

## To Sea or not to Sea?

Graham Edmonds | 3 Oct 2017

The F35 programme continues to receive considerable criticism and negative publicity, not the least that it is the 'most expensive defence programme ever', the aircraft are over-priced, suffer from continuous breakdowns and are 'flawed'<sup>1</sup>. However a successful appearance at the Paris Air Show and positive support from the 14 FAA and 14 RAF pilots flying the aircraft with the USMC could indicate that the negativity from across UK Media is misplaced and will lessen.

Pressure from President Trump and economies of scale with a possible build of over 3,000 aircraft mean that F35 unit costs are falling 'contract by contract'<sup>2</sup>. At the recent Paris Air Show it was announced that by 2020 the unit cost of the F35A would be, at most, \$80m.

Delays in developing the extremely advanced software – and this is a feature of all innovative programs – are likely to continue, but as a fighting machine the F35 operates and integrates with ships, other aircraft and ground forces in an entirely different way to any aircraft that has gone before. Pilots laud its combat advantages and the USN sees the integration of the F35C and Super Hornet Block III as a significant and positive pairing, particularly when taking on 'tough opponents'. Similarly the RAF sets store by integrating the operations of the Typhoon Tranche 3 and the F35B and this will be one of many important tasks for 617 Sqn, initially the trials squadron, to undertake as Lightning II aircraft numbers build up.

In RN Fleet Air Arm (FAA) and RAF service it would appear that much of the criticism has been flawed and outdated when it comes to fact; ignorance of the wider context in the way the F35B will operate and a general lack of knowledge by some commentators of how the MoD now runs its equipment capability programmes. The First Sea Lord, who holds the budget, is accountable for the delivery of the QEC. ACNS (Carriers) is the Senior Responsible Owner for the programme. However DCDS Military Capability (Mil Cap) is responsible for the delivery of Carrier Enabled Power Projection (CEPP) which comprises the Ship, the F35B and Merlin Crowsnest.

Periphery to and supportive of the programme are the new RFAs (being delivered), T45 destroyers (engineering problems being resolved), T26 frigates (the first HMS Glasgow will be operational in 2026) and Astute class SSNs. Other resources such as the Joint Helicopter Command (Chinooks and Apache) and the amphibious forces (Royal Marines and the Commando Helicopter Force Merlins), means that the overall programme will provide the government with a very significant and substantial conventional strategic deterrent and power projection force. Although denied, it is still rumoured that a V-22 Osprey buy is under consideration as this aircraft is being developed by the USMC in a AAR role. It cannot be a coincidence that QEC lifts can accommodate the V-22.

RN and RAF aircrew, engineers and support personnel who work or who have worked on the project have nothing but praise for the aircraft as the three versions approach or pass IOC after hundreds of thousands of hours of flight and ground testing. An officer associated with the project reports that having seen the jet operating onboard the USS WASP and

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<sup>1</sup> James Dean, Business Editor; The Times 19 July 2017

<sup>2</sup> The Times 19 July Letters – Cost of Fighter Jets - *Jeff Babione* - Executive vice-president and general manager, F-35 programme, Lockheed Martin

worked with numerous F-35B pilots and maintainers (both UK and US), having hands-on time in the development programme and also visiting the ships on numerous occasions, "can hand on heart" say that it will be a game-changer in the way the RN does business. There have been undoubtedly problems along the way and there will continue to be obstacles to overcome but this should not be unexpected during the development of such an advanced aircraft.

HMS QE is in a very similar position but there are very encouraging reports that the ship's company of HMS Queen Elizabeth, from which the government expects the aircraft to operate, show a genuinely high level of commitment and enthusiasm for their ship not witnessed in the past by those standing by ships in build and on first of class trials. There has been slippage in the programme, which should not have been unexpected, but HMS QE has completed contractor's sea trials and is currently (3 Oct) berthed in Portsmouth.. After Commissioning the ship will continue first of class and harbour and sea acceptance trials followed in mid 2018 by flight trials, most of which will take place on the US Eastern seaboard.

The first F35B aircraft have been delivered to the RAF's 617 Sqn based at RAF Marham. Initially 617 Sqn will be the trials squadron with its balanced mix of FAA and RAF personnel undertaking both land and sea-based trials and development. In time and as aircraft numbers build up the FAA element will form an initial seaborne capability and then form 809 Naval Air Squadron (NAS), currently scheduled for 2023. The NAO report on Carrier Strike<sup>3</sup> states that an initial operating capability with embarked F35B and Crowsnest will be achieved by 2020 and full operational 'Carrier Enabled Power Projection' by 2026.

The Government has announced that 138 F35B would be purchased over a number of years, if not decades. The plan is that a rolling buy is needed to sustain 70 aircraft which will be organised, eventually, into four front-line squadrons (2 FAA and 2 RAF) of 12 aircraft each plus a training squadron (OCU) of 20 aircraft with 3 or 4 immediate use reserves. On that basis the calculation for a buy of 138 takes into account replacements for aircraft losses and early models that become life fatigued. Seventy aircraft is about the same number of GR7/9 airframes that were available to Joint Force Harrier (JFH) when it was summarily disbanded by SDSR 2010. However in actuality the RAF maintenance system of 'fleets within fleets', which also applies to other current RAF aircraft types, meant that only 10 'high end' aircraft were available for Op Herrick, the remainder having software and weapons being upgraded or in deep maintenance. The assumption for the F35B is there will be 70 aircraft kept at the same Block software standard and thus the exact same capability standard – hopefully. The build up of aircraft numbers will not be quick, and when 809 NAS forms there should be 48 aircraft, comprising 8-12 in each squadron (617 and 809) and the OCU. However the purchase of an additional two aircraft in 2018 over planned delivery schedule might enable 809's commissioning to be brought forward to 2020. This plan has probably been scuttled by the General election result, the forthcoming 'mini-SDSR' and the MoD's reconciliation of the budget against the rocketing cost (currently £20Bn) of the overall equipment plan, created in part by the fall in the value of the pound against the dollar. Doubtless procurement of other US equipment (eg Chinook, Apache and P8A) will be equally affected.

When sufficient aircraft – that is the full complement of 70 - have been delivered to form four squadrons, the embarked operating plan will probably be that the 'duty' carrier will routinely deploy with one squadron of 12 F35B and it is inevitable that will be one of the two Naval Air Squadrons. At approximately two year intervals and for about three months at a time there will be a larger deployment with two squadrons embarked. Clearly there will be the an 'on

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<sup>3</sup> HC 1057-I Session 2016-2017 dated 16 Mar 2017

watch' (embarked) carrier squadron for 'routine nine month deployments' and an 'off watch' squadron ashore, and at the two year point 'on' and 'off watch' squadrons will embark for a full work up and handover. The capability to surge to three embarked squadrons will be retained but this could only be achieved by embarking an RAF or USMC squadron, one of many reasons why there is already so much close involvement with the USMC. This assumes that one carrier is operational and the other in maintenance, however with HMS PoW also available as a LPH to replace HMS Ocean (the ship decommissions in 2018) it is possible that two carriers, both with embarked F35B squadrons, will be operational at the same time.

Pilot currency is vital and even if RAF squadrons do not routinely embark it is important that pilots from the 'off watch' FAA squadron and RAF do so as to remain 'current'. However currency requires not only operational flying from the carrier but also a significant amount – if not the same amount – of time in a simulator. It is important that the number of F35B squadrons available can meet the Secretary of State's CEPP policy goals and it can be seen from the likely embarkation profile described above that could probably be achievable with just two front line Naval Air Squadrons with aircraft for training and in reserve. In the days of Joint Force Harrier MoD statistics show that RAF embarkation periods in the CVS were – inevitably – low, even accepting necessary operational deployments to Iraq and Afghanistan, which were undertaken by FAA squadrons also.

“The RAF might buy F-35As instead of F-35Bs” according to a UK Parliamentary statement by the Minister for Defence Procurement. If this is the case the F35A would far better suit the RAF's normal land based role in support of the Army's ground operations. The aircraft has a greater radius of operation, a highly desirable attribute for a combat pilot. The F35A is marginally less expensive than the F35B but both have considerable compatibility in logistic support. Were such a decision taken then the 70 strong F35 Lightning Force would need to be divided so as to sustain two sea going and two land based squadrons and that a slightly larger number of aircraft would be required for the OCU. This plan to operate two F35 types in the Lightning Force would not detract from the investment in RAF Marham infrastructure, nor that FAA and RAF pilots would be interchangeable between sea going and land based squadrons.

However, purchase of the F35A for the RAF poses a number of issues, of which the most significant is the Air to Air Refuelling (AAR) system. The F35A is fitted with the 'boom' AAR; the RAFs KC2 and KC3 tankers are fitted with 2 under-wing hose and drogue systems, and the 5 KC3 additionally have a high capacity fuselage mounted hose and drogue. Further, RAF tankers operate under leasing arrangement and were built as closely to civilian standards as possible with limitations which include no self-refuelling capability. In simple terms the RAF's Voyagers cannot refuel the F35A unless either a boom system is fitted to the tankers or a probe fitted to RAF F35As. Alternatively and logically, or even common sense dictates, the RAF should opt for the F35C, destined for the USN, which is fitted for the probe and drogue and should, or when, the QEC be refitted subsequently with catapults and an arresting system (Cats and Traps) at first long refit then a purchase of the 'C' in lieu 'A' for the RAF (and FAA) would vastly improve the flexibility of the overall Lightning Force. QEC will need cats and traps if UCAV, currently under development, are to be part of the Carrier Air Group.

The incompatibility of the Voyager's AAR system is not unique to the F35A as the RAF's P8A Poseidon and Rivet Joint aircraft are also equipped only for the boom AAR system. As the RAF Voyagers are hose and drogue only the RAF could not join the NATO 'A330 tanker pool' with Norway, Luxembourg, Germany and the Netherlands whose air forces use the

boom method<sup>4</sup>. Also the UK, Norway and the USN have agreed to work together on ASW in the North Atlantic and which will 'leverage' the joint acquisition of P-8 aircraft.<sup>5</sup> To increase the radius of action of the RAF's P8s beyond 4 hrs on station at 1,000nm (less than half the distance between RAF Lossiemouth, which will be the home of the 2 P8 Squadrons, and Halifax Nova Scotia) they will need to be refuelled when airborne by either Norwegian or USAF tankers until such time as a Voyager is retro-fitted with a boom or the RAF P8 has a probe.

The probable 'on' and 'off' watch embarkation plan also raises the ongoing issues of operational and administrative differences between the RN and RAF. A senior naval officer remarked recently that the FAA and RAF 'do things differently' an expression that embraced both operational and administrative methodologies. Flying at sea operates to a different set of rules, as, for example, there are no diversion airfields, the runway (the carrier) is not in the same place from take off to landing and administratively personnel Harmony Rules differ between the two services. This means that RN personnel can be separated from home for up to 9 months and the RAF for lesser periods of between 3 and 4 months. In the House of Lords a question "To ask Her Majesty's Government whether the harmony rules for RAF personnel serving in the new F35B squadrons will be brought into line with their Royal Navy equivalents" received the response that "RAF personnel serving in the new F35B squadrons will follow RAF harmony guidelines. They will not be brought into line with their Navy equivalents".<sup>6</sup> This unfortunate lack of 'jointery' (all of one company) means that in a carrier deployment of 9 months the embarked RAF personnel could be changed in mid-deployment at least once, possibly twice; whereas NAS personnel would remain for the entire time.

This would undermine the maintenance of Operational Capability; in JFH RAF pilots on 3 month detachments to a CVS rarely achieved an operational night flying capability. In the final years of HMS Ark Royal's CVS operations the number of RAF pilots who qualified for "Full Weather" was very low if not nil. It must be stressed that the reason was not due to lesser skills, but simply that to abide by RAF Harmony Guidelines, the RAF squadrons of the JFH could not take on any deployed activity additional to their Afghanistan tours within the RAF 'separated service' time-lines. On the other hand 800 NAS undertook the same Afghan tours followed immediately by deployed tours on the CVS without breaching RN Harmony guidelines.

The plan to 'surge' to three embarked squadrons may involve the USMC, who will arrive deck qualified; however should the surge squadron be drawn from the RAF historical evidence shows that 'augmentees' must be fully deck qualified (night and day) and be conversant with ship operating procedures. If 809 NAS is initially the 'core' maritime squadron and 617 Sqn RAF embarks from time-to-time it is essential that all 617 Sqn aircrew maintain day and night carrier qualifications and can understand and operate to Naval / NATO maritime doctrine.

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<sup>4</sup> Germany and Norway Join A330 MRTT Tanker Pool <http://www.airinternational.com/2017/06/29/germany-and-norway-join-a330-mr-tt-tanker-pool/>

<sup>5</sup> Allies And The Maritime Domain Strike Enterprise" [http://breakingdefense.com/2017/07/allies-and-the-maritime-domain-strike-enterprise/?utm\\_source=hs\\_email&utm\\_medium=email&utm\\_content=54136802&hsenc=p2ANqtz-921o47DqLjWr0J\\_wVRV0ZvjeVoHDe\\_zlnJaD7i3Q6xqsdevraE6J7LrCoXJrMtm5NTMSZYi1UGwnURCt\\_AVsHLVdVh1\\_R6\\_ttRsi8tIHhw-qB3DtI&\\_hsmi=54136802](http://breakingdefense.com/2017/07/allies-and-the-maritime-domain-strike-enterprise/?utm_source=hs_email&utm_medium=email&utm_content=54136802&hsenc=p2ANqtz-921o47DqLjWr0J_wVRV0ZvjeVoHDe_zlnJaD7i3Q6xqsdevraE6J7LrCoXJrMtm5NTMSZYi1UGwnURCt_AVsHLVdVh1_R6_ttRsi8tIHhw-qB3DtI&_hsmi=54136802)) in

<sup>6</sup> <http://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Lords/2014-12-09/HL3590>

The RAF acknowledges that any F35 version will complement their Typhoons really well. Both provide a formidable capability that when combined will be pretty hard to beat. It is important to the RAF to develop this relationship in support of operations in support of ground forces and other operational roles and is best achieved the 'RAF way' from fixed airfields with AAR and communication and intelligence support aircraft. In operations the aircraft is the RAF's prime reason to exist.

For the RN and the Fleet Air Arm the carrier strike group provides mobility, flexibility of operations and can project force in a number of ways in which the aircraft, without doubt, is the most important and flexible, but is but one devastating weapon system amongst many. For the Navy the F35B will not only provide power projection to shore and on the sea, but will also provide air defence and maritime patrol and surface attack.

A significant role of maritime power projection is to act as a force in being by proximity – just over the horizon - to regions of international tension. Ultimately the Carrier and Amphibious task groups can deliver marines for ground combat operations ashore, supported by embarked aircraft and land attack cruise missiles. Such a force has a vital ability to provide immediate response to a rapidly changing situation, including rapid withdrawal.

There are those who advocate a mixed F35 fleet of As and Bs. The F35A is much closer to what the RAF wants as, essentially, a much advanced Tornado replacement. It does not make much sense for the UK to buy a large fleet of STOVL jets when the principle 'owner' doesn't really grasp the implications in operating fast jets from sea.

A Lightning Force of two aircraft that have a huge amount of commonality in the areas that really drive costs, including all of the avionics, most of the aircraft systems, and even the propulsion area with a single support chain ( 'owned' by the MoD) makes excellent sense.

The mixed fleet also offers an excellent way to resolve the key issue of command, control and ownership. Were the Lightning Force to be treated as a 'MoD rather than RAF owned or 'UK owned' fleet - not 'RAF owned'. A true Mod Owned fleet could be based and supported at a joint base (although it is unlikely that the RAF will accept 138 aircraft held at one base for a moment - their normal planning assumption is for no more than 36 at a base) with separate chains for what I think are the key functions, namely:

a. Command and control – it is absolutely essential that aircraft at sea come under a system of command and control that is fully integrated within the task group. Aircraft operations on a carrier have to be under the control of a naval aviator who understands how those operations are executed and optimised from a carrier. The F-35B fleet should be quite easily put under Sea Command, with As falling under Air ashore. Previous attempts under JFH for aircraft embarked on a CVS to be tasked and commanded from ashore proved to be a tactical and command and control nonsense, if not disaster.

b. Air Safety Management (Airworthiness) – the Military Aviation Authority (MAA) has a complex and demanding set of responsibilities for 'Air Duty Holders' at senior levels of an aviation organisation. The Duty Holders who are charged with understanding and managing the safety risks associated with carrier operations must be fully integrated with and understand the ship's own safety management systems - handling of explosives is a good example how the two 'worlds' (sea and shore) have to be managed so as to fully complement each other with absolutely no gaps. Relevant MAA regulations raise concerns as to how any RAF pilot could ever be assessed as a 'Suitably Qualified and Experienced Person' (SQEP) so as to discharge a Duty Holder's responsibilities at sea.

The purchase of the F35A would allow the F-35Bs to be properly 'badged' as FAA aircraft, the NAS would function under RN harmony rules and the 'MoD' owned Lightning Force would avoid the high level infighting that bedevilled Joint Force Harrier and which Lightning Force is working hard to avoid. It would not obstruct frequent and useful 'exchange' appointments for aircrew and maintainers.

In conclusion the deployment plans for the four F35B squadrons indicate quite clearly that the NAS will always go to sea and the RAF just might but then only very rarely. If that is to be the case then the RAF should purchase the F35A as soon as possible, not the least as it makes operational sense, although AAR system will need to be resolved. The Lightning Force will have two strands of activity, maritime and land which will not prevent air and ground crew exchange – in the interest of 'jointery' if nothing else. Air Safety Management under the complex regulations of the MAA will avoid being complicated with parallel regulations for ships at sea. Command and Control of aircraft will be vested in Sea Command for the B and Land Command for the A, thus avoiding the disasters of the JFH era.

By the very nature of their operations the 'FAA and RAF do things differently', one Service goes to sea, the other does not. And operating the F35A the RAF will never go to sea. But with the F35C?

Graham Edmonds – 3 Oct 2017