration, where an attack can have a more devastating and disproportionate effect.

The combination of lethal force, flexibility, speed and reach enable the maximum freedom of choice and options for military and political leaders up to the last possible safe moment. Able to respond quickly from rest or ground alert, it enables decision-making with the most up-to-date information, and the freedom and flexibility to escalate and de-escalate quickly by scaling up or down, or redirecting effect swiftly.

In our cyber-centric world of instantaneous communication, threats and information move at the speed of light and in four dimensions not two. In the 21st century, the foundation of hard power is increasingly in the shape

of Air and Space Power, without which all other forms of military capability are far less effective and far more vulnerable. Whilst the UK's nuclear deterrent is our ultimate safeguard, it is incapable of deterring all except the most extreme threat scenarios and is essentially a weapon of last resort. More practically, deterrence is scaled through layers and degrees of conventional power, of which Air and Space Power is at the very tip, whether defending our airspace from surprise attack 24/7, 365 days a year, or the threat or use of lethal force quickly at a time and place of our choosing.

What is Air Power? →
MOD Video



3: CONTROL

"If we lose the war in the air, we lose the war and we lose it quickly."

FIELD MARSHAL MONTGOMERY

In 1944, the Nazis launched some 7,000 V1 'Doodlebug' cruise missiles against England, causing 5,475 deaths and injuring a further 16,000; roughly half of the flying bombs were destroyed by fighter aircraft and artillery. Today we face a far more dangerous, prolific and growing threat, both at home and abroad, and are far less prepared and able to meet it than we were in 1944.

When you lose control of your skies or, increasingly today, your airwaves, you become vulnerable to attack at any time and in any place. At home in the UK, this means that our people, our critical national infrastructure, our homes and our very way of life can be attacked directly or can be held to ransom by its very threat. Due to our increasing reliance on technology and quest for efficiencies of scale and co-location, we have become ever more dependent on a relatively small number of vulnerable sites.

Controlling the skies (or air superiority as militaries call it) is the ability to achieve a sufficient dominance of air or space power over an enemy, so that you can conduct your operations without meaningful interference from their

air forces. So, it not only protects you from the actions of your enemy, but allows you to impose your will on them through Air Power. Your control of the airwaves is carried out through the measures and counter measures called electronic warfare

On the battlefield, as Field Marshal Montgomery said, in the absence of air superiority, you lose the war and you lose it quickly. If neither side can control their skies, as has been the case in Ukraine, then you get the static, attritional type of warfare, that has come to characterise that conflict - where thousands of soldiers lose their lives, sometimes in a single day, with little strategic advantage being gained.

The longer range threats we face now include ballistic and air or ground-launched hypersonic cruise missiles and long-range drones; shorter range systems include rockets and artillery or smaller attack drones. It is true that we benefit from some protection through our geography and a NATO screen in front of us, but we still remain particularly vulnerable to air-launched cruise missiles from the North of our islands.

In the airwaves, electronic warfare has been evolving since the First World War, and has become a vital element of air operations in order to gain and sustain operational advantage. By the end of the Cold War the duel between surface-to-air missiles and counters to those missiles

became ever more complex and complicated - NATO and Soviet air forces were filled with modified aircraft and specialist operators to contest the spectrum. But, as with our missile defences, the era of expeditionary operations saw a removal of the skills and equipment to conduct such roles. Unfortunately, Russia has kept investing in the electro-magnetic spectrum, as we see to great effect in Ukraine; where the Ukrainians have done a superb job in innovating and reapplying counter measures with a shelf life of weeks not months. So, we need to revalue and reinforce our few remaining specialists, relearn the fail-fast and experimentation mentality necessary (with a procurement cycle to match) in order to compete in the live and rapidly-changing electromagnetic spectrum.

Wars past and present have demonstrated that those who achieve control over their skies and airwaves and those of their enemy can achieve their military objectives swiftly without undue interference. It is the foundation upon which military success is built.

What is control of the air? ↻
MOD Video



4: FIGHTING FIT

According to accepted boxing wisdom: 'everyone has a plan till they get punched in the face'. Some boxing fights finish spectacularly early after a knock-out blow, but most go the distance. As Russia's invasion of Ukraine has shown, major wars tend towards the latter. However, the truth is that the UK does not have the capacity or reserves to go 12 rounds with a peer competitor. If it wants to deter current and future threats it needs to both have a solid defence and pack a punch, but with the means to keep blocking and keep punching if deterrence fails.

When assessing military might the tendency is to take a "Top Trumps" approach that looks at simple performance figures or numbers that can never truly convey worth – it would be the equivalent of judging a boxer by height, reach and bicep size alone. It is also said that quantity has a quality all of its own, but the truth is there is a balance to be struck. Raw strength and hitting power are important, but so is the stamina necessary to sustain it. **Our armed forces need to be resilient if they are going to be credible, and after years of under investment under the guise of so-called 'efficiency' our resilience has paid the price.**

By resilience we mean the ability to survive and the capacity to keep fighting, which comprises many elements. Sheer numbers of the right equipment (aircraft, satellites, systems, weapons, ancillaries etc) is a key element, but so do sufficient spares and their supply chains play an essential part, especially when the manufacturing of complex systems can be measured in years. Ensuring that we have enough 'gas in the tank' and/or the assured industrial capacity to resupply (where sovereignty might provide the ultimate guarantee) are fundamental areas that need immediate attention.

Resilience also requires back-up systems and redundancy to ensure that there are no critical vulnerabilities that can be targeted or exploited. This includes the physical and the digital world, both of which could come under attack. In the physical sphere this includes protection in, on and around our critical national infrastructure and key politically-sensitive centres to ensure their security, as well as our key military installations to enable their ability to continue to launch and sustain missions.

Past efficiency measures, based on commercial, savings-driven consultancy models have stripped out our capacity to withstand attack or mount those of our own. It not only reduced our footprint through base closures, which has presented high-value choke points to our enemies, but

also reduced the resilience of that much smaller footprint through the use of less protected or more concentrated infrastructure, or leaner supply chains – **this has to be rectified if we are not to suffer our own Pearl Harbour moment.** It should be noted too that our industrial complex and supporting critical national infrastructure is equally vulnerable to the same fate.

Last but not least, the recruitment, retention and recovery of trained personnel is vital, particularly in the air and space domains where skill levels are high and training long. Whilst armies can be conscripted to a degree, air and space forces largely cannot: we need to find and keep the right people in the right numbers before a battle starts - recruiting and training personnel for the more technical roles after the bell sounds is not only extremely challenging without the spare capacity to do so, but also far too late.

We have some catching up to do just to build back our stamina before we even think about growing in size. In the UK we have some World class capabilities and people, but what we need to do is make sure our enemies wear out long before they do.

5: UNITY

In addition to their own unique independent strategic effects, UK Air and Space Power underpin our national security by being a unifying and enabling force. They bind and integrate with all other forms of national security, in order to protect, connect, and deploy our national power independently, or in unison with our allies and partners.

This unifying concept is known as **Multi Domain Integration**, which is simply about every facet of defence working seamlessly together, alongside other government departments, agencies, allies and partners, to deliver the common purpose of defending national and, where appropriate, allied interests. The QR codes and web links at the end of this section link to a blog that covers this in a bit more detail; but the key takeaway here is how Air and Space Power is central to this concept.

The first and most important role of Air and Space Power is to keep the nation and our armed forces safe from attack. Without control of the skies above we have no safe foundation from which to project our own will; 24/7 surveillance from air and space, integrated with the means to deter or intercept any attack provides this fundamental element.

In addition:

Space Power provides the means to gather data and intelligence that help inform decision making and warn against impending threats in order to guard against surprise attack. It is the primary means by which we navigate the world and guide our weapons or sensors onto targets with incredible accuracy and precision. And finally, it provides the connectivity and bandwidth to allow the real time sharing of information and knowledge across the force, providing decision-makers with the up-to-date information they need to make the right decisions at the right time.

Air Power is so integral to the Army's and Navy's own internal needs that they have their own organic air elements to meet their specific and exclusive needs - with the Royal Air Force owning and controlling the more universal air elements that span the land and maritime domain and beyond. In addition to our surveillance from space, aircraft also provide invaluable information from across the electro-magnetic and sound spectrum, ranging from the detection and tracking of submarines at sea to the precise locating and identification of adversary units or equipment on land. Aircraft also provide the swiftest means of moving equipment and personnel across large distances in order to deploy and sustain operations. And,

most importantly, they can detect and strike an enemy before it can engage our land or sea forces, leaving them free to manoeuvre and operate with relative impunity.

Alliances are a vital and integral part of our defence. Air and Space Power, because of its all-pervasive nature and being unconstrained by geography, are, by design, more readily and easily integrated within alliances and between nations, making the whole more than just the sum of the parts. In the specific case of NATO, the UK's contribution in air and space is highly regarded and valued. As such, we are uniquely placed within the Alliance to make a disproportionately positive contribution in the space and air domains, and enhancing our effectiveness and prestige within the political Alliance.

What is Multi Domain Integration? ➔
Strategic Command blog



6: ROBOT WARS?

A propensity to view drones primarily as a pilot-replacement scheme did mask their wider potential, because they are now a new dimension of military power outright. They are revolutionising the way we fight - replacing some things and enhancing others. Not every potential use is proven or invulnerable to future counter measures, but we need to move quickly to grasp the real opportunities and meet the growing threat.

There has been no greater interest and focus in recent warfare than on the subject of drones and the artificial intelligence that could control them. However, drones, like the V1 missiles that attacked London so devastatingly in 1944, have been around for over a century. The last two decades of counter-insurgency and counter-terrorism operations show-cased the most complex and costly types yet, where remotely piloted drones like the Predator provided invaluable, persistent surveillance and armed-overwatch to ground patrols. But these operations never tested or exposed their relative vulnerability to conventional air defences, nor their complete reliance on secure satellite communications.

What we are witnessing now is a surge of cheaper (often commercially available) drones, which are both expendable and far cheaper than the countermeasures used against

them – although this is likely to change over time. What is clear is that the simple word ‘drone’ can no longer define the ever-increasing number of types available. Such systems now offer the potential to replace some or all of a ground force’s fire missions currently carried out by attack helicopters, artillery or mortars. And on - or under - the sea, they not only offer conventional capabilities without a crew, but, as we have witnessed in the Black Sea, now question the very vulnerability of crewed vessels. Longer range attack drones have now blurred the definition and classification of what is a drone and what is a cruise missile. Collectively, they now span the entire spectrum of military power, from surveillance to attack, and as expendable decoys or jammers to enhance the survival of crewed machines and human combatants.

And the most tantalizing promise comes from ‘smart’ drones that will be as sophisticated and valued (and almost as valuable) as the most sophisticated crewed aircraft – able to survive in hostile environments and carry out the most complex of tasks over long range or endurance and be re-used repeatedly. These advanced drones may offer the potential to reinforce reduced aircraft numbers at a fraction of the cost, either by adding to or enhancing the survival of existing crewed fleets. The RAF’s Autonomous Collaborative Platform strategy is already looking at a suite and sliding scale of drones that can exploit this potential.

Drones are ideal for 'dull, dirty, and dangerous' missions; where the elimination of risk to life and their relatively low cost can change the balance of investment equation dramatically. The debate over how much autonomy is possible or desirable will continue, but drones of all forms will become commonplace on the battlefield, as will the counter measures to combat them. Once seen as a revolution of air power, they are now proving even more disruptive on the land and at sea.

How are drones revolutionizing warfare? →

Bloomberg video



7: STAR WARS

Space underpins our way of life, our national security and our prosperity. But it has become weaponized by both Russia and China, and because of the dual-use nature of space assets and the universal accessibility (or democratisation) of space, the commercial and national security risks are now entwined for ever. Space has become as vital to our everyday life as it is to our military and national power, and it is under threat every single day.

In 2007, with no warning to the rest of the world, China successfully launched an anti-satellite weapon into space, in breach of "The Outer Space Treaty"; the resultant debris of over 3,000 trackable pieces from that strike still linger in orbit today creating a hazard to all other space objects. In 2021, Russia carried out their own anti-satellite test.

We have become increasingly reliant on Space: ATMs, point of sale card machines, the internet, transport systems, farming yields, environmental monitoring, global logistics and mobile communications all depend on signals or observation from space. A UK Government paper in 2023 (based extensively on the 2018 Blackett Review into Satellite-derived Time and Position) suggested that the economic benefits to the UK of Global Navigation Satellite Systems alone were worth over £13Bn a year (double what they were 5 years previously); but it also showed that an

outage of just 7 days would result in a wider economic loss of over £7Bn.

Space is a critical national infrastructure, and watching over it and protecting it is a strategic priority.

But just as our day-to-day existence and prosperity are increasingly underpinned by Space, our armed forces have become equally dependent on it too. It now gives the ability to see things that were once hard or impossible to observe and provides secure reliable communications that are critical for the gaining and sharing of data and information. Space-derived global positioning is embedded in our sea, land and air operations, and precision weapons routinely require satellite signals to accurately locate and home in on their targets. The loss of signal would result in less precision and require more effort to create the same effect – ‘more effort’ that was traded away for ‘efficiency’ long ago.

Communications are essential for command and control of our forces and increasingly these rely on space systems (including timing), especially over long ranges. The ability to rapidly move information is key to timely decision making and disorientating a foe. One example is that drones flying beyond line of sight rely on satellites to connect to their operators – lose communications and you lose the capability. Watching Ukraine (and Russia) negotiate with Elon Musk over the use of Starlink gives

an indication of how critical and prevalent commercial systems have become, and what happens if you don't have assured access to your own.

Space-based sensors are increasingly critical in understanding the battlespace and numerous systems support decision making with the data they provide. Intelligence, surveillance, reconnaissance, military tracking, screening, missile warning, signal detection, weather and environmental monitoring all increasingly rely on space - to lose these would be like fighting blind.

In order to maintain advantage and offset some reductions in numbers, our armed forces are increasingly designed around and highly dependent on space-based services, including their highly critical and equally vulnerable ground and digital links,. The impact of the loss of Space Power is to make the force less effective and inefficient at best, and inoperable at worst. Our enemies know that our way of war and way of life are increasingly based on the uninterrupted availability of services from Space. Just as we must protect our skies, so must we protect our upper skies in space at all costs.

Keeping space safe 
RAF video



8: SHIELD

A Government's fundamental duty is to protect the nation, yet the means to do so from the increasingly acute risk of air and missile attack has never been so thin. Currently, the UK cannot adequately defend or protect itself from sustained air attack, either at home, on all our sovereign overseas territories or on military operations. To do so requires an Integrated Air and Missile Defence system with the ability and capacity to defend and protect our vital assets at home and abroad.

Defending air attacks became a task soon after the airplane was invented and was the reason for the creation of the Royal Air Force, but since the V1 and V2 attacks on London in the Second World War, the threat has continued to evolve into one more dominated by missiles than aircraft – missiles in increasing numbers, range and capability. Home-based defence was deprioritised after the Cold War as the perceived threat dissipated; and our wars of choice since then have been largely free from the threat of air and missile attack.

The growing arsenal and capability of long-range missiles in countries such as North Korea, Iran, China and Russia, and the most recent attacks combining missiles, aircraft and drones in Ukraine and the Middle East, readily demonstrate that the threat to the UK and its allies has intensified – both at home and overseas. The development of hypersonic and

low observable missiles, as well as low-cost drones that can be launched in large swarms, have increased the range, reach and concentration of options available to our adversaries.

However, whilst the overall threat to the UK has increased, because of its location it does not face the same level of threat as Ukraine or Israel. So we must be wary of eye-catching solutions, such as Israel's much hyped 'Iron Dome', which is a solution to short-range attacks only. In reality, the UK is most vulnerable to air-launched cruise missile released by long-range bombers, and so its defence system needs to be designed accordingly – defending every inch of the UK would be both prohibitively expensive and unwarranted.

So, the UK and its overseas territories need countermeasures against the longer-range threats of aircraft, ballistic, cruise, and hypersonic missiles; whereas, our armed forces once deployed abroad need to focus too on the shorter range systems to defend against rockets, artillery and drones.

An Integrated Air and Missile Defence System can detect, identify and intercept hostile air or missile attacks, but is complemented by protection measures such as the concealment, hardening, dispersing or resilience of our equipment, bases and infrastructure. Currently, the UK's Air and Missile Defence consists of our excellent space monitoring capability for detecting long range missile launches, but only backed up by a barrier of dwindling numbers of RAF Typhoons; and small numbers of already

committed deployable radars, Royal Navy Type-45 air-defence destroyers and the Army's Sky Sabre ground-based air defence system. These in combination are just about capable of protecting some of our overseas territories, but not all, barely capable of defending our aircraft carriers, and incapable of defending our ground forces if and when deployed. We need a barrier that is wide enough to cover the likely avenues of attack, and with an arsenal deep enough to withstand one that is intense and prolonged.

Even our 24/7 ground alert Typhoons are only postured to deal with a rogue 9/11-type threat, or a small number of Russian bomber incursions. Our limited numbers of aircraft and weapons, mean that they would be overwhelmed by the sustained air and missile attack that a future war might bring – one that we see every day in Ukraine. If a strong defence is the basic foundation of a conventional deterrence, by demonstrating that the cost of an attack is high and the probability of success is low, then the UK needs to build an effective Integrated Air and Missile Defence System, and fast.

How an Integrated Air and Missile Defence works →
NATO video



9: NATIONAL TREASURE

Wars cost far more to fight and recover from than they do to deter, so investment in a strong and credible defence makes long term economic sense. Air and Space Power is a critical element of that investment, but it also has far greater benefits than just fighting power. Whilst any return on defence investment should be measured in 'bang for buck' terms, there is also a far broader value for money case to be considered.

The costs of the Ukraine war can be measured in the £100Bns, but not just from the cost of fighting. Even more will be required to cover the huge cost of reconstruction, and then there is the wider harm to the environment, and global economies through increased commodity prices, mass migration and inflation to be considered. And that doesn't begin to address the devastation to the Ukrainian people, their families and the loss of life, limb and mental health.

Conventional deterrence is not cheap but the cost of it failing to deter is far worse; the good news is that insuring against such eventualities is an investment with an even bigger and better return.

Flexibility. Firstly, Air and Space Forces have a significant role outside of actual war, whether it be climate observation or data and time signals from space, or the more dramatic responses using aircraft for the delivery of humanitarian aid for disaster relief or evacuations of citizens from harm. The dual use of space and air assets means that the benefit goes far wider than just the achievement of military operations.

Influence. Although our Air and Space Forces today are small, they are based on equipment and skills that remain at the forefront of capability. The UK retains a privileged relationship with the US in terms of access and co-operation, based on a combination of traditionally strong political support, our ingenuity and our added value - nowhere is this truer than in the air and space domains. But we also hold a trusted and valued position within the NATO Alliance because of our leading air and space research and development capabilities and our leadership credentials. Quite simply, we leverage our investment in air and space many times over.

Value for money. Because of the strong (but bare) foundations we have retained in our Air and Space Forces, any investment adds immediate value rather than be absorbed by the need for wholesale change or reinvestment. Every pound invested increases in value immediately in terms of security benefit, but it

also contributes hugely to the social value of growth and prosperity in the wider economy. The air and space sectors in the UK generated revenues of £27Bn and £17Bn respectively in 2023, supporting a combined total of over 150,000 direct jobs and even more in the supply chain. Compare that to another UK stalwart - the shipbuilding industry (that generated £2.4Bn revenue and supported 15,000 direct jobs in the same period) and we can see that the space and aerospace sector is 20 times bigger in revenue terms, and 10 times bigger in direct jobs created.

A first rate, credible Air and Space Force is much better value than a second rate one, because deterring a war is so much cheaper than fighting or, even worse, losing one. But UK Air and Space Power is also a great return on our investment for the wealth it generates in terms of the economy, social value and skills for the Nation - a Nation it then serves to protect.

10: VENTURE

We must now deter, or be prepared to defeat, a clear and present danger. Critical to that effort is a strong and credible conventional Air and Space Force that makes the cost to an adversary of an attack too high and the probability of its success too low; but we need to rebuild them after years of neglect. To do so with limited finances will be tough, but the investment will pay itself back many times over, and in more ways than one.

We have already highlighted the supplementary return for national wealth and growth from any investment in Air and Space Power in the previous section, but in this final part we focus on the primary reason for that investment – a credible force capable of deterring and defeating our foes.

Air and Space Power is indispensable in modern warfare. It is our first line of defence, at the forefront of our conventional strength, and the unifying element of a strong national and allied military force. It provides our quickest means of lethal force to take the fight to the enemy and offers significant political choice and flexibility for a range of scenarios. It protects all our armed forces and continues to hold a considerable technological advantage over our potential foes in most areas. The UK's Air and Space Forces have not forgotten what threats we face or how to face

them, but like a boxer that knows how to fight – that's only half the battle. So where must we invest?

Pleas for increased investment in defence quickly turn to debates over equipment numbers, but our starting point is very different in that we believe a sustainable foundation is where we need to focus first. This includes a **fully resourced strategy for the recruitment, retention and training of the right skills**, whilst in parallel **building back** our spare parts and stockpiles so that we can sustain kinetic operations against a determined and sustained threat. And before we commit any more significant expenditure, **a defence industrial strategy and wholesale change of our procurement model is long overdue.**

Hard on those heels is the provision for a solid and secure base from which to preserve and project national power. This includes an **investment in sufficiently robust infrastructure** with built in redundancy, including our capability in and for space, and a **fully Integrated Air and Missile Defence System** with the ability to sustain it over the critical areas of the UK, her interests and deployed forces, and **investment in our Electronic Warfare capabilities** to protect and control the airwaves. Finally in this category is **an assured and robust supply chain**, that is as resilient as the force it supports in order to maintain tempo and sustain intensive operations.

Subsequently, we can and must revisit the shape and size of our force. Detailed numbers are for a more classified and informed discussion elsewhere, but we must not forget that **a credible deterrence ultimately comes from your proven ability to make your enemy pay too high a cost for their actions** – those capabilities that make them pay the greatest price should be highest on that list.

Last but not least, **we must maintain our momentum in future air and space programmes that maintain our technological advantage**; these include programmes such as the Global Combat Air Programme and the drone strategy for Autonomous Collaborative Platforms, all of which explore and exploit our use of Artificial Intelligence and Quantum computing. AI, in particular, will have a significant benefit in improving space awareness where it will serve to reduce the element of surprise. These will ensure that the UK stays ahead of its foes, whilst also benefitting from the cutting-edge skills and technological advances they bring, which in turn benefits our national growth and prosperity.

The above will require investment and ruthless prioritisation, but it can't wait for long. The best time to have done this was at least 10 years ago, the second best time is now. But we have a solid foundation and the untapped potential within our aerospace and defence

sectors is ready to be exploited; modest investments will yield disproportionate benefit.

UK Air and Space Power is what our allies value and our foes fear the most. We must invest wisely in our Air and Space Power; our most critical form of defence and attack, and one of our most vital and valuable National Treasures.

NATO air power 

NATO video





SHAPING THE FUTURE OF AIR AND SPACE POWER

The Air and Space Power Association (ASPA) is an authoritative independent voice and platform for discussion and debate on how air and space power influences today's world and its relevance to the future.

Our mission is to promote the understanding and advancement of military air and space power in the UK and beyond.

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"The huge potential of air and space power is grasped intuitively by most people, but it is not understood very well or appreciated in its rapidly evolving modern context.

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