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Britain's air defences: Inventing the future?

Dr David Jordan

Paper 2

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The Freeman Institute places a priority on identifying, developing and cultivating air and space thinkers in academic and practical contexts, as well as informing, equipping and stimulating relevant air and space education provision at King's and beyond.

The Institute is named after Air Chief Marshal Sir Wilfrid Freeman (1888–1953), who was crucially influential in British air capability development in the late 1930s and during the Second World War, making an important contribution to the Allied victory. He played a central role in the development of successful aircraft including the Spitfire, Lancaster and Mosquito, and in planning the wartime aircraft economy – the largest state-sponsored industrial venture in British history.

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About the Author

Dr David Jordan is a co-director of the Freeman Air and Space Institute. He joined the Department of Defence Studies, King's College London in 2000, based at the Defence Academy. He has been variously the Air Warfare Historian to the Higher Command and Staff Course, the Academic Director for the RAF Division and for the air and space power elements of the Advanced Command and Staff Course. He is a Fellow of the Royal Aeronautical Society, the Royal Historical Society and the Royal Society of Arts.

Abstract

Considerations of the air defence of the United Kingdom are often limited to thinking about the Second World War, particularly the Battle of Britain in 1940. Although a vital, continuing, element in British defence since 1945 air defence has been subjected to charges of irrelevance in changed strategic circumstances, or in the face of new technologies which are held to render extant concepts of air defence obsolete. This paper challenges these perspectives and contends that it is essential that the United Kingdom's air defence requirements are provided by a careful, balanced approach which blends the adoption and integration of new technologies with some long-standing principles which would not be unfamiliar to those who fought, and won, the Battle of Britain 80 years ago.

With the Conservative Government's 'Integrated Review of Security, Defence, Development and Foreign Policy' in full swing, this paper cautions against carelessly throwing out existing air defence capabilities based on a future vision of the conflict environment focused purely on projected technological advances in the realms of cyber, space and artificial intelligence (AI). The paper approaches the topic by applying a basic interpretation of the premise first outlined by Denis Gabor, and then taken up by thinkers such as Alan Kay, that making accurate predictions of the future is all-but impossible, but it is possible to 'invent' the future by taking decisions which help shape the direction of travel and do not impose limitations because of a narrow view of what might occur.[1]

While there can be no doubt that cyber, space and AI are essential areas within which the United Kingdom (UK) needs to develop and evolve its defence capabilities, there is a danger of succumbing to exactly the same temptation that befell Duncan Sandys as Minister of Defence in his review of 1957: to seek to fund new technologies by carelessly removing extant and important defence capabilities in the belief these are no longer relevant, only to subsequently realise their continued salience.

Although it is a great military cliché, the fact that 'the enemy has a vote' ensures that there is a great risk of designing the UK's defences to meet a future construct of conflict imagined by defence experts, only to discover that adversaries do not respond in an accommodating manner. This may be because they lack the new capabilities themselves and thus have an operational construct which is designed to counter or mitigate the higher technology ranged against them, or the result of their possessing a wide range of technologies including those deemed irrelevant to modern conflict by the most recent UK defence review and removed from service. Both constructs mean that the UK risks becoming heavily dependent upon its allies, undermining the aspiration to be a significant 'player' in coalition operations, with a concomitant diminution of the influence British governments have consistently sought.

The paper also highlights how attempts to shape a future of air defence based upon arguably overly-optimistic premises so as to deliver cost-savings have had deleterious effects on British capability, and suggests that a measured approach, which seeks a balance between extant and new capabilities, is a better approach.

Inventing the future in the past

It is not unfair to suggest that most considerations of the air defence of the UK are still dominated by one key event, namely the Battle of Britain in 1940. A dazzling array of books, journal articles, television programmes and feature films cover the battle, along with books and journal articles which analyse the coverage the Battle has received. This popular perception not only ignores other challenges to Britain's air defences, such as the German air raids of the First World War and the V-weapons offensive in 1944–45, but ensures that thinking about the capability since the war ended has tended to be overlooked.

During the Cold War, the UK's decline from being one the world's leading military powers became all-too clear. The granting of independence to British colonies, against a backdrop of frequent financial difficulties saw Britain's world role decline, particularly in the 1960s as the so-called 'East of Suez' commitment came to an end. This saw increasing focus upon Britain's strategic nuclear deterrent and the NATO theatre of operations, albeit with a refusal to abandon completely the notion that Britain might participate in various intervention operations outside the NATO area. The appreciation after the Suez debacle that Britain was no longer a leading world power (but still a significant one) led to a fundamental reappraisal of defence. Coupled with a strong desire to reduce the proportion of Britain's Gross Domestic Product which was spent upon defence, the conditions for a far-reaching review seemed ideal.

Upon appointment as Prime Minister in 1957, Harold Macmillan chose Duncan Sandys to be his Minister for Defence and the agent for change. Sandys duly produced one of the most controversial and far-reaching defence reviews in British history. The review ended National Service and made the nuclear deterrent – at that time air delivered by Royal Air Force (RAF) Bomber Command – the bedrock upon which British defence policy would be founded. The review also suggested that ballistic missiles would make the UK's extant air defences all-but obsolete as no defence against them existed. The only counter was to deter the Soviet Union from being prepared to use them. A bare minimum level of air defence would be required to protect the deterrent forces from Soviet reconnaissance or surprise attack by conventionally-armed bomber aircraft, and much of this, Sandys contended, could be provided by surface to air missiles.* The so-called 'Sandystorm' thus significantly reduced the size of RAF Fighter Command and repurposed it as a force to protect the deterrent rather than the nation as a whole. Aircraft programmes were either cancelled or curtailed to meet the new reality as Sandys saw it.

Unfortunately, Sandys' attempt to predict the future went awry. It quickly became clear that Sandys' assessments of the threat and the pace at which missile technology would develop had been misplaced. A three-year long debate about the correct size of Fighter Command ensued, but although the Air Staff gained some ground in ensuring that the air defences of the UK were not reduced to a mere token, the fighter force which was finally arrived at was still too small to meet all the commitments it faced.

Two squadrons of English Electric Lightning fighters were transferred to RAF Germany in the early 1960s, while the despatch of two Vulcan bomber squadrons from the UK to Cyprus in 1969 was accompanied by the removal of another Lightning squadron from the UK. Yet another Lightning squadron was moved to Singapore in 1967, again without replacement. When the Singapore commitment ended in 1971, the squadron disbanded, rather than being reincorporated into what had become RAF Strike Command. By the mid-1970s, the RAF had two fighter squadrons in Germany, one in Cyprus and six squadrons in the United Kingdom, along with one Bloodhound SAM squadron in each country.

The state of the UK's air defences concerned the Labour government led by James Callaghan (1976–79) greatly. The Conservative opposition led by Margaret Thatcher criticised the size and capability of air defences. The replacement of the majority of Lightnings by the more capable McDonnell Douglas F-4 Phantom did little to assuage concerns about lack of numbers.[2] Although the Conservatives promised to strengthen the UK's air defences, the fiscal reality of the times meant that when Mrs Thatcher became Prime Minister in 1979, improvements were limited in scope. The formation of an additional fighter squadron was abandoned. The government could at least point to the forthcoming arrival of the Air Defence Variant of the Tornado multi-role aircraft and the procurement of the Nimrod AEW3 early-warning aircraft. The Nimrod programme failed, and while the Tornado F3 represented a significant evolution in interceptor capability, it arrived in service as the Cold War drew to a close.

This brought about further reductions in the UK's air defences. The effects of these changes persist to this day, and the relative unimportance which seems to be attached to the air defence not only of the British Isles, but also of British forces deployed on operations overseas suggests that there is a risk that they may be targeted for further defence reductions, with money reinvested in new technologies such as cyber warfare, space and unmanned technologies, particularly those involving AI. This speaks to a long-standing desire on the part of successive British governments since 1945 for the UK to be able to make a significant 'hard power' contribution to international security, working closely with allies and gaining considerable influence in the direction of coalition operations though the provision of strategically-significant capabilities.

* Sandys of course had a background in ballistic missiles having been charged with leading a Cabinet Sub-Committee on the V-weapons threat during World War Two.

Air defence: From Cold War to unstable peace

The conclusion of the Cold War and the collapse of the Soviet Union (USSR), led to western nations making large reductions in defence spending as they sought out a so-called 'peace dividend'. The expectation of a more peaceful and stable international order was to be sorely disappointed. Saddam Hussein's invasion of Kuwait in August 1990 was followed by the break-up of Yugoslavia, along with other crises. From a British perspective, the eviction of Saddam's forces from Kuwait marked merely the start of a series of ongoing deployments to the Middle East which have not yet come to an end. The crisis in Yugoslavia demonstrated the complexity of what became known as peace support operations (PSO), not least the difficulties of sending an ostensible peace-keeping force when there was no peace to keep, and between combatants in a civil war with air power capabilities. The RAF not only participated in the longest humanitarian airlift in history to supply the besieged citizens of Sarajevo, but contributed Tornado F3 interceptors to Operation Deny Flight, designed to ensure that the warring parties, particularly the Serbs, were severely constrained in their use of aircraft, even if a complete cessation of their flying operations was impossible.

Despite the willingness of the British government to participate in interventions, these occurred against a backdrop of defence reviews which were more to do with the reduction of spending rather than configuring the UK's defences for forthcoming operations, reflecting uncertainty about the future and continuing interest in a post-Cold War peace dividend. This began with the 'Options for Change' defence reviews.[3] With the threat of Russian air attack on the UK reduced, the RAF's Bloodhound surface to air missile was withdrawn from service, with a replacement system to be procured "in due course".[4] Nearly 30 years later, the requirement for a replacement appears to have been abandoned, leaving the UK in the unusual position for a major power of not possessing a ground-based medium range SAM. The UK instead fell back upon air defences based around a small fighter force supported by Boeing Sentry airborne early warning (AEW) aircraft, short-range SAMs and a well-developed control and reporting system which, over time, was to be eroded through further reductions in defence spending. [5] The fighter force was not immune from cuts; the four squadrons of Phantoms were disbanded in 1992 with the retirement of that aircraft, while the number of Tornado F3 squadrons was progressively reduced between 1994 and 2002.

This was despite the Tornado F3s being tasked with a wide range of duties, and delays to its intended replacement, the multi-role Typhoon. Following the Gulf War, an unrepentant Saddam Hussein was contained by No-Fly Zones over both northern and southern Iraq, with elements of the Tornado F3 force regularly deployed as part of the British contribution. The standing commitment to provide four aircraft for the air defence of the Falkland Islands remained, while the establishment of Operation Deny Flight added to the fighter force's tasks.[6] The standing commitment of maintaining Quick Reaction Alert (Intercept) duties to protect the UK's airspace remained, although the dramatic decline in Russian long-range aviation capabilities meant that there was at least some respite here. Assumptions that the end of the Cold War would lead to a much more stable world were rapidly shown to have been misplaced. This did nothing to encourage the Conservative government led by John Major to increase the size of the armed forces, or to attempt to balance resources with commitments in a more appropriate fashion.

The reduction in defence spending had been the subject of considerable criticism by the Labour party, and the election of Tony Blair's government in 1997 brought with it the promise of a new defence review. The Strategic Defence Review (SDR) was presented to parliament in 1998. The threat to the UK's airspace was deemed sufficiently low to allow for another Tornado F3 squadron to be disbanded, with the Operational Conversion Unit being designated to provide crews and aircraft if circumstances demanded.[7] The Blair administration's view that the UK should be a 'force for good' in the world implied that reductions in strength might not achieve the desired reduction in 'overstretch' that the SDR was meant to bring about, but in fact increase it. [8] The House of Commons Select Committee on Defence issued a report on the Kosovo intervention which suggested that the operation had brought the United Kingdom to the 'very limits of, and quite possibly exceeding, the concurrency criteria set out in the Strategic Defence Review', although the government response to the report demurred.[9]

The government was eager to stress that the replacement of the Tornado F3 force by the Eurofighter Typhoon from the early 2000s would be a significant boost to fighter capabilities, although the fact that seven squadrons of Typhoons were intended to replace all of the original seven Tornado F3 squadrons as well as three of SEPECAT Jaguar attack aircraft with obvious risks of stretching the force were not remarked upon. Nevertheless, the apparent absence of an obvious air defence challenge to UK airspace seemed to make the government's approach to air defence an acceptable balancing of effort. Unfortunately, within less than five years, the picture changed considerably.

Air defence since 9/11

The question of air defence rose again in public consciousness following the terrorist attacks on the US on 11 September 2001. Although shooting down commercial aircraft hijacked so that they could be employed as weapons had not been a routine part of British air defence planning, the incident highlighted the challenges that even the most capable air defence network might encounter.[10] The United States Air Force had fought off some attempts to reduce the number of North American Air Defense Command (NORAD) bases by arguing that they were still vital to the maintenance of air sovereignty in the face of emerging threats such as drug smuggling by air and the possible use of aircraft to deliver weapons of mass destruction, as well as noting that there were growing concerns that non-state actors might obtain cruise missiles which could be launched from commercial shipping.[11] Although these challenges presented a concern, the western intervention in Afghanistan, followed by participation in the US-led coalition to remove Saddam Hussein from power were of perhaps greater relevance to the UK's air defences in the early 2000s because of the prioritisation upon fighting those conflicts above enhancement of the air defence network. The subsequent SDR 'New Chapter' made little comment on the possible challenges faced by air defences.

Additional complications came with the resurgence of Russia's Long Range Aviation forces, which resumed regular flights in 2007, prompting an increase in Quick Reaction Alert (QRA) launches of interceptors.[12] The tempo of operations has not declined since, and although coordination of NATO air defence forces helps to share the burden, there is little doubt that the Russian flights add a further layer of complexity in thinking about air defence. The need to 'shadow' Russian aircraft remains and, while not at the levels seen during the height of the Cold War, illustrates the importance of maintaining this capability. Unfortunately, the UK went through a period where what was once seen as a non-negotiable capability, relying on cutting-edge technology to maintain parity with possible threats, became the 'obvious' target for cutbacks to enable capabilities supposedly more relevant for current operations such as strong land forces or counter-insurgency aircraft.[13]

Notions that Britain's capabilities should be directed towards fighting campaigns such as those in Afghanistan and the Iraq counter-insurgency, on the basis that these were almost certainly the only notable threats and challenges that the UK would face for the foreseeable future, proved to be misplaced. Even before operations in Afghanistan ended, events suggested that complaining of Typhoon's 'inappropriateness in meeting the modern threat' was perhaps premature.[14] The aircraft utilised its ground attack capability over Libya in 2011, and is at time of writing, the critical element in operations against Islamic State in Syria and Iraq. It is also regularly 'scrambled' on Quick Reaction Alert duties both in the UK and the Falklands.

The evidence seems to suggest that rather than changing dramatically, the threats and operational challenges facing the UK in the near – to medium-term remain similar in generic terms to those that have punctuated Britain's experience since the end of the Second World War. The scope and scale of the different types of military operation will vary (as always), but the capability of adversaries is clearly increasing, with modern technology offsetting or closing capability imbalances in areas where western nations might have previously assumed a clear and unassailable lead.

Meeting the challenge

A further problem in respect of thinking about air defence lies in the British experience of expeditionary operations since 1991. The Iraqi Air Force was unable to launch attacks against British troops, being suppressed by a highly effective Offensive Counter Air campaign. Similarly, there were no air attacks against troops deployed in Yugoslavia, and the Taleban and Al Qa'eda had no means of carrying out air operations against British forces in Afghanistan. In 2003, the Iraqi Air Force chose not to fight. Both the 1991 and 2003 conflicts nevertheless provide an insight into the possible future threats against which an air defence capability is likely to be required.

In 1991, the Iraqi use of the R-11 surface-to-surface missile (SSM; better known by the NATO reporting name of 'Scud') and various local derivatives of the weapon gained considerable attention. Saddam chose to fire the weapons against Israel, leading to the hasty deployment of Patriot SAMs, the employment of coalition special forces and a diversion of a significant proportion of the coalition air campaign to suppress the threat. In 2003, he chose to make similar use of SSMs, attacking the staging areas for coalition forces with a mixture of Scuds and Chinese-made 'Seersucker' SSMs. While the larger SSMs were intercepted by Patriots, the Seersuckers proved far more difficult to deal with. None were detected or engaged, and it was only the fact that the weapons were intended for use against ships and thus lacked the necessary guidance systems for accurate delivery against land targets which reduced their efficacy. The Iraqis also made use of ultralight aircraft, with at least two being known to have overflown American troop formations without being detected beforehand.[15] Although the ultralights were apparently employed for reconnaissance purposes, the risk of such aircraft carrying even a relatively small chemical or biological weapons payload in future conflicts cannot be disregarded.

Since 2003, the ability of states and non-state actors to access cruise missiles, ultralight aircraft and remotely-piloted air systems (RPAS) has only increased. While the remotely-piloted systems seen in the hands of non-state actors to date have been small and incapable of carrying a payload as large as a combat aircraft, the risk of an adversary employing multiple, weaponised RPAS in swarm attacks against a target is now considerable.

Technological advances and the growing accessibility of that technology means that the potential threat ranges from the infamous SCUDs through to weapons such as the Russian Iskander. When the potential use of cruise missiles and/or armed remotely-piloted air systems is taken into account, the risk to British forces deployed overseas is considerable. The ease with which adversaries might employ commercially-available 'drones' should also be a source of concern. These drones might be no more sophisticated than those purchased from a catalogue store, with their mode of use being simply to fly them at speed into a target, using kinetic energy to cause damage against targets such as parked aircraft, communications antennae or other items of equipment. The proliferation of these threats is not in place of extant challenges such as enemy air attack, or the use of ballistic or cruise missiles, but in addition to them. The risk calculus is more complicated than ever.[16]

While British operating bases 'East of Suez' and in Cyprus enjoyed a mix of active and passive defences including aircraft, medium – and short-range SAMs and point defence guns during the Cold War, an equivalent level of UK national capability is lacking today. A potentially over-extended force of fighter aircraft operating alongside Rapier SAMs and the British Army's Starstreak High Velocity Missile system does not provide the full set of capabilities that were once possessed. This suggests that the UK may find itself playing 'catch-up' in the bid to address the range of potential air-delivered threats, particularly to deployed forces. While reliance upon allies, particularly the United States, has been the mitigation for this in the past, the question arises as to how long this approach will remain credible. A nation which appears to be overly-reliant on allies for the defence of its deployed forces may discover that aspirations to be considered a leading power are not taken seriously.

Weapons such as the Common Anti-air Modular Missile (CAMM) will offer an increase in the level of capability which the UK enjoys, but the critical question must be whether there are enough of these systems to meet the threat levels likely to be faced. There is a strong case for increasing force protection levels at airfields both in the UK and overseas to reincorporate SAMs as part of airfield defence, as well as ensuring that the capability to deal with drones forms a part of the range of options on offer. Although a weaponised system was not employed, the closing of Gatwick Airport in December 2018 demonstrated the challenge that drones present. The deployment of the RAF to Gatwick, using the Falcon Shield system as a stop-gap, while the civil authorities arranged for their own counter-drone capability, also hinted at the value of possessing a full suite of defence capabilities for air defence both at home and in support of expeditionary operations.[17]

Inventing the future?

An analysis of the history of Britain's air defences since 1945 suggests that there has been a tendency to imagine a future based upon two wildly differing parameters. The first, as portrayed in the Sandys review, suggested that the air defence threat was now presented by a technology against which traditional methods of defence were useless. The second, an evolving perspective since 1991, has been that the threat is minimal and can be managed with a relatively small force. Yet it would appear the truth lies somewhere between the two.

At time of writing, media speculation about the 2020 Integrated Review focuses upon notions that traditional approaches and equipment are obsolete, and that the future will be focussed on cyber warfare, space and artificial intelligence, while capabilities such as main battle tanks have had their day.[18]

But there is a danger that the fixation on specific technological trends – – that must, without doubt, be brought firmly into the realm of defence – – will lead to the casual labelling of long-standing capabilities as irrelevant followed by a hasty disinvestment in them, only for subsequent events to prove their continued salience, as happened with maritime early warning capability in 2010. As the full economic effects of the Covid-19 pandemic are only just starting to be realised, the temptation may be strong to use the Integrated Review to reduce air defence capabilities to a bare minimum to allow spending to be focused on cyber warfare, AI and space power.

This is emphatically not to argue against the proposition that AI and space power are critical areas for the UK's national security. Efforts to enhance and develop these aspects should not be dismissed as technological fetishism as this too would not reflect the reality of the current and emerging operating environment. The recent demonstration of the American Advanced Battle Management System (ABMS) offers a fascinating glimpse of a possible near-future. This involved the synthesis of data drawn from multiple sensors using cloud computing and AI to create a level of situational awareness that until recently would have seemed like the products of science fiction.[19] The benefits of drawing upon such capabilities are potentially enormous.

The danger, though, lies in placing too great an emphasis on these areas at the expense of the items necessary to provide the suite of capabilities to deliver effective air power. The UK still requires a balanced range of capability, given the potential threats which may come from the air, be that state-operated combat aircraft, cheap weaponised drones employed by a terrorist group, or cruise missiles launched by a non-state actor serving as a proxy. The risks in removing air defence capabilities are therefore considerable.

While the days when the UK could afford a full range of resources are long gone, the risks of having capabilities which are too 'niche' are considerable. A 'Global Britain' seeking to demonstrate that 'we are the best possible allies' and 'an even stronger force for good in the world' is unlikely to achieve these ambitions if reductions in key capabilities valued by our Allies are reduced.[20]

The contribution of air defence forces to Britain's national interest, and the risks – military, diplomatic and political – associated with their diminution are clear. The forthcoming Integrated Review offers an ideal opportunity to think carefully about how to address the numerous challenges now facing the UK when it comes to the question of air defence, and to invent its own future by taking a broad, balanced view rather than making the same mistakes of throwing all the effort into an imagined future that may never transpire. Britain's experiences with air defence over the years suggest that aiming for the stars is a worthy ambition – but without exercising some degree of balance and recognition of the wide range of threats, it comes with the grave danger of never leaving the ground.[21]

Endnotes

1 Denis Gabor, *Inventing the Future* (London: Secker & Warburg, 1963) and *InfoWorld*, Vol4:16, 6, reporting the remarks of the computer scientist Alan Kay. Multiple iterations of Kay's observations can be found online.

2 The Cyprus-based squadron (Number 56 Squadron) returned to the UK in 1976, re-equipping with Phantoms and thus adding an extra squadron to the air defence force.

3 *Statement on the Defence Estimates, 1991: Britain's Defence for the 1990s* Cmnd 1559 (London: HMSO, 1991)

4 *Hansard*, 2 May 1991 vol 190 col.455. The term 'SAGW' had fallen from favour some years previously. The Bloodhound squadron in RAF Germany was withdrawn to the UK in 1983, disbanding in 1989. The squadron was replaced by a new Tornado F3 squadron which bore the same 'numberplate' (25 Squadron) as the former missile unit.

5 The Sentries entered service with Number 8 Squadron in 1991 after the farcical efforts to procure the Nimrod AEW3 had been brought to a conclusion and the RAF allowed to procure the aircraft it had wished to obtain for some years. Between 1996 and 2009, the Sentry fleet was shared between Numbers 8 and 23 Squadrons, before reverting to a single-squadron force. Although the number of squadrons increased, overall force size did not.

6 David Jordan, 'Air Power and Intervention: The Royal Air Force Experience in The Former Yugoslavia, 1992–95' and Luke Botting, 'Air Power in and Age of Armed Humanitarian Intervention', *RAF Air Power Review*, Vol.21:3, 40–59 and 14–39

7 *Strategic Defence Review* (Cmnd. 3999), Paragraph 38. The deleterious effect this might have on training new Tornado crews was glossed over.

8 *Hansard*, 6 June 1997 vol 296 col.5

9 House of Commons, Defence Committee, *Fourteenth Report of Session 1999–2000, Lessons of Kosovo, HC 347-I*, para 308; House of Commons, Defence Committee, *Second Special Report: Government Observations on the Fourteenth Report from the Defence Committee of Session 1999–2000, HC-178.*

10 One of the major issues for the United States on 9/11 was the lack of communication between the Federal Aviation Administration and North American Air Defense Command. See Adam J Hebert, 'Sept 11, Minute by Minute', *Air Force Magazine* 1 October 2004, https://www.airforcemag.com/article/1004sept/ (accessed 22 August 2020); also https://www.9-11commission.gov/report/911Report.pdf (accessed 26 July 2020)

11 *The 9/11 Commission Report*, 17 https://www.9-11commission.gov/report/911Report.pdf (accessed 26 July 2020); National Intelligence Council, 'Foreign Missile Developments and the Ballistic Missile Threat to the United States through 2015', https://www.dni.gov/files/documents/ForeignMissileDevelopments_1999.pdf (accessed 26 July 2020).

12 James Bosbotinis, 'Russian Long Range Aviation and Conventional Strike'https://www.defenceiq.com/air-forces-military-aircraft/articles/russian-long-range-aviation-and-conventional-strat (accessed 15 May, 2020); Keith Crane, Olga Oliker & Brian Nichiporuk, *Trends in Russia's Armed Forces: An Overview of Budgets and Capabilities* (Santa Monica: RAND, 2019), 35–36.

13 Max Hastings, 'Routed by the Eurofighter: the Pride of Britain's Army', *The Guardian* 29 June 2004; Hastings, 'Arm us for the Wars of Today, Not Yesterday', *Financial Times*, 14 May 2009; Tom Coughlan, 'RAF urged to cut 'Cold War' new jets for cheap propeller aircraft', *The Times*, 22 January 2010

14 Greg Mills, 'Between Trident and Tristars: On Future War and Its Requirements', *RUSI Journal*, 155:3 (2010), 31

15 'The Iraq War and Missile Defence: Lessons Learned', *Strategic Comments* 9:6 (2003), 1–2.

16 Milton Hoenig, 'Hezbollah and the Use of Drones as a Weapon of Terrorism', *Public Interest Report*, Vol.67:2 https://fas.org/wp-content/uploads/2014/06/Hezbollah-Drones-Spring-2014.pdf (accessed 16 May, 2020); Alyssa Sims, 'The Rising Drone Threat from Terrorists' *Georgetown Journal of International Affairs* Vol 19, 97–107; Shaan Shaikh, "Missiles and Rockets of Hezbollah," *Missile Threat*, Center for Strategic and International Studies, June 26, 2018, last modified September 27, 2019, https://missilethreat.csis.org/country/hezbollahs-rocket-arsenal/ (accessed 20 May 2020)

17 See, for example, https://uk.leonardocompany.com/en/news-and-stories-detail/-/detail/focus-on-falcon-shield
(accessed 17 May 2020)

18 'British Army Could Axe Aging Tanks as Part of Modernisation Plans' https://www.bbc.co.uk/news/uk-53909087 (accessed 25 August 2020); 'British Army 'Could drop Tanks in favour of cyber caabilities' says report', https://news.sky.com/story/british-army-could-drop-tanks-in-favour-of-cyber-capabilities-says-report-12056160 (accessed 25 August 2020); Michael Graydon, Jeremy Blackham, Jonathan Shaw, and Antony Hichens, 'The Strategic Defence and Security Review Britain Needs', https://rusi.org/commentary/strategic-defence-and-security-review-britain-needs (accessed 25 April 2020)

19 'Advanced Battle Management System field test brings Joint Force together across all domains during second onramp' https://www.af.mil/News/Article-Display/Article/2336618/advanced-battle-management-system-field-test-brings-joint-force-together-across/ (accessed 9 September 2020)

20 Rt. Hon Dominic Raab, MP (Secretary of State for Foreign Affairs), *Hansard*, 20 February 2020, Vol 617, Col. 26-27.

21 A concept first articulated by Mr William Shankly OBE, in his phrase 'if you aim for the sky, you may reach the ceiling, but if you aim for the ceiling, you'll never leave the floor.'

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