

## A Defence of the HMS Queen Elizabeth/F35B STOVEL Combination

Since their inception the Queen Elizabeth (QE) aircraft carriers have attracted a lot of negative comment, comparing them very unfavourably with conventional CATOBAR carriers (catapult launch and arrested recovery). Very little of the comment has highlighted the advantages of STOVEL operations (short take off and vertical landing). The negative comment centres almost entirely on the performance capabilities of the STOVEL F35B as opposed to the conventional F35C, F18 or even the Dassault Rafale jet fighter bombers and the suggestion that the QE carriers will be unable to launch and recover the heavy unmanned air vehicles (UAV's) that will be a feature of future air operations. A further criticism is that cross decking from alliance carriers will not be possible.

When considering the pros and cons of the CATOBAR versus the STOVEL variant, has the QE/F35B combination been given a fair crack of the whip? Within the popular press I believe that it has not and that a critical appraisal of both types will show that the STOVEL combination is the ideal one for the UK.

Why when I see pictures of F18 fighter bombers or E2 early warning aircraft being catapulted from the bows or recovered to the deck of American aircraft carriers, is the Sun always shining down onto an Azure blue sea? Why do I not see those aircraft being launched or recovered while the carrier is pounding into a heavy deep ocean swell, topped by a large wind wave which is being driven by a 50 knot + wind as a deep weather front crosses her location? The answer of course is because it would be dangerous for them to do so; the potential for catastrophic accident would be huge and the attrition in both aircraft and aircrew immense.

Enter the STOVEL carrier. With its ski ramp at the bow to help flick the launching F35B into the air and then that aircraft being able to hover alongside the centre of the ship before landing vertically, where vessel motion is at its least, the QE's aircraft will be airborne and able to handle incoming threats long after their conventional sisters have been struck below or secured to the deck for safe keeping. Likewise, the Merlin based Goalkeeper, Airborne Early Warning helicopter (AEW), will be aloft and giving effective coverage when the far more capable (when it is airborne) Hawkeye E2D is deckbound. Thus the STOVEL carrier has a far wider weather operating capability than her CATOBAR sister.

In the wake of the Falklands war there was widely reported comment that had the 1950's to 70's era HMS Ark Royal still been available, her Phantom fighter and Gannet early warning aircraft would have tipped the air battle more in the UK's favour. The comment that was not reported so widely was that if she had been available, the weather conditions in that part of the world would have shut her operations down for considerable periods of time and left the task force bare of aerial defence. The two STOVEL carriers however, Hermes and Invincible, continued operations during some very extreme weather conditions. The moral of that story is if you want to operate aircraft from a carrier in the winter South or North Atlantic, or anywhere else where you can expect periods of bad weather, with an emphasis on fleet defence, opt for a STOVEL carrier.

Therein lays another consideration; what is the carrier for? In the question and answer session that followed the 2016 UKNDA Richard Holmes Memorial lecture, historian Allan Mallinson questioned whether the UK actually needed aircraft carriers because long range strike could now be carried out over great distances by modern land based aircraft. To a point he is right but only if you believe that an aircraft carrier exists solely to carry out bombing missions. You can attack from great distances but you cannot defend from that distance. Before the term Strike Carrier became common, these vessels were known as

Fleet Carriers. They were part of a balanced fleet and while they could strike at anything within the range of their aircraft, one of their main tasks, if not the main task, was the aerial defence of the fleet. With that consideration in mind a major requirement is being able to get your aircraft airborne quickly, in any weather condition. A long range capability, while always nice to have, in this instance reduces in importance as the threat will be coming to you and it is the attacker who will need the extended endurance. The RAF benefited from this reality over the southern county's of England in the summer of 1940. An ex US Navy seaman once told me that while he was serving on one of the Nimitz class aircraft carriers, "one of those diddy little Brit carriers" (an Invincible class vessel) "beat the pants off of us in exercise because they could get their aircraft into the air so quickly". Having the best performing aircraft isn't always the deciding factor; operational considerations weigh heavily! One should always bear in mind that attacking is carried out to your timetable, can be cancelled at very short notice and will generally not proceed until all of your assets are in place. Defence however has to be carried out to your enemy's timetable and you have to be ready to react instantly, all of the time.

The negative comment that, without a catapult system and arrestor gear the QE carriers will be unable to operate the larger UAV's that will be a part of future air groups, needs critical scrutiny. Combined diesel and gas (CODAG) powered vessels, such as the QE carriers, do not produce a lot of steam and so that type of catapult would be difficult to install. In any case, the heat produced by such a system would be counter to the Navy's desire for a reduction in Infra Red signature. The new Electromagnetic Aircraft Launch (EMAL) system, presently being developed in the US and which has been installed on their new carrier, the USS Gerald R Ford, is still in development and is untried. It remains to be seen if the electromagnetic pulse that this system will produce can be masked sufficiently so as not to affect other onboard systems and give the vessels position away every time it launches an aircraft.

There is however another way. It should be remembered that during the 2nd world war, Walrus aircraft were catapulted across the waists of cruisers and Hurricanes were rocket launched from the fore decks of merchant ships. Also aircraft were recovered to the decks of carriers before the advent of the angled deck, with a net barrier being used to catch those that missed the wire. OK, those aircraft were slower and lot lighter than the UAV's presently being tested from the decks of US carriers but with modern automotive technology it should not be beyond the wit of engineers to produced a motorised sledge that will accelerate an aircraft down the length of a nearly 300 metre long flight deck and help push it into the air. By having several such sledges stowed in the hanger a redundancy advantage would be gained over catapult systems, even to the point of being able to launch aircraft when the vessel was operating on reduced power. I suspect that the problem, rather than getting the aircraft into the air would be in stopping the sledge from following it. As far as the smaller and lighter UAV's are concerned, such as a marinised version of the army's Watchkeeper, there should be no real problem in their launch and recovery. Even the heavier 5.3 tonne Reaper or its folding wing marine version, the Mariner/Guardian, should be launchable by motorised sledge. With ultralight systems such as the QinetiQ designed Solar Powered Zephyr, currently being built by Airbus under a contract from the MOD, which will loiter aloft at 70,000 feet for more than a month and have a 324 mile horizon, the problem would be keeping it on the deck rather than getting it airborne! By looking beyond the confines of a steam or electromagnetic catapult, there are options that can be developed to come part of the way towards, and on some issues to surpass, the capability that those two systems offer.

As mentioned in the first paragraph, most of the criticism has been directed, for various reasons, at the fact that the F35B is not as capable as its F35C sister or even the earlier generation F18 or the Dassault Rafale. On critical analysis however it can be seen that those criticisms are not as definite or as decisive as they might at first sight appear. Take for example the question of range, or really we should say unrefueled range. The F35B has the

shortest legs of them all but as mentioned above, for fleet defence that is not so critical and when attacking, RAF or alliance long range tankers would be used to give the F35B more reach. It would have been nice if the RAF Voyager refuelling aircraft had been given the ability to refuel themselves, thus extending the range of everybody and possibly a boom so that non hose and drogue aircraft could also receive fuel but that is a subject for another discussion. In reality even conventional combat aircraft are supported by tankers when they go into action. During the Libyan campaign, the European alliance partners had to call upon the US to supply aerial tanking for their land based aircraft because they did not have enough. Conversely the US Marine Corp and Italian Harriers, standing by on station, fuelled and armed on the decks of their STOVEL carriers, 20 miles off the Libyan coast, required little or no tanker support to get them to their targets and back; ditto the Apache helicopters onboard HMS Ocean. When the US Navy changed from the Intruder to the F18 for bombing missions, they accepted a much reduced range capability for other performance advantages. The MV22 Osprey, already in use by the US Navy for onboard delivery and the Marine Corp for assault and special operations, is presently being trialled with a refuelling package that will possibly benefit the F35B. As far as range is concerned however, the F35B will have one advantage over its conventional competitor; should it over reach itself, in an emergency, it could settle onto a short pre-prepared strip ashore or the heli-deck of an assault ship, auxiliary or any other vessel with a deck large enough to take it and then when stripped out to reduce weight, take off vertically for a return to the carrier (in trials the prototype took off vertically). If the MOD and Navy have the foresight, for little cost, the heli-decks of their medium to large vessels can easily be strengthened and fitted with a heat dissipating water skim/pre-wet system, in order to handle an F35B (in a commercial venture there would be little cost!). Load carrying is another criticism where the F35B falls short of the others. In the stealth mode this is true but only when applied to the F35C versus the B. When low observability (stealth) is not a requirement and under wing stores can be carried the disadvantage largely disappears. Air to air combat against more manoeuvrable aircraft such as the F18 or the Rafael is another point of criticism where the F35B is said to be deficient. In recent Red Flag exercises however, a kill rate by the F35A (the B's land based sister) against 4th. Generation aircraft (e.g. F18 and Rafale) are quoted as being 15 to 1 or higher. The air combat critique does not stand up to scrutiny.

If I have one criticism, it is that the QE carriers appear to be deficient in self defence armament. With a shortage of escorts already apparent and the carriers being prime targets in any serious war, these vessels should carry at least the air defence capability of the type 45 and 26 vessels. They have the onboard space and hopefully such a capability will be fitted once they are in service.

Why then has the QE carrier/STOVEL combination come in for so much criticism? I believe it is because most of those critics have been thinking as airmen and only as airmen. They have not fully considered the problems of heavy weather operations as a seaman would, the ways in which the disadvantages of the STOVEL package versus its conventional competitors can be overcome, nor the operational advantages that it will give. They have not subjected their own criticisms to a critical analysis and have been guilty of tunnel vision. They appear to be unable to think outside of the box, or should I say the cockpit!

While Britain is a major ally of the US and supports them in most of their military campaigns, the UK is not in the business of projecting power in the same way that they do. We do have global interests however that need defending; with some in areas of the world that experience extreme weather conditions. Thus we need carriers that can project power but at the same time become the major defensive hub of an entire area, with the flexibility to disperse their aircraft over several decks and/or austere strips ashore and because of budget restrictions (one has to face reality!) do so at an affordable cost. A STOVEL carrier that is large enough to carry a substantial mixed air group, which may consist of the F35B, Merlin/Goalkeeper AEW, Apache attack helicopters, various other helicopter types, UAV's and possibly the

MV22 Osprey is, I believe, the best combination to achieve this and the QE carriers are the right vessels for the UK and the Royal Navy.

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