

National Audit Office Report, “Carrier Strike – Preparing for Deployment”

The National Audit Office (NAO) published “Carrier Strike – Preparing for Deployment” on 26 June 2020. The report concerns the current status of the United Kingdom’s (UK) approach to developing Carrier Strike capability (i.e. an ability to conduct military operations with fixed-wing aircraft launched from and recovered, to a ship) with the two sixty-five-thousand-tonnes aircraft carriers, *HMS Queen Elizabeth* and *HMS Prince of Wales*. As introduced, it is believed the new aircraft carrier systems have weaknesses in lethality, supportability, sustainability, survivability and vulnerability. Further, they are insufficiently independent, patently unaffordable and technically, as a system integrated with an advanced short take-off vertical landing (STOVL) and fifth-generation fighter, the sum of the whole falls short of the bold and innovative solution that might have marked British re-entry into 21st century fixed wing maritime aviation. The aircraft is an absolute winner and the early UK investment was wise but, nevertheless, an ASTOVL aircraft denies the Royal Air Force (RAF) the best available advanced strike fighter for multi-operational needs and this and other like-important questions remain in abeyance pending resolution of which service actually owns, funds and commands maritime air and whether this Government will dispense with woolliness and properly assess the practicability of earlier administration’s global power projection aspirations. Undoubtedly, there is a perfect need for deployable Royal Navy (RN) fixed wing air defence as part of a balanced fleet for a country of the size, influence and complementary warfighting assets of the UK, but it should be tailored realistically, according to the national resources that can be made available to assure affordable warfighting effectiveness.

No Briton wishes to see the Royal Navy fail. However, continued strong and critical scrutiny is essential to have some hope of averting new military calamities of the type that have peppered history (e.g. WW I Dardanelles, WW II loss of the *Prince of Wales* and *Repulse* and Falklands loss of *Sheffield* and the high costs to men and material at San Carlos Water) or avoiding those muted bombshells that arrive as staggering equipment cuts in Treasury savings measures. NAO provides a useful juncture to take stock of these matters before either calamity has occurred and the report deserves to be widely read.

“Carrier Strike – Preparing for Deployment” is the fourth in a series of reports on the Ministry of Defence’s program and addresses the risks concerned with whether Carrier Enabled Power Projection (CEPP), a proposed national military capability to mount global operations at short notice, will be realized. The report is written with care and the authors appear cautious about the prospects for success since there is a dearth of evidence to suggest otherwise, there being a number of key conflicts and dependencies that remain unresolved. The challenges that are identified, and others still murky, are systemic and they have beset the UK approach to new fixed wing maritime air from the very outset when in late 1989, the RN approached Deputy Commandant for Aviation (DCA), United States Marines Corps (USMC), to explore the possibility of a joint effort to replace AV-8B and Sea Harrier. The question to be answered is, why operate RN fixed wing aircraft at sea? With the very ambitious CEPP, there is a real concern that it is neither affordable nor sustainable and its pursuit by the RN has provided a distraction from taking a path to achieving a practicable fleet fixed-wing air defence solution with companion tailored strike capability, et alia. Such is the huge cost of the current carrier program and stretching into the future with many unfunded unknowns, it is distorting the total Armed Forces equipment budget. The argument for fleet air defence is actually relatively simple but the value of CEPP can be surrendered in a heart-beat by this or the next Defence Review and at the whim of a Government under severe financial pressure to invest elsewhere post Covid-19, post European membership and post the Prime Minister’s touted “long national hibernation.”

To provide context, there is a need to rehearse a little maritime-air history because a sense of déjà vu has much to teach. The *raison d’être* of maritime fixed wing aviation is fleet air defence. Equal, but less, are counted strike and intelligence, surveillance and reconnaissance (ISR) and emerging modern data sharing. In the case of air strike, there is a concern that tactical air power may not be able to operate without serious asset attrition such that the use of such power must be metered with great circumspection to

balance losses against operational gains...or necessity. Under severe financial pressure, a Labour Government published its *Statement on the Defence Estimates (SDE) 1975*, and at a stroke, the UK moved towards a homeland and Euro-centric defence posture that proposed a virtual elimination of national out-of-area capability. As a result, in 1978-9, RN fixed wing aviation and aircraft carriers were to be withdrawn and the Royal Air Force was tasked to provide such air defence as needed for future fleet protection. Essentially, effective fleet air defence died on the twin anvils of unreconcilable service priorities and budget cuts. This decision echoes the decisions of April 1918 when the RAF was established to provide ostensibly home defence and strategic air capability with the tactical needs for close air support and fleet defence more marginally prioritized although still vested with the Army and RN. Quite suddenly, in 1978, in practical terms, the RN lost adequate fleet air cover and this remained so until reconstituted in early 1980, just in time for the Falklands Conflict. The short take-off or landing (STOVL) Sea Harrier was not a bespoke maritime aircraft but the Navy 'got lucky' and it is surely not necessary to reprise that the aircraft performed well above all reasonable expectations with not one lost in actual air-to-air combat, while over twenty enemy aircraft were claimed as shot down. The Sea Harrier fighter was operated in the air defence role after learning quickly that in air-to-ground, it was too vulnerable and too valuable to be risked. For those readers with technical nous and familiarity with maritime operational challenges, the serendipity of the Sea Harrier success story will be understood to be jaw-dropping in the extreme. The operation of a STOVL aircraft type in through-deck cruisers and an old Centaur class aircraft carrier was not a carefully contrived exercise of superior systems integration that optimized anticipated complementary strengths and mitigated weaknesses; it was happenstance in the extreme. Save only to say that good people may sometimes make their own luck and the Sea Harrier proved to be simply the best (as rocker Tina Turner pitched it). However, as Einstein reputedly said, "insanity is doing the same thing over and over and expecting different results" and in 2006, the Sea Harrier was withdrawn from service by the Government of the day. The loss was insufficiently resisted or perhaps somewhat aided by the Admiralty who, to be kind to their lordships, unwittingly enmeshed the future of fleet air defence in a Faustian deal with the RAF to operate the GR-9 under Joint Force Harrier from their existing aircraft carriers. This too came to an end in 2010 when GR-9s were withdrawn as a result of Strategic Defence and Security Review (SDSR) 2010, argued to be comparatively more expensive to operate than Tornado or Typhoon and sold as parts and scrap to the USMC for the princely sum of \$180 million (less than the cost of two F-35B). These decisions have resulted in a second period, this time around ten to fifteen years, of fleet air defence fixed wing fighter aircraft capability, abandoned. It suggests that fleet air defence has been treated like a plaything; a toy to be lost and whose absence from the toy box has been of little consequence rather than the very serious delinquency that it truly is.

The fact is that the SDSR 2010 identified UK defence planning unaffordability and fixed wing maritime air was cut. Perhaps smarter anticipation and better earlier decisions by responsible Government Ministers and their Service's Chiefs could have avoided the 2006-10 'meatball-surgery'. If, from this, the lesson to be learned is that previous management of maritime air operations capability has been palpably ad hoc, what confidence in the present proposed CEPP way forward? Is it a further example of initial overreach?

Winning conflicts, at most simple, is surely about having the best weapons, fit for purpose and fielded in adequate numbers, operated by well trained and motivated personnel and over ground that has been well scouted. We invest in research and development (R&D) to develop advanced capabilities that seek to provide asymmetric advantage to our forces in present and future warfare. No weapon or capability is without shortcomings and we rely on clever integration of several parts to produce a system that compensates weaknesses and magnifies strengths. Witness to ancient history, for example, mount an armed Bronze Age warrior on a horse and you multiply his maneuver, speed, endurance, shock and range capability and, thereby, his military effectiveness. During the past thirty-years or so, military equipment development has embraced a "systems of systems" approach. Venn diagrams, trade studies and 'likelihood-consequence' risk analysis provide the clearest of pointers to making good acquisition decisions. Although, unfortunately, the inertia of the last decision oftentimes defies the changes that should be made and that are only finally triggered by the rude awakening of a military disaster. Along

with failure to prioritize fleet air defence as an essential part of a balanced fleet and to crush any assertion otherwise, the most painful has been the technology failure to pursue a maritime air system that truly integrates an advanced STOVL aircraft with host aircraft carrier. If the Sea Harrier and Invincible Class ships were an afterthought and rather impromptu systems integration, the Joint Strike Fighter (JSF)/F-35B offered the RN an opportunity for an innovative, advanced and technically exquisite system of systems integration. The F-35B established two critical cardinal design points to guide the host aircraft carrier design. The first being short take off and vertical landing capability – small deck and no cat-trap requirement. The second is best illustrated by the Norm Augustine's¹ 16th law which begins, “in the year 2054, the entire [US] defense budget will purchase just one aircraft” and moots a light hearted adage around the continual year on year increase in the cost of defence equipment. However, the cost of new equipment in any meaningful assessment should be normalized against increased capability and so a fifth-generation strike fighter can be operated in smaller numbers to achieve equal effectiveness with larger numbers of earlier and less capable aircraft. The advanced STOVL F-35B provides a capability *knee in the curve*, allowing smaller air groups, smaller flight decks and thereby, smaller host-ships. This is not one-way traffic and the aircraft lethality may be improved symbiotically by increased ship speed, agility, deck availability, increased survivability, reduced vulnerability and so on. The argument here is that it is a failure to follow a best system of systems optimization approach that has led to a size-misfit with the current aircraft carriers and this has contributed to a predisposition to the shortcomings identified in the NAO report.

It would not be fair to lay all the blame with the RN or RAF Commands for the choice of ship design or exclusive ASTOVL F-35B variant procurement. Operations in Iraq and Kuwait (1991), the former Yugoslavia (1992/5), Afghanistan (2001) and Iraq (2003) demonstrated that the UK's in-theatre air power was too limited. From the sea, it fell well short of US carrier strike capability but was also arguably less than the other medium maritime air power, France, with the aircraft carrier *Charles de Gaulle*. The period 1997-2007 was a time of significant international influence for the UK government especially with elements of the US Administrations, witness Prime Minister Tony Blair's great honour of being invited to address a Joint Session of Congress on the 17 July, 2003. Nicely tucked into coalition operations, the UK found a big voice in global crusading, as a closest US ally. The case for UK supercarriers and 24/36-aircraft strike wings apparently resonated with a globally pro-active Cabinet leadership and was perceived to be the 'big stick' to provide the clout suited to Britain's rekindled world status. Besides this, building two aircraft supercarriers was politically important for jobs in UK shipbuilding and after program Main Gate approval on 25 July 2007, there was little appetite to question continued operational relevance. Rumbles from the Army about how the F-35B/carriers were distorting their budgetary provisions and whimpered RAF closet aspirations to buy some F-35As instead of Bs have, so far, amounted to little more than ripples on a potentially troubled sea.

In 2021 the anticipated joint familiarization deployment, under the umbrella of US assets, sails to the South China Sea and undoubtedly underpins a much-needed diplomatic initiative. Although potentially dangerous and provocative, it is an entirely appropriate in response to China's imperial maritime claims facilitated by colonial island-grabbing and which, like the 2014 Crimea annexation and other such land appropriations, is a blatant challenge to international law. The use of “gunboat diplomacy” may be to simply send a warning message to China or to actually deter further expansion beyond existing Chinese occupation or, to force a full reverse of the evident growing fait accompli of Chinese suzerainty over the near whole of the South China Sea. Such daring confrontations are best done when able to over-match potential adversaries and also not to run into any of those nettlesome asymmetric threats that have sometimes caused embarrassment. Although this article is critical of the choices, the resulting systems

¹ Norman Augustine is US aerospace businessman who served as United States Under Secretary of the Army, chairman and CEO of the Lockheed Martin Corporation and is the author of Augustine's Laws, series of tongue in cheek aphorisms. The full 16th law is, “In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3-1/2 days each per week except for leap year, when it will be made available to the Marines for the extra day.”

approach and according to the NAO report, sub-optimum readiness and execution, with sailors standing into danger, no Briton would wish the *Queen Elizabeth* and her escorts other than, Godspeed².

An earlier letter³ to this magazine discussed the disadvantages of not pursuing smaller, faster, more survivable and more agile innovative aircraft carriers that best exploit the remarkable synergies shared with an advanced STOVL F-35B. The decisions to procure expensive super-size aircraft carriers, to acquire the F-35B type exclusively, to form up under a shared but ambiguous Command structure and to base the whole capability on an unclear CEPP gunboat reverie, are now coming under increasing scrutiny as practice supersedes the optimism of untested precept and the adjective *expensive* morphs to *unaffordable*. The NAO reports on these issues which are discussed below under technically useful headings and with the paragraphs relating to the report reference shown in parenthesis:

- a. **Current Status** – The Carriers have been accepted and are in continuing sea trials. Eighteen of forty-eight ordered F-35Bs have been received and with trickle delivery, the final seven have been delayed for delivery in 2025 (1.18). Initial Operational Capability (IOC) and Full Operational Capability (FOC) are planned for December 2020 and December 2023, respectively. Deployment with USMC assets is planned for 2021 and worldwide UK capability anticipated by 2026. CEPP is stated presently as central to the UK’s future defence strategy (1.4). Achievement of FOC and CEPP are under ambitious schedules (2.21) and are both threatened by various unresolved issues (2.22) including coinciding with a “time of significant budgetary pressure” (3.5). The full UK commitment is to acquire 138 F-35 aircraft but out-year funding has not yet been identified to do this and will likely be subject to the Covid-19-delayed Integrated Review of Security, Defence, Development and Foreign Policy recommendations that will assess ambitions, priorities and approach (3.3).
- b. **Lethality** – The F-35B is a transformational air capability but the UK carriers, compared to US Nimitz class are not nuclear powered, are slower, have an additional replenishment burden and they lack a full fixed wing air support suite capability. Nevertheless, UK maritime air capability will be improved, if not by the order of magnitude, then very significantly compared to the previous generation. Planned escort capability of one destroyer and one ASW frigate and auxiliary vessels for support and resupply (1.6), although buttressed by one attack submarine, appears comparatively light and may provide a weak springboard to operations in contested waters. The planned airborne Crownsnest radar is delayed by eighteen months and must still be proven and will mean that complete IOC is absent this capability until September 2021 (2.2 - 2.7). Additionally, with the overall amount of work still to do, continued equipment acquisition and personnel training, operational readiness will be affected for some time (2.20) as identified in the NAO report. Notably, deploying the UK carrier force will require a significant proportion of the Navy’s fleet (1.7) suggesting detrimental impact to readiness in support of other naval commitments.
- c. **Supportability** - The UK carriers require conventional support from fleet auxiliary ships with a minimum of one to supply ammunition, dry stores and spares and one fuel tanker. To support two carriers, three solid stores are required but Royal Navy presently has only one, Fort Victoria, due to be retired in 2028 (2.15 – 2.17) but withdrawn for a period of re-fit in 2022 (2.17). Three replacement solid stores ships have been delayed and may not be available until after Fort Victoria leaves service (2.16). Carrier spares are reported to be underfunded (15) and are provisioned for only one carrier, although government policy is to hold “both” carriers at high readiness” (3.12). Also unfunded is a weapons stockpile (2.13) and intra-theater conveyance of logistics and personnel (2.14). Overall, the report notes that there is not a “clear view of support and operating costs” for the carriers (2.10; 3.9). Responsibilities for Carrier Strike straddle the

² Successful voyage and safe return

³ Royal Aeronautical Society Aerospace Magazine, April 2016 edition, Page 12

Commands who are individually responsible for making investment prioritization (3.8) and this poses particular problems for supportability with who buys what. Provisioning of spares for the UK F-35B has been parsed to holdings below usual carrier targets. Aircraft spares usage appears to exceed predictions (3.12). Last, the US supply chain, itself, does not have sufficient spares to meet requirements (3.11). These problems are directly linked to underfunding and affect readiness and achievement of FOC. This was exemplified in a November 2019 Air Command one-year postponement to procure a second deployment spares pack on affordability grounds (3.7).

- d. **Sustainability** – The uncertainty of the Naval or Air Command responsibility for Carrier Strike constitutes a major problem for both operational and support sustainability because of the Services' default condition of "creative tension" that will lead to contested prioritization. There is a risk that, when faced with annual budgetary pressures, the commands will make funding decisions that might affect the longer-term needs of Carrier Strike (3.7). For example, under equipment programs' funding pressures, the RAF reduced future flying hours by 20% as a savings measure (3.7). Sustainment of operations at sea will be driven by spares holding availability and ability to replenish. Logistics planning has been inadequate and there is not a stockpile strategy to support CEPP ambitions (2.12). Without a funded solution to intra-theater airlift carrier onboard delivery (COD) capability, to supply people and goods, even with a large embarked stockpile, CEPP sustainability (2.10; 2.14) will be challenging. With the Equipment Plan 2019-20 already unaffordable, there is not a through life plan for Carrier Strike (3.5) and further, future development funding for the F-35B, Merlin helicopters (AEW), solid stores ships and escort Types 31 and 26 (3.5: 3.8) appears underestimated or absent. The carriers' 50-year service lives appear optimistic compared to historical examples and whether they can truly be sustained is uncertain without a plan, however, this is being addressed (3.10). In respect of the 138-aircraft buy and continued spares procurement, the costs are beyond the UK control (1.17), affected by how many aircraft other countries buy, US policy and any further weakening of the pound sterling (if that be the case).
- e. **Survivability** – While the NAO report did not specifically address this issue or indeed the next, it is an essential part of commentary and is a significant variable when considering affordability. It is defined as the ability to remain mission capable after a military engagement and includes the protection of personnel, continued weapon capability and logistic support. Concealment, deception, and camouflage are important such that, say, small size, speed, signature control, escort protection, agility and limited replenishment exposure may improve a system's survivability. The UK carriers enter service with severely compromised survivability; limited escorts and auxiliary support (e.g. a single solid stores auxiliary (1.6)), Crowsnest AEW absence (2.7; 2.8), large size, limited speed/range (absent RAS), limited defence against emerging weaponry (e.g. hypersonic glide vehicles (HGV)) and dependency on coalition support. Survivability at best is part of an integrated design plan incorporated from the outset, however, it can be improved, even after a poor start but this requires new funding. Given the general pessimism of the NAO report in regard to general underfunding, unaffordable Equipment Plans, absence of development funding, air budget squeeze and so on, there is no cause to be sanguine that these ships will be adequately survivable at FOC and represents risk during the planned 2021 deployment.
- f. **Vulnerability** – Although nearly 40-years past, look no further than the 1982 Falklands' War combat experience to provide a starting point to consider whether the two aircraft carriers have vulnerability weaknesses in support of Carrier Strike and CEPP. The vulnerability of the carriers was a primary concern of the task group commander and dictated the operational planning choices. It is inconceivable that the loss of one and certainly both carriers would not have ended operations. Frigates demonstrated the vulnerability of surface ships if, out of necessity, they were militarily ill-used and could be considered necessary attrition. Sea Harriers were too vulnerable to be used for strike operations. The NAO report is specifically silent on vulnerability, however, it

does concern itself with value for money (9) and anticipates the possible descoping of carrier capabilities (3.2-3.4) to lower costs. At sea replenishments, too few escorts and auxiliaries, ship performance limitations, size, propulsion etc. all represent the scope for increased carrier vulnerability. And today, forty years on from operations in the South Atlantic, with the emergence of hypersonic cruise-glide weaponry in addition to esoteric mines and UUV, all capital ships are more vulnerable and an 'SS Atlantic Conveyor' may not be there 'to take one for the team.' Carrier Strike and CEPP need to be carefully thought through and appropriate strategies adopted and upgrades introduced that address the particular vulnerabilities of these large capital ships. Think of this, quite literally as spend to save!

- g. **Limited Independent Capability** – The success of the US-UK alliance in Europe has been massive but a few of out-of-area disputes, where American and British interests have differed, have been difficult. The 1956 Suez Crisis saw sanctions threatened on the UK by the US if Britain did not pull back operations in Port Said, Egypt. Although the Anglo-American relationship was mended quickly afterwards the episode evidently signified the end of Britain's role as a world super power. In the lead-in to the Falkland's War, the US administration found itself having to decide between competing US national interests and its initial response to the UK was somewhat ambivalent. A sufficiency of independent capability then possessed by the UK provided the confidence to galvanize the national will to press on and to mount the military action that removed the occupying forces of the Galtieri military Junta; eventually, led by the influence of Defense Secretary Caspar Weinberger, US support for Britain was very strong. Since WW II, by the development of its own fighter/strike aircraft (sometimes in partnership with European allies), the UK has largely maintained supply and operational independence in this key area except for the use of the excellent F-4 Phantom from the late 1960s to the 1980s. Arguably, the F-35 changes this and supply of this strike fighter is now dependent upon the US and may result in UK being more fully beholden to alignment with US interests and, presumably, is a condition that the Franco-German Future Combat Air System (FCAS) initiative is hoped to prevent for those nations. A goal of Carrier Strike has been to provide the UK with "greater flexibility to act without needing to use other countries' air bases," thereby assuring increased independence. However, the issues raised above concerning supportability, sustainability, survivability and vulnerability may affect the ability of the UK aircraft carriers to operate beyond the umbrella of allied assets (principally with US forces, as with the upcoming 2121 joint deployment to the South China Seas) with assured military effectiveness and safely. Of course, the US is a closest ally of the UK and the effect of Brexit may increase closeness but the prelude to the Falklands demonstrates the price that compromised independence may involve. The NAO report appears to be sensitive to this concern and indicates a need to clarify the "extent of interoperability (20b)" and to identify "interdependencies (20.b)" without which it will not be responsible to employ Carrier Strike and CEPP without some limits to independent operation.
- h. **Affordability** – The NAO report identifies three very serious problems, namely that Carrier Strike and CEPP (10; 2.11; 2.12; 2.16; 2.22; 3.2; 3.14; 3.17) are insufficiently defined, Command and financial responsibility (2.10; 3.23; 3.24) are not clear and the introduction of the carrier capabilities is likely to have an impact on Armed Forces budget as a whole (20a; 3.6). The report questions the adequacy of funding provisions for aircraft and carrier spares (3.9-3.20), aircraft procurement through 2026 (48 F-35B) and beyond (1.19), AEW introduction and sustainment and the burden of operating costs (3.19). Substantially and across the board, the NAO report suggests that future costs are underestimated noting that aircraft operating costs may be off by 15% (3.15) and consolidated support cost estimates for a carrier strike group are unknown (3.17). US/UK interoperability (2.10), datalinks (2.13) and anticipated F-35 upgrades (1.17), mission data integration (2.13) are reported to be unfunded commitments presently. The Integrated Review will incorporate Carrier Strike and will reassess intentions, priorities and approach to delivering defence policy through the next decade (3.3). The funding needs to execute the Carrier Strike policy aims and indeed the impact on overall Armed Forces operations will be considered and

cognizant that, for example, the “Equipment Plan is already unaffordable” (3.6), ominously, the NAO report questions whether it (Ministry of Defence) “can fund all the original roles of Carrier Strike, including supporting amphibious capabilities” (13).

Few military acquisition programs result in the introduction of advanced capabilities without cost growth and schedule slip. Advanced technology development is hard and inevitably involves risk because it employs hypothesizing – that is, a plan, schedule, funding and level of risk are established as a supposition based on evidence known at the beginning and this is invariably limited, even when sound techniques such as risk-lowering research are employed to reduce unknowns and surprises. However, there are many examples of programs that are based on false premises and unfounded ambition and deserve no sympathy when, inevitably, they fail to deliver. The NAO points out lack of clarity in Command ownership, support and financial obligation, woolliness with Carrier Strike and CEPP and current and future underfunding at a time of rising financial pressure on the Armed Forces budgets. There is evidently a major affordability problem. Something will have to give. Perhaps it will be the early loss of one carrier and a change to the F-35 procurement plan. Hopefully, looking back these past fifty years, it will be third time lucky for the Fleet Air Arm and fixed wing will not be lost this time.

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