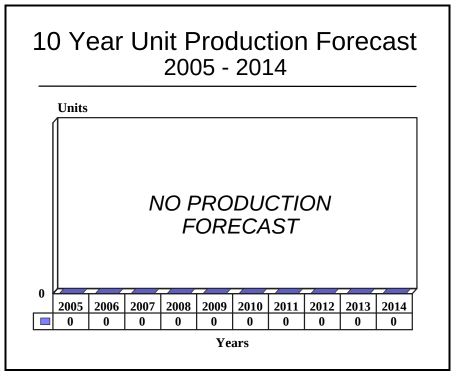
Future Surface Combatant - Archived 10/2006



Outlook

- Program canceled November 2004
- Requirement now split into two classes
- Medium-Sized Vessel Derivative likely to be based on Type 45
- Buying into Franco-Italian FREMM a possibility
- Far-Future Versatile Surface Combatant still undefined

Orientation

Description. The FSC, was conceived as a versatile and affordable maritime platform that could be deployed across the spectrum of defense missions, ranging from peace support to high-intensity warfare.

Sponsor

Peer Group F(1)
Defence Procurement Agency
Maple 1c #2120MoD Abbey Wood
Bristol BS34 8JH
United Kingdom
Fax: + 44 0 1179 130902

Licensee. No production licenses were granted.

Status. Program canceled.

Total Produced. Originally, up to 20 ships were projected.

Pennant List

Number & Name	Builder	Launch Date	Commission Date

No nomenclature or construction details are yet available.

Mission. FSC will enable the Royal Navy (RN) to exert influence and project power when operating independently, but will also be capable of joint and combined operations with national and international forces. Particular emphasis is being placed on the FSC's ability to contribute to joint operations with the Army and RAF. The new ship is therefore being designed for the projection of force to ground and for "in-depth strikes" against enemy territory using land attack missiles and a gun firing extended-range munitions.

Price Range. No price estimate had ever been formulated.

Contractors

Prime

BAE Systems - Naval Ships	http://www.baesystems.com, 1048 Govan Rd, Glasgow, GS1 4XP United Kingdom, Tel: + 44 141 445 8000, Fax: + 44 141 445 4455, Prime
Vosper Thornycroft (UK) Ltd	223 Southampton Road, Paulsgrove, Portsmouth, PO6 4QA Hants, United Kingdom, Prime

Technical Data

No technical data were defined.

Design Features. As originally conceived, the FSC design was intended to use a new, full-electric propulsion system that is also being developed for the CVF. Integrated Full Electric Propulsion (IFEP) provides a highly reliable layered propulsion solution that offers much efficiency across the speed range. Two WR21 gas turbine alternator (GTA) sets are employed singly (for an economical cruise speed of about 20 kt) or in combination (for a maximum speed of about 25 kt) to drive two 20 MW transverse-flux Permanent Magnet Motors (PMMs), which in turn drive waterjets or controllable pitch propellers. A smaller gas turbine alternator is available for low-speed operations, while a 1 MW generator provides emergency capacity and harbor requirements. Battery units enable the minimum safety load to be maintained in the event of total generator failure, as required by IMO regulations.

One of the design options envisioned a trimaran hull which, due to the reduced hull drag, would allow a top speed of about 35 knots, compared with the 29 knots of a monohull Type 45 destroyer of similar displacement and machinery output. However, a lower speed of 28-30 knots would have been acceptable in order to realize savings in costs, powerplant size, and fuel economy.

To reduce lifetime operating costs, the RN wanted to reduce the FSC crew size significantly from that required on existing frigates. The objective crew complement was about 100, excluding ship's flight. Any smaller, and the complex and sophisticated automation required would probably negate the marginal potential savings; also, there is a certain minimum crew size required in some circumstances, e.g., for effective damage control. In line with the practice being adopted for all new RN warships, considerable excess austere accommodation was to have been provided. For example, FSC would probably have embarked a platoon of Royal Marines with all their equipment and supplies.

Originally a hull displacement of 5,000-6,000 tons was expected for FSC, but this crept steadily upwards, and concept studies have apparently considered displacements as high as 14,000 tons. This continuous size growth may well have been a deciding factor in the decision to terminate the program.

Operational Characteristics. The original specification demanded a mission duration of 45 days. From historical data, it was estimated that the FSC would spend 22 percent of its time in refit, 41 percent at sea, 14 percent in maintenance, and 23 percent in other activities.

The armament of the FSC remained very uncertain right up to project termination. The favored armament mix would have included weapons suitable for air, surface, land attack and anti-submarine warfare. Again, this multiplicity of roles and the vagueness of the operational rationale for the FSC probably contributed in no small part to its eventual cancellation. All published artists' impressions of FSC showed an extremely large flight deck with a double hangar able to accommodate at least two helicopters or other aircraft.

Variants/Upgrades

Trimaran Hull. One design option for the FSC was a revolutionary trimaran hull concept with a slender main hull and two outriggers. This design has numerous theoretical advantages over conventional monohulls:

- Reduced hull resistance at higher speeds, resulting in typically 18-20 percent less installed power for an escort-sized vessel required to achieve 28 knots.
- A wide range of propulsion options.
- Greater fuel economy.
- Improved stability and reduced motion.
- Increased directional stability.
- Greater top weight growth margins. There are significant additional stability benefits in the area of growth margins that will allow equipment upgrades during the life of the ship to be easily accommodated.
- Increased deck area (up to 40 percent) on one and two decks for a given tonnage, offering more space for hangars, helicopter operation, and weapons. Some of the greatest advantages for the trimaran stem from the improved effectiveness of the ship design afforded by this very large deck area.
- Improved sea-keeping performance at higher speeds, enabling operation in higher sea states.
- Increased stealth potential for reductions in radar cross-section and infrared signatures. A reduction in heat signature could be gained by arranging the machinery spaces to exhaust between the side hulls rather than by way of conventional superstructure ducting.
- The side hulls can be utilized for configuring a multiline towed array sonar.

The Ministry of Defence has been sponsoring research into triple-hulled ships since the late 1980s. Work by QinetiQ (formerly DERA), UCL, and Vosper Thornycroft has now confirmed that a trimaran hull form does indeed reduce drag by about 20 percent at high speeds compared to a single hull. The lower resistance will permit either higher speeds to be achieved, or a reduced machinery fit leading to lower through-life costs.

Increases in size and, to some degree, location of the superstructure can be easily accommodated without affecting the ship's stability. This is because of the decoupling of the main hull beam from the required stability. The required stability can be obtained by adjusting the size and distance from the main hull to the side hulls with little impact on drag and weight. This adjustment will allow heavy equipment such as large radars to be fitted more easily than could be achieved with a monohull.

The outriggers make the ship more stable and give it a larger flight deck, which can be moved away from the stern and nearer amidships, allowing helicopters to operate under a wider range of sea conditions. It is possible that the wide upper deck will lead to the provision of a second hangar, which could be used for other service helicopters, such as the Apache, for land attack, support, or relief operations. Optional side-hull propulsion in the outriggers makes the ship more maneuverable. And if the ship does take a hit, the outriggers protect the inner hull, where the main powerplant is contained. Survivability in general from weapons strikes will potentially be greatly improved.

However, the trimaran approach does also have several possible disadvantages when compared with a monohull approach for FSC:

- The very long and wide hull will make a trimaran FSC too large to fit into existing escort refit drydocks, necessitating expensive redevelopment of these facilities.
- Worldwide, there is no experience with designing, building, and operating large steel trimaran ships (other than the small RV *Triton*).
- Increased and unusual structural stresses may present significant design challenges and technical risks.
- Higher construction costs might be entailed.
- The design could result in reduced stealth, and could actually lead to increases in radar, noise, and wake signatures.
- Reduced internal hull volume for a given tonnage might result, meaning less room for accommodation, VLS cells, fuel and stores, etc.
- Instability could occur if an outrigger is lost or flooded.

These disadvantages, when combined with the risks and doubts inherent with any major revolution in naval design, may yet prove too severe, and a monohull form may be adopted for FSC.

Monohull Designs. BAE Systems preferred a monohull design for FSC, although this may be partly influenced by the advocacy of the trimaran concept by its bitter rival, Vosper Thornycroft.

It has been suggested that the large Type 45 hull design could form a suitable basis for the FSC, with its role changed from an emphasis on air defense to emphasis on land attack, ASuW, and ASW. There would be obvious benefits in terms of ship commonality, reduced design and support costs, and personnel training. It may well prove relatively easy to produce an FSC design based on a modified Type 45 hull, the major changes likely being:

- Replacement of the PAAMS (Principal Anti-Air Missile System) and ASTER 15/30 area air defense system with the SAAM (Surface-to-Air Anti-Missile) and ASTER 15 system intended for local air defense only;
- Replacement of the advanced but expensive BAE Systems Sampson multifunction radar with a less capable radar that is still compatible with SAAM. This could either be new or extant – e.g., the French Arabel radar;
- Replacement of DCN Sylver A50 VLS cells with Lockheed Martin VLS-41 cells loaded with Tomahawk land attack cruise missiles;
- Addition of a revised fantail and stern for operating the Thales Underwater Systems Type 2087 variable-depth sonar;
- Integration of the capability to operate the Merlin anti-submarine helicopter;
- Installation of a revised engineering plant incorporating IFEP and reduced low-speed noise emission;
- Implementation of so-called smart ship measures to substantially reduce crew size; and
- Implementation of measures to reduce through-life costs compared with the Type 45.

Artist's Impression of Future Surface Combatant – Trimaran Version

Source: Royal Navy

Program Review

Background. Although the first unit was not expected to enter service until 2012, work began on a Future Escort (FE) in 1994. It was first envisioned as a general-purpose frigate, specializing in anti-submarine warfare. At that time, up to 20 units were planned to replace the 16 Type 23 and four Type 22 Batch 3 frigates. However, since then, and in light of the Strategic Defence Review (SDR), the emphasis has been changed to reflect rapid reaction and global intervention requirements, as embodied in the Future Surface Combatant (FSC).

The FSC program quickly became linked with another new development, the trimaran warship hull form. The initial work on trimaran warships was carried out at the University College in London, where the U.K. Ministry of Defence sponsors a department that studies warship design. In the early 1990s, students were given the task of designing various trimaran warships. The results of this work were so encouraging that the Royal Navy sponsors decided to fund research at the Defence Evaluation Research Agency (DERA) to confirm the advantages promised by the hull form and also to identify any constraints that might be imposed as the result of its use. This work, which started in 1994, initially concentrated on the hydrodynamic aspects of the hull design, and was carried out by running small-scale models of typically eight meters' length in the tanks at DERA Haslar. The research was successful, and the key parameters of main hull length to beam ratios, side hull length, and position, together with the lines, were identified. As this was progressing, computer design tools were developed which predicted the resistance, propulsion, sea-keeping, and maneuvering characteristics of the trimaran warship. Once the hydrodynamic design was established, DERA, together with the U.K. MoD Procurement Executive, investigated the structural design requirements. Specifically, load prediction computer codes were developed in a series of numerical models that have been used to calculate the plate thickness, frame spacing, and stresses that will be imposed on the ship by the onerous requirement to operate warships in the most strenuous of sea conditions. In the final area of research, which covered survivability, scale-model experiments and computer-based numerical models were used to investigate any peculiarities of using a long, slender hull form.

On July 28, 1998, DERA placed an order with Southampton-based shipbuilder Vosper Thornycroft to build a two-thirds-scale trimaran demonstrator. Assembly of the modules for the RV *Triton* was started at the Woolston yard of Vosper Thornycroft in January 2000. She was launched on May 6, 2000, and was accepted by DERA on August 31, 2000.

RV *Triton* is 98.7 meters long, and has a beam of 22.5 meters, a draft of 3.4 meters, and a trials displacement of 1,200 tonnes. She is powered by a diesel-electric propulsion plant, two Paxman 12 VP185 main generators each of 2,085 kW 4 MW power, and an HMA 3.5 MW AC electric motor driving a fixed-pitch propeller on a single centerline shaft for a maximum speed of 20 knots and a range of 3,000 nautical miles. Built of steel, *Triton* is classified to commercial standards with det Norske Veritas (DNV) approval, and meets the requirements of the U.K. Maritime and Coastguard Agency. Construction features include a comprehensive ballast system to allow for different operating conditions, provision for containerized trials outfits on the flight deck, and the capability to embark a Lynx-size helicopter or an unmanned air vehicle. Two laboratories are sited in the main superstructure, one housing the Trials Instrumentation System (TIS) and the other for general trials use. Accommodation is provided on board for 12 crew plus 12 scientific personnel.

Under a joint Memorandum of Understanding signed in 1997, the U.S. Naval Sea Systems Command (NAVSEA) is partly funding *Triton's* Phase 1 trials. NAVSEA also supplied the TIS, which was fitted under an intergovernmental agreement. The TIS records over 300 channels covering a wide range of data, such as machinery control, ship motion, steering gear, navigation, and the environment, from structural instruments and other sources. RV *Triton* undertook a series of tests and trials to evaluate the performance and suitability of a trimaran design. The trials program is intended to assess and confirm the ship's general handling performance, architectural and structural performance, and sea-keeping behavior. It is also intended to address issues such as docking and Replenishment at Sea (RAS).

Pilot vessels at HMNB Portsmouth were used to put *Triton* in a number of different berths around the dockyard in order to better ascertain the characteristics and potential problems of docking a large trimaran; no problems were found. She also undertook simulated RAS evolutions in the Devonport training areas with the Type 23 frigate HMS *Argyll* and with RFA *Brambleleaf* in order to ascertain any pressure wave effects encountered between a trimaran and a monohull performing this evolution. All evolutions were conducted in a standard manner a number of times, and no problems were encountered or anomalies detected.

A notable breakthrough was achieved in September 2001 when, during RV *Triton*'s helicopter trials, a Royal Navy Lynx Mk 8 successfully carried out a series of landings and takeoffs from the deck of the research vessel. This was the latest success in RV *Triton*'s trials program and the first time ever that a helicopter had landed on a trimaran. The success marked a significant stage in the development of the trimaran concept.

The initial concept investigation phase ended in August 1999. Although FSC was a U.K.-only project, the French Navy had a similar concept and was keen that the U.K. merge its requirement for 20 FSCs with its plan to design and construct 17 new multimission frigates (FMM – Frégates Multi-Missions) expected to enter service after 2010. In March 2000, the French General Delegate for Armament, Jean-Yves Helmer, discussed with his British counterpart at the MoD the possibility of cooperation between the two navies' projects – starting with a definition of the requirements, performance, and characteristics of a common new generation of general-purpose frigates that could enter French service around 2010.

After the U.K.'s disastrous experience with Project Horizon (CNGF), this proposal raised considerable alarm within many quarters of the RN. The prospect of another overly expensive and poorly managed project that might fail to meet the RN's needs was greeted with much skepticism. However, the French were unhappy with the RN's apparent preference for a trimaran hull design, considering this approach to be too risky, too expensive, and unlikely to meet their more urgent timescales. However, there would still be collaboration in specific areas; for example, the French are participating in the RN's development of new electric propulsion systems.

Under the plans laid down in July 2000, Initial Main Gate approval for the project was expected in late 2002, a prime contractor would be selected to build the first-of-class in 2007, and this unit would enter service in late 2013 (a year later than previously planned). The FSC project fell further behind in October 2001 when it was announced that work was being undertaken by the U.K. Ministry of Defence's Director, Equipment Capability (Above Water Battlespace) to examine options for an Interim Capability Frigate (ICF) to bridge the gap between the current out-of-service date of the Royal Navy's Type 23 frigates (which have only an 18-year service life, so the first is due to pay off about 2010) and the introduction of the projected Future Surface Combatant in 2013. A Type 23 Service Life Extension Program (SLEP) was the favored option, but this was just one of a range of alternatives for the ICF. Others included buying or leasing foreign warships, making new-build frigates, and advancing the FSC program. The ICF requirement was quietly dropped in 2003.

At that time, the FSC Initial Gate was pushed back two years (as part of the Equipment Plan 2002 work - EP02) until spring 2004 and Main Gate to late 2008; consequently, the in-service date of the first unit has slipped to 2015 or later. Also, the number of units planned was reduced from 20 to 18. The less demanding timescale allowed the DPA's dedicated FSC Integrated Project Team (IPT) to be withdrawn temporarily, and the residual concept phase activities reallocated to the Future Business Group.

In March 2003 BMT Defence Services Ltd was awarded a "quick-look" study contract by the U.K. MoD to explore the fundamental feasibility of "mother/daughter" ship concepts as a potential solution for the Royal Navy's projected Future Surface Combatant capability requirement. The team considered the potential of small, flexible and stealthy surface and subsurface craft optimized for littoral warfare. These would be deployed from oceangoing motherships. The study aimed to develop a mix of outline concept designs for motherships and deployable assets. As a result of this effort, the mother/daughter ship concept was found to be unworkable on a number of levels and was dropped.

In early 2003, the size, shape, and variety of ships required to deliver the FSC capability were still uncertain and were intended to be derived from a series of Assessment Phase studies. Three options were under study: a 9,000 tonne trimaran, a Type 45 derivative, and a family of warships. In September 2003, the Defense Procurement Agency re-formed the Future Surface Combatant Integrated Project Team (FSC-IPT) with the objective of preparing the program for an initial Main Gate in 2005 and a subsequent four-year assessment phase. The first ships would then enter service in 2015. The frame of reference given to the FSC-IPT was a 9,500 ton ship equipped with a single 127mm or 155mm gun, multiple vertical launch silos, and a large flight deck/helicopter hangar complex. These parameters were provided merely as guidelines, however, and were subject to change as required by ongoing development.

In November 2004, the MoD quietly canceled the FSC project as it had been envisioned up to that point, issuing a statement that it had decided not to proceed with the FSC as originally planned, and was instead developing ideas for a possible two-class solution to the requirement for a multipurpose warship. Official cancellation of the FSC project was avoided by the continuing use (for a while anyway) of the term FSC as the "umbrella" title for the low-key studies on developments of the Type 45 Daring design to meet some of the FSC objectives.

On February 24, 2005, the Minister of State for the Armed Forces, Adam Ingram, issued a statement that "The Future Surface Combatant (FSC) program has not been canceled. Some of the assumptions associated with this project, which is still at the concept stage, have changed as a result of the MoD's recent planning rounds. As a result, it was decided to disband the FSC Integrated Project Team and transfer the program to the DPA Future Business Group."

He repeated this claim on March 7 in a statement that explained: "The Future Surface Combatant project is still in its concept phase. Studies continue to develop ideas for the platform solution and no decisions have been taken. Our current assumption for planning purposes is that the Future Surface Combatant requirement will be delivered by a two-class solution. The principal element, now known as the Versatile Surface Combatant, is expected to enter service around 2023, and a 'military off-the-shelf' variant known as the Medium-Sized Vessel Derivative is expected to enter service between 2016 and 2019."

The MSDV is essentially a general-purpose derivative of the Type 45 Daring class destroyer.

Funding

The original plan was to minimize the development costs of the FSC by ensuring the Integrated Project Team (IPT) included Smart Procurement concepts in their planning. The Smart Procurement initiative focused on how equipment could be delivered more quickly and cheaply to achieve time and cost targets. The team drew upon many lessons from commercial industry, and identified a sharper focus for determining lifetime ownership costs of equipment. Many of the FSC's systems would have been procured commercially off-the-shelf and would maximize commonality of equipment with other platforms such as the Type 45, the Future Attack Submarine, and the Future Carrier CV(F). These common features were intended to include the Combat Management System and the main propulsion systems.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Vosper Thornycroft	21.5	Jul 28, 1998 – Contract to build RV *Triton*, seagoing testbed for the trimaran hull form.
Alstom	9.5	Dec 15, 2001 – Contract to extend the Anglo-French Electric Ship Technology Demonstrator (ESTD) to provide a range of electrical supplies and loads.

Timetable

Month	Year	Major Development
	1994	Requirement for Future Escort formulated
Aug	1996	Vosper Thornycroft takes part in enabling study on trimaran warships
Jul	1998	Contract placed for trimaran demonstrator
Oct	1998	Future Escort Requirement recast as Future Surface Combatant
Feb	1999	First steel cut on trimaran demonstrator RV *Triton*
May	1999	Common hull for Type 45 and FSC explored
Dec	1999	Studies on Integrated Full Electric Propulsion initiated
Jan	2000	RV *Triton* laid down
May	2000	RV *Triton* launched
July	2000	Sea trials of RV *Triton* initiated
Sep	2003	Integrated Project Team restarted
Nov	2004	Program terminated

Worldwide Distribution

U.K. Up to 20 ships of this class (replacing 16 Type 23 and four Type 22 frigates) were originally planned

Forecast Rationale

It now very much appears that the stop-go progress on the Future Surface Combatant has finally stopped. The FSC program had already been placed in some doubt by the British defense review of July 2004. This struck the Royal Navy particularly hard, with the frigate/destroyer fleet being reduced to 25 ships. The order for Type 45 destroyers is being reduced to eight, leaving the balance of the fleet at 13 Type 23 frigates (three of the original 16 being withdrawn from service far earlier than planned) and four Type 22 frigates.

When *de-facto* canceled in November 2004, the FSC project had become so broad in scope that it had ceased to be a warship design project and had morphed into an evaluation of radical and innovative solutions such as very large trimaran "cruisers." The potential risks and costs of developing some of the cutting-edge ideas into a viable combat platform caused concern and ultimately the project became perceived as unrealistic. In short, the program had lost its way and was eventually so ill-defined and vague that its continued funding could not be justified.

While, officially, the FSC remains alive, it does so only as a convenient umbrella under which the original program can be wound up and a new project launched that will either be built on the Type 45 Daring class destroyer or, in the alternative, the Franco-Italian FREMM class ships or the U.S. Navy's Littoral Combat Ships. This does not disguise the fact that the FSC as a warship design and construction program died in November 2004.

Ten-Year Outlook

Since this program has been canceled, the forecast chart has been removed.

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