AN ALTERNATIVE ROYAL NAVY FOR THE 1970s – AND BEYOND

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(with significant amendments in red font)

During the 1970s the major surface warships of the RN underwent several substantial changes in equipment. Steam plant (or a steam/gas turbine combination) was replaced by all-gas turbine machinery in new designs. The Sea Dart and Sea Wolf SAMs were introduced to replace Sea Slug and Sea Cat, and Exocet anti-ship and Ikara anti-submarine missiles acquired. The old semi-automatic 4.5 inch Mk VI twin mounting was replaced by the new automatic Mk 8 in the same calibre. The Limbo anti-submarine mortar was replaced by homing torpedoes. And three new classes of escort ships were developed – Type 42 destroyers, Type 22 anti-submarine frigates and Type 21 general purpose frigates – plus the Invincible class light aircraft carriers.

The purpose of this article is a 'what if?' think piece, looking at what alternative decisions might have been made at this crucial time, and their possible outcomes, within similar overall levels of resources. Trying to compare costs is made even more difficult than usual by the rapid inflation which occurred over the period of the construction of the new ships and adaptation of existing ones. Accordingly, 1973 has been taken as a baseline (the year when the first of the adapted Leander class was commissioned) and the costs of all of the other ships - actual and proposed - has been calculated in 1973 prices, using the overall annual inflation figures.

It must be emphasised that this is not intended to be critical of the decisions made at the time; they were influenced by countless political, financial and practical considerations and I have no reason to doubt that those responsible made the best decisions they could, in the light of the information then available.

The RN in 1970

At the beginning of the 1970s, the major vessels in the RN's surface fleet were as follows (displacements given are standard or 'normal': full or deep load figures were higher, also the normal displacement for a class could increase over time as equipment was added):

Aircraft Carriers

Ark Royal (43,000 tons): steam plant; just converted to operate Phantoms and Buccaneers.

Eagle (45,000 tons): steam; decommissioned in 1972.

Hermes (24,000 tons): steam; converted to Commando Carrier 1971-73.

Bulwark (22,000 tons): steam.

Cruisers:

Tiger (10,000 tons): steam; converted to a Command Helicopter Carrier 1968-72, one twin 6 inch + one twin 3 inch + Sea Cat.

Blake (10,000 tons): steam; converted to a Command Helicopter Carrier 1965-69, armament as above.

Destroyers

County Class guided missile AAW destroyers (6,200 tons): 8 commissioned 1962-70; steam plus gas turbine; Seaslug; two twin 4.5 inch Mk VI; Sea Cat; helos.

Daring Class gun destroyers (2,800 tons): 8 ships commissioned in the 1950s; steam; three twin 4.5 inch, in the process of being disposed of.

Some remaining WW2 ships, most converted to anti-submarine frigates.

Frigates

Whitby/Rothesay/Leander Classes (2,150-2,790 tons): 41 ships completed 1956-73, steady evolution of the basic Type 12 design ASW frigates; steam; Limbo; helo (later); one twin 4.5 inch Mk VI; Sea Cat (later).

Tribal Class Type 81 GP frigates (2,300 tons): 7 ships completed 1961-64; steam plus gas; two WW2-era 4.5 inch single mountings; Sea Cat; light helo.

Leopard Class Type 41 AAW (2,300 tons): 4 ships completed 1957-59; diesel; two twin 4.5 inch Mk VI.

Salisbury Class Type 61 air direction (2,170 tons): 4 ships completed 1957-60; diesel; one twin 4.5 inch.

Blackwood Class Type 14 class economy ASW ships (1,180 tons): 12 completed 1956-58; steam; Limbo; about to be disposed of.

The RN in 1980

By 1980, the following new classes of ships, or significantly adapted ones, were in service or under construction (all costs quoted below are adjusted to 1973 prices):

Aircraft Carriers

Invincible Class (20,000 tons) 3 completed 1980-85; gas turbines; Sea Dart; CIWS (later).

Destroyers

Bristol: single ship of Type 82 Class fleet escorts, completed 1972 (6,700 tons): steam plus gas; Sea Dart; Ikara; 4.5 inch Mk 8; c. £26 million).

Type 42 AAW ships completed 1973-1985 to replace County Class: *Sheffield* Class (3,850 tons), ten ships; and *Manchester* Class (4,750 tons), four ships (2 as replacement for Falklands War losses); gas turbines; Sea Dart; 4.5 inch Mk 8; Phalanx added to some later. Average cost per ship c. £24m.

Frigates

Amazon Class Type 21 GP ships (3,100 tons); 8 ships completed 1974-78 (2 sunk in Falklands 1982); gas turbines; 4.5 inch Mk 8; Exocet; Sea Cat. Average cost per ship c. £12m.

Type 22 ASW ships completed 1979-90 to replace *Leander* class: *Broadsword* Class (4,000 tons), four ships; *Boxer* Class (4,100 tons), six ships; and *Cornwall* class (4,200 tons) four ships: gas turbines; Sea Wolf; Exocet; Cornwall class also with Harpoon; 4.5 inch Mk 8; Goalkeeper. Average cost per ship c. £34m.

Modified Frigates

Leander Class Ikara conversions: 8 ships modified 1972-78, losing 4.5 inch mounting in favour of Ikara AS missile system. Average conversion cost per ship c. £8m.

Leander Class Exocet conversions: 8 ships modified 1975-82, losing 4.5 inch mounting in favour of 4 Exocet ASu missiles. Average conversion cost per ship c. £11m.

Leander Class Seawolf conversions: 5 ships converted 1980-84, losing 4.5 inch mounting in favour of one Seawolf AA mounting and 4 Exocet ASu. Average conversion cost per ship c. £20m.

Other 1970 ships remaining in 1980

The two big carriers had gone and *Bulwark* went in 1981, leaving only *Hermes* and *Invincible* available in 1982.

The two *Tiger* Class Command Helicopter Carriers had also gone by 1980.

The *Bristol* and five of the *County* Class were still in service.

The remainder of the unconverted *Leander* Class (about six ships) were still in service.

Elements of the Ships: Engines

In deciding what ships might have been designed to enter service by 1980, an important element is the machinery. All three new classes of escorts used the same **COGOG** (Combined Gas Or Gas) plant, which consisted of two propeller shafts, each with one R-R Tyne (4,000-5,000 shp) and one R-R Olympus (25-28,000 shp) gas turbine. The two types of engines could not be used together. These engines were marinised versions of aircraft turboprop and turbojet engines respectively. The ships therefore had 8,000-10,000 shp for cruising, with 50-58,000 shp for burst speed. The Invincible Class had a different **COGAG** (Combined Gas And Gas) arrangement consisting of two propeller shafts each with two R-R Olympus which could be used singly or together, giving a total power of 112,000 shp.

The COGAG arrangement was also employed in contemporary USN escorts, using two 20-25,000 shp gas turbines per shaft. Two propeller shafts (80,000 shp) were enough for the 6,000 ton *Spruance* Class destroyers, while one (40,000 shp) sufficed for the 2,700 ton *Oliver Hazard Perry* Class frigates.

One of the Type 22s (*Brave*) was fitted with R-R Spey instead of Olympus gas turbines, and these were subsequently fitted to the Duke Class Type 23 frigates of the 1990s. The Spey is less powerful than the Olympus (around 19,000 shp) but more efficient. It was available for aircraft use in the 1960s, and a marinised version would probably have developed around 15,000 shp at that time.

Proposal: to marinise the Spey rather than the Tyne and Olympus, and to use it in a COGAG arrangement, providing 30,000 shp per shaft, rising to 38,000 with development. This would have had the following advantages:

- **Significantly lower cost to marinise, build and maintain one engine rather than two**
- **Enough cruising power to enable a small escort to manage with only one shaft (15,000-19,000 shp available compared with 8-10,000 shp from two Tynes)**
- **Invincibles could use three or four shafts, cheaper than developing a new gearbox and installation**

The disadvantage would have been a higher fuel consumption in low-speed cruising for the two-shaft installations (30,000 shp available, whereas 10,000 shp was adequate).

Elements of the Ships: Weapons

The **Sea Dart** was an advanced SAM when introduced, with the advantage over the similar-sized USN SM missiles of an efficient ramjet engine which put its range in the same class as the bigger USN Extended Range missiles. It utilised a trainable twin launcher (as did SM at the time). The USN later adopted a VLS (Vertical Launch System) for its SMs, as that was simpler and more reliable and the VLS silos could easily be used to launch other missiles of similar size.

The RN purchased the French **Exocet** anti-ship missile, which was launched from substantial fixed boxes.

The RN also purchased the Australian **Ikara** anti-submarine missile, which was like a small radio-controlled aeroplane carrying a homing torpedo. It was launched using rocket boosters, and then glided to its target. The installation required a 'zareba'; a circular mounting to launch it from.

Proposal: to develop a VLS system for Sea Dart from the start. This could also be used to house AShM (anti-ship missiles, e.g. Exocet), and torpedo-carrying ASW missiles; possibly ASROC, although ideally the Australians would be persuaded to design Ikara to fit. The advantages would be:

- **Much less expensive and space-consuming than the three separate launcher installations**
- **More reliable than a trainable launcher (the Sea Dart launcher**

had some reliability problems in the Falklands)

- **More versatile in allowing a VLS-equipped ship to vary its armament to meet requirements**
- **More export opportunities for Sea Dart, possibly including France and Australia. An increased customer base would have made it more feasible to keep upgrading the missile system.**

The disadvantage would be that the *Sea Dart* missile would no longer be pointed at the target before launch, so some means of steering the missile after launch would be needed to enable its seeker to pick up the radar signal reflected from the target. This could either have been achieved by fitting an autopilot programmed just before launch or via a command guidance system. The latter might be achieved by using the *Sea Wolf* command guidance system, making their directors dual-purpose.

Initially the **Sea Dart** would use semi-active radar for the rest of its flight, but active terminal guidance could be developed later.

Sea Wolf was (and remains) a very effective short-range AA and anti-missile system. It was introduced in a trainable six-round launcher, now replaced by a VLS. Ironically, early in its development in the 1960s it was tested with a VLS and it is unclear why this was not proceeded with then. The missile system also experienced a very protracted development which greatly increased its cost and delayed its entry into service.

Proposal: develop Sea Wolf as a VLS system from the start, and concentrate on getting the initial version into service quickly, leaving performance improvements to later software upgrades. Advantages:

- **More flexible in terms of launcher location**
- **More reliable launching, without the need to manually reload**
- **More ships available with Sea Wolf more quickly**
- **Potentially more attractive for export sales, which would also have helped fund upgrades.**

The **4.5 inch Mk 8 gun** was (and remains) a satisfactory but unremarkable shore bombardment and secondary anti-ship **MCG** (Medium Calibre Gun). However, the opportunity could have been taken to strike deals with other countries over 'weapon swaps'; e.g. by acquiring the Italian 5 inch OTO Melara gun, or the French 100 mm, or the Swedish 120 mm Bofors, in return for Sea Wolf and/or Sea Dart.

Proposal: that a suitable foreign MCG be acquired by exchange instead of developing the 4.5 inch Mk 8. Advantages:

- **Cost of developing 4.5 inch Mk 8 avoided**
- **Opportunities to extend export sales for other systems**

The RN continued to rely for close-in defence on the basically WW2 era 20mm **Oerlikon** and 40mm **Bofors** until after 1982, when there was a rapid switch to modern Oerlikon weapons: the 20 mm KAA in a single mounting, and the 30 mm KCB in single or twin stabilised mountings.

Proposal: to adopt the 30 mm KCB in a single stabilised mounting for the new ships. Advantages:

- **Much more effective in the AA role, provided laser rangefinder / computer predictor sights were used.**

Proposed Ship Classes

To summarise, the RN acquired 15 new destroyers (c. £368 million), 14 new anti-submarine frigates (c. £470 million) and 8 less expensive new general-purpose frigates (c. £100 million) of three different designs from the 1970s onwards, a total of 37 new escort ships. In addition, 21 Leander class ships were extensively modified, with entirely new weapon systems, at a total cost of £245 million (all in 1973 prices). It seems rather odd to spend such a large sum on modifying the Leanders from gun ships by giving them modern weapon systems, while at the same time buying unsophisticated new gun ships in the form of the Type 21 class. In this alternative world, the Leanders would be retained unmodified as gun ships, then be phased out as new frigates with modern weapon systems were introduced.

Several problems with these decisions emerged, largely because the nature of the expected threat changed. In the 1970s the RN was thinking almost exclusively about the threat to North Atlantic trade posed by Soviet surface ships, submarines and long-range missile-carrying aircraft. The ships procured therefore tended to be specialised for particular functions (anti-air, anti-ship or anti-submarine) except for the less capable general-purpose Type 21 frigates, which were bought more or less off-the-shelf.

The 1982 Falklands War drove home the lesson that all ships need to have general-purpose capabilities, even if they are biased towards one

major function. So the last batch of the gunless (apart from 40 mm Bofors) Type 22 frigates was modified to carry a 4.5 inch gun, as was the design of the succeeding Type 23 Duke Class ships.

Bearing this in mind, it might have been better to consider a high/low mix of escorts, with some having the full range of functions, and other being smaller and less expensive but still with good all-round capabilities.

Proposal: that two different classes of escorts be developed instead of three, as follows:

Alternative Destroyer (AltD) – two-shaft, c.6,000 tons, with VLS for Sea Dart / Exocet / Ikara, also VLS Sea Wolf, MCG, 30 mm, and a flight deck and hangar for one Sea King or two Sea Lynx helos.

Alternative Frigate (AltF) – one-shaft, c.3,500 tons, with VLS for Exocet/Ikara only, also VLS Sea Wolf, MCG, 30 mm, and a flight deck and hangar for a Sea Lynx.

The large VLS aboard the AltD would need a minimum of 40 cells (24 Sea Dart, 8 Exocet, 8 Ikara/ASROC missiles); in the frigate, a minimum of 16 cells (8 Exocet, 8 Ikara/ASROC missiles). The small VLS for Sea Wolf would probably need a minimum of 32 cells in both ships, with the possibility of quad-packing extra Sea Wolf in the large VLS later.

Costs

The key question is: could these have been afforded? In ship terms (steel and machinery), the AltD would probably little more than a Type 22 or 42 (the larger ship being balanced by the less expensive machinery), but the weapon fit would be considerably more expensive as it would essentially consist of both types of ship combined. Despite the fact that the Type 22 and 42 were similar in size and had the same machinery, the Type 22 cost an average (in 1973 prices) of £34m compared with £24m for the Type 42. Even allowing for the possible cost savings in weapon procurement indicated, at a rough guesstimate each AltD would probably cost in the region of £44m.

The AltF would basically be significantly cheaper than the similar-sized Type 21 because of the one-shaft machinery, but again the weapons fit would be considerably more expensive. It is very difficult to estimate the likely cost; probably more than the Type 42 Batch One, which averaged £17m (later batches were a lot more costly). Say £24m per ship for the AltF, compared with £12m for the Type 21. In compensation, the

Exocet/Ikara/Sea Wolf modifications to the Leander class would have been unnecessary, resulting in a £245m saving.

There is another important element in the savings, and that is the crew. The RN went through a manning crisis in the late 1970s, and the more rapid replacement of the steam Leanders by gas-turbine ships would have led to crew savings.

The total cost of the historic new and modified escorts discussed here (Types 21, 22, 42, 82 and modified Leanders) was in the region of £1.2 billion in 1973 prices. This money applied to the proposed two-class ships would buy 12 AltD (£528 million) and 24 AltF (£576 million) for a total cost of £1.1 billion: a useful saving, which could be applied to developing the weapon systems.

Overall, it seems reasonable to project a target of 12 AltD and 24 AltF to be constructed over the 1970s and 1980s for a similar cost to the actual procurements.

It should be noted that the versatility of the AltF in particular would have made them far more attractive on the export market than the specialised ships actually acquired. A stretched version of the AltF, to accommodate a radar and crew needed for Sea Dart plus more large VLS cells, could also have been very attractive to navies looking for an economical escort with some air defence capability, at a displacement of around 4,500 tons.

The *Invincible* Class carriers were bedevilled with political compromises in their development (being originally known as 'Through-Deck Cruisers' in an attempt to fool the Labour government, which was opposed to aircraft carriers). This led to them being planned with the unnecessary armament of Sea Dart and Exocet (although the latter was not fitted). They would have been far better served by a Sea Wolf installation instead, with the emphasis given to increasing their hangar capacity.

Implications: the Falklands War

Assuming that the proposed ships could have been built at a rate of one AltD and two AltF per year over a period of 12 years, with the first ones commissioning in 1975, then 7 AltD and 14 AltF would have been in service, fully worked-up, at the time of the 1982 Falklands War. Every one of them would have had Sea Wolf, backed up by 30 mm guns, which would have made them vastly more effective in the savage battles with

Argentinian aircraft around San Carlos Water. Each one would also have had an MCG for shore bombardment. Equipping *Invincible* with Sea Wolf would have reduced the risk to the carrier, possibly enabling her to operate closer to the battle zone to the benefit of Sea Harrier availability. Of course, a great benefit would also have resulted from the earlier introduction of the Sea King Searchwater AEW helos, developed in a rush just too late for the Falklands.

Implications: the Next Generation

Assuming that all of the above changes had taken place, what would have happened next?

Historically, the only entirely new class of escort warships to enter RN service between the end of the Falklands War in 1982 and 2008 was the Type 23 Duke Class 3,500-ton ASW frigates which appeared between 1989 and 2001.

The final batches of Type 22 frigates (*Cornwall* Class) and Type 42 destroyers (*Manchester* Class) were enlarged and improved in various ways as already mentioned, the last of them being completed in 1985 (T42) and 1989 (T22).

By 1989, there were twelve T42 and fourteen T22 in service, a total of 26 modern first-rate escorts. There were also six T21 *Amazon* Class and seventeen *Leander* Class still in service, giving a total of 49 escorts.

By 1999 all of the *Leanders* and *Amazons* had gone as had the first batch of T22, leaving ten of them in service. All of the dozen T42s had survived. To these were added thirteen T23 ASW frigates at an average build rate of just over one per year (with three more still to be delivered), meaning that the number of escorts had dropped from 49 to 35.

Only five years later, the RN was shrinking rapidly. Defence cuts announced in 2004 saw the number of T42 reduced to eight, the T22 to just four, and the T23 to thirteen, giving a total of 25 escorts.

The number of escorts has since dropped to 19 with the disappearance of all of the T42 and T22 but the arrival, between 2008 and 2013, of six Type 45 *Daring* Class 7,000+ ton AAW destroyers. The thirteen T23 (eight specially equipped for ASW with Variable Depth Sonar, the other five in a general-purpose role) are scheduled to remain for many years in suitably modernised form, most notably with Sea Ceptor and the Artisan radar. The ASW T23 will eventually be replaced by the Type 26 (still at the design stage) with the five GP T23 being replaced by the proposed new "lighter frigate" – of which a larger number might be built, although this is so far into the future that such political intentions are meaningless.

What would be different?

Under the alternative proposals described in the first part of this article (one AltD and two AltF being completed every year), the last of the thirty-six ships would have entered service in 1986. In that year there were historically still 57 escorts in RN service including 26 of the *Leander* / *Rothesay* Classes although they were beginning to disappear. To keep up the numbers, 21 of the unmodified *Leanders* would therefore still need to be in use.

So what new ships should enter service from 1986 onwards?

It is clear that the RN was primarily concerned with improving its ASW capabilities, since they chose to build the Type 23 to replace the Leanders and ultimately the T22. That is therefore taken as a given for a new alternative frigate (AltF2). There seems to be no reason to change the weapon systems from those of AltF, in fact they could be carried over to AltF2. The obvious area for improvement would be the propulsion system, as the RN has clearly regarded it as important for its ASW ships to have electric propulsion for use at very low speeds. So a new hull for the AltF2, somewhat bigger to accommodate a VDS and accommodation improvements, with the T23's CODLAG powerplant (which means that the Spey GTs can be retained). Displacement would be around 4,500 tons, reflecting the growth which actually occurred with T23 (deep load increasing from 4,200 to 4,900 tons). Despite the larger size, the cost should be less than T23 because the existing weapons could be carried over.

The AAW AltD2 which would ideally be scheduled to enter service from about 1999 to replace the AltD may need no more than a slightly bigger hull to allow for displacement growth, plus a new radar and FCS to boost the performance of Sea Dart. This should be much cheaper than the T45.

Sea Ceptor would replace Sea Wolf as it is now doing.

In all, the reduced cost and earlier production of AltF2 and AltD2 might have enabled more of them to enter service; ideally, eight AltD2 and sixteen AltF2 for a total of 24 escorts.

Meanwhile…

This article focuses on the RN's escorts, but what about the rest of the fleet?

There's no point in separating discussion of the carriers from the planes which would be using them, so I'll start with those. At about the time that discussions over what became the Eurofighter Typhoon were getting going in the early 1980s, the Harrier design team were working on their ultimate STOVL combat plane: the BAe P.1216. This was a very promising design with an estimated performance in the same league as that of the F-35B, only without the stealth. Had the UK chosen to develop this project instead of the Eurofighter, it was believed at the time that it could have entered service in around 1997.

The P.1216 could have replaced the Harrier and the Jaguar (and would very probably have attracted a major order from the USMC), and kept the RN's carrier air power in the front rank.

So, what of the ships to carry the P.1216? I would prefer to have seen a substantial increase in size over the *Invincibles* but nothing like as gargantuan as the QE and PoW; probably somewhere in the 30-40,000 ton range. I would also have wanted the carriers to be backed up by multipurpose amphibious warfare ships similar to the Spanish *Juan Carlos I* (also selected by Australia) in place of the vessels actually acquired. These would be fitted with ski-jumps so that they could provide an alternative deck for STOVL operations in an emergency.

Ideally, I would like to see three carriers and three such multipurpose ships acquired (one of each abroad, another pair home-ported for training and exercises, and the third pair in maintenance/refit/reserve). That would enable two carriers and two multipurpose ships to be deployed in a relatively short time if required, avoiding the "all eggs in one basket" risk of having just one STOVL-capable ship available.

With all of this, the UK could have maintained a well-balanced and capable navy throughout. Assuming that the politicians had allowed it, of course…
