# Skjold Class

## Outlook

- All six ships now delivered
- No additional domestic requirement
- Cost and specialized design make exports extremely unlikely
- No future production forecast

## Orientation

**Description.** Missile-armed fast attack craft (FAC-M), with a surface effect ship (SES) hull. Gas turbines are main propulsion power.

**Sponsor.** Royal Norwegian Navy through the Norwegian Ministry of Defense. The project is managed by NATO's Navy Materiel Command Norway (NAVMATCOMNOR).

**Status.** Six ships complete. Construction has ceased.

**Total Produced.** Class total is six craft.

**Pennant List**

| Number & Name | Builder | Launch Date | Commission Date |
|---|---|---|---|
| P-960 *Skjold* | Kværner Mandal, Gismerøya SY | 9/1998 | 4/19/1999 |
| P-961 *Storm* | Umoe Mandal, Gismerøya SY | 2007 | 9/10/2010 |
| P-962 *Skudd* | Umoe Mandal, Gismerøya SY | 2007 | 10/28/2010 |
| P-963 *Steil* | Umoe Mandal, Gismerøya SY | 2007 | 6/30/2011 |
| P-964 *Glimt* | Umoe Mandal, Gismerøya SY | 2008 | 3/29/2012 |
| P-965 *Gnist* | Umoe Mandal, Gismerøya SY | 2008 | 11/8/2012 |

**Mission.** The primary mission of the patrol boats was to police and control territorial waters and the country's exclusive economic zone (EEZ). Peacetime tasks were to include surveillance, patrol, search-and-rescue, and anti-smuggling operations, and the monitoring of commercial traffic and marine pollution.

In crisis situations, those tasks were to be augmented by area control, which includes boarding ships when necessary, as well as intelligence, patrol, and covert operations. Other missions in crisis times were to include anti-invasion operations in concert with the Air Force and the Army; anti-surface vessel warfare as part of a surface action group; and escort, convoy, and anti-shipping operations as part of a larger group.

**Price Range.** The contract issued in 1996 for the first unit had a value of $36.7 million. This was almost certainly a bare hull cost, since the command system alone is valued at $20+ million. The construction contract proposed in July 2003 gave a unit cost of $125 million, with an additional $35 million for armament, for a total of $160 million.

Skjold Class

# Contractors

## Prime

| | |
|---|---|
| **Aker Solutions ASA** | http://www.akersolutions.com, Snarøyveien 36, PO Box 169, Lysaker, Fornebu, 1364 Norway, Tel: + 47 67 51 30 00, Fax: + 47 67 51 30 10, Prime |
| **Kongsberg Defence & Aerospace AS** | http://www.kongsberg.com/en/kds/, Kirkegårdsveien 45, PO Box 1003, Kongsberg, 3601 Norway, Tel: + 47 32 28 82 00, Fax: + 47 32 28 86 20, Email: kda.office@kongsberg.com, Consortium Member |
| **Umoe Mandal** | http://www.umoe.no, Service-Boks 902, Mandal, 4509 Norway, Tel: + 47 3827 9200, Fax: + 47 3826 0388, Consortium Member |

## Subcontractor

| | |
|---|---|
| **DCNS Naval Facilities** | http://www.dcnsgroup.com, PO Box 30, Ruelle, 16600 France, Tel: + 33 5 45 24 30 00, Fax: + 33 5 45 24 33 33, Email: dcn-equipements-navals@dcn.fr (Senit) |
| **Kongsberg Defence & Aerospace AS** | http://www.kongsberg.com/en/kds/, Kirkegårdsveien 45, PO Box 1003, Kongsberg, 3601 Norway, Tel: + 47 32 28 82 00, Fax: + 47 32 28 86 20, Email: kda.office@kongsberg.com (Command and Control Software Components) |
| **Oto Melara SpA** | http://www.otomelara.it, Via Valdilocchi 15, La Spezia, 19136 Italy, Tel: + 39 0187 5811 11, Fax: + 39 0187 58266, Email: press-office@otomelara.it (76mm L62 Super Rapid) |
| **Pratt & Whitney** | http://www.pratt-whitney.com, 400 Main St, East Hartford, CT 06108 United States, Tel: + 1 (860) 565-4321, Email: info@pw.utc.com (ST-40) |
| **Thales Air Systems SA** | http://www.thalesgroup.com, 7/9 Rue des Mathurins, Bagneux, 92221 France, Tel: + 33 1 40 84 40 00, Fax: + 33 1 40 84 33 81, Email: info.tad@fr.thalesgroup.com (Mistral) |
| **Thales Optronique SA** | http://www.thalesgroup.com/Markets/Defence/Home/, 2, avenue Gay-Lussac, Centre Guynemer, Guyancourt, 78995 France, Tel: + 33 1 30 96 70 00, Fax: + 33 1 30 96 75 50, Email: tosa.customerservices@fr.thalesgroup.com (Mirabel Thermal Imager) |

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

# Technical Data

| | Metric | U.S. |
|---|---|---|
| **Dimensions** | | |
| Length (overall) | 46.9 m | 153.5 ft |
| Beam (overall) | 13.5 m | 44.3 ft |
| Maximum Height (on cushion) | 15.0 m | 49.0 ft |
| Draft (at rest) | 2.3 m | 7.5 ft |
| Draft (on cushion) | 0.8 m | 2.6 ft |
| **Displacement** | | |
| Full Load | 260 tonnes | |
| **Performance** | | |
| Speed (at Sea State 4) | 85 kmph | 45 kt |
| Top Speed | 105 kmph | 57 kt |
| Range | 1,480 km at 74 kmph | 800 nm at 40 kt |
| Crew | 15 | |

| | Type | Qty |
|---|---|---|
| **Armament** | | |
| Missiles | | |
| – SAM | Mistral | 1 launcher |
| – SSM | NSM (Nytt Sjømålsmissil) | 8 |
| Gun | 76mm Oto Melara Super Rapid | 1 |
| **Electronics** | | |
| Countermeasures | | |
| – Decoys | Buck MASS | 2x 32 |
| – ESM | EDO ES3701 | 1 |
| Combat Data Systems | DCN Senit 2000, Link 11/14 | 1 |
| Weapons Control | Sagem VIGX-20 optronic director | 1 |
| Radars – Air/Surface Search | Thales MRR | 1 |
| – Navigation | I-band | |
| – Fire Control | CelsiusTech Ceros 2000 (I/J) | 1 |
| **Machinery** | | |
| Main Propulsion Power (gas turbines) | Pratt & Whitney ST-40M | 2x 4 MW |
| Loitering (Maneuvering) Engines | Pratt & Whitney ST-18M | 2x 2 MW |
| Auxiliary Engines | MTU 6R 183 TE52 diesels | 2x 275 kW |
| Lift Fan Engines | MTU 12V TE92 diesels | 2x 735 kW |
| Propulsor Units | KaMeWa 80S2 waterjets | 2 |
| Generator | 440 V 60 Hz, 3 phase, 4 polar | 1x 228 kW |

**Design Features.** The hull is a surface effect ship (SES) design using rigid sidewalls to contain an air cushion generated by lift fans. Rubber finger-type seals in the bow and a bag seal in the stern prevent the air cushion from leaking. An air pressure equivalent to the pressure released by a column of approximately 0.5 meters of water is maintained and controlled in the central tunnel by a proprietary Ride Control System.

All structures are made of a fiberglass sandwich using uniaxial fiberglass and carbon-fiber laminates in combination with vinylester or polyester resin. Polyvinyl chloride (PVC) core material is used in the primary structural elements under the main deck. PMI core material is used in other sections and in the entire superstructure. Extensive calculations and modeling were carried out to test the viability of the structure. The materials for the hull were selected following detailed assessment of the mechanical properties of each material. The use of a sandwich structure simplified construction and allowed for a structural design without using secondary stiffeners.

Carbon fiber is used extensively in structures requiring high stiffness, such as the beams, the mast, and the supporting structures for the gun and the EO/radar director. Many of the internal structural elements were manufactured using the SCRIMP process (a vacuum-assisted resin injection method that also reduces styrene emissions) to reduce the structural weight and to improve the laminate properties. In this process, the polyester itself is applied under pressure, in controllable amounts, over the pre-laid fiber mats. This process results in little variation in the pressure, weight, and quality of the panels, which are easy to assemble.

The design of the Skjold places high priority on reducing the infrared and optical signature. For the first time, radar-absorbing materials (RAM) are included in the load-bearing structure of a vessel in large areas. This SRAM (structural RAM) method significantly reduces weight in comparison to external RAM coatings. The Defence Evaluation and Research Agency (DERA) of the U.K. carried out a study on the application of SRAM early on in the program.

The ship has few reflective panels and no 90-degree angles on its exterior, hence the appearance of large flat and angled surfaces. The sides of the hull and the superstructure have all been inclined at a small angle to reduce radar cross-section. In order to eliminate aberrations in the signature properties, all exterior doors and hatches are flush-mounted and have the same radar absorbing/reflecting characteristics as the adjacent panels.

Visual signature is reduced by the use of a special paint that has high absorption properties. A camouflage pattern that is optimized for typical Norwegian coastal waters is used. Windscreens are covered with mesh panels made from radar anti-reflective material and are flush with the surface. Air intakes to the gas turbines and lift fans are covered with a radar-absorbing mesh.

Two gas turbines (one inside each sidewall) supply the main propulsion power. On the initial preproduction boat, they are Rolls-Royce KF 571s coupled to Allen

gearboxes custom-built for this particular application. The five production craft will be fitted with a COGAG (combined gas turbine and gas turbine) arrangement of four gas turbines: two Pratt & Whitney ST-18Ms and two P&W ST-40Ms. The prototype will be refitted to this standard. Waterjets will remain the chosen propulsion method on the production boats.

The bridge is based on a proven design used on a number of civilian fast ferries. It includes high-back seats for the officers, surrounded by a number of large display screens. Much of the steering is by means of a joystick, in lieu of a traditional wheel. The bridge features full ECDIS (Electronic Chart Display and Information System) navigation systems and radars, all fully compliant with NATO standards and specifications. Built around the Senit combat management system (CMS) consisting of six consoles with flat-panel multifunction screens, the hardware is based on HP's RISC processors and is the same as that used on the French *Charles de Gaulle* aircraft carrier. The systems on board the Skjold and Hauk class are being made fully compatible with each other, under joint development by Kongsberg and France's DCN International. The systems have been developed jointly by DCNI and Norway's Kværner Ship Automation and use many components from civilian applications, helping keep costs down.

The weaponry on board will include an Oto Melara 76mm L62 gun and eight of the new NSM anti-ship missiles under development at Kongsberg. No weaponry was installed on the prototype boat other than a 76mm L62 Oto Melara gun fitted briefly for exhibition purposes in mid-1999 but demounted soon after. The main gun can be operated from under the deck. The missiles on the production versions will be placed in appropriate launchers behind the superstructure.

Extensive tests have been carried out using appropriate hull sections and Advanced Medium-Range Air-to-Air Missiles (AMRAAMs) with launch tubes. These show that the composite hull will be able to withstand the blast and heat effects resulting from an accidental firing. The blast and heat effects from the missiles are routed through the sides of the hull. The elevation angle of the missiles in the canister has been selected to ensure that launches can be performed in all weather conditions and sea states. The position of the missiles was changed from the original concept on the foredeck to the rear of the vessel before construction. This resulted in the vessel being lengthened by about 2 meters. The redesign resulted in better weight distribution. Air defense will be provided by eight Mistrals, using a launcher that will be either housed permanently under the deck or elevated to the deck level for launches, aft of the superstructure.

All emissions of exhaust gases, bilge water, etc., are routed into the air cushion or through the stern in order to provide the lowest possible infrared/heat signature in most angles in relation to an enemy radar. Air intake for the engines is located behind the superstructure. Heated walking zones are installed on the upper deck to avoid ice buildup. All cleats, capstans, and ropes are accessible through hatches on the main deck or have been fitted with rails. The inflatables ("zodiacs") are accessed through a large hatch on the starboard side, and the rescue boats are likewise placed inside, behind hatches in the fore and aft sections of the ship. Emergency exits have been built throughout the vessel to ensure escape routes.

Engine control can be carried out from the bridge as well as from the main control room below-decks.

When operating at full speed, the waterjets pump 8.2 $m^3$ of water per second through each unit, for the forward motion of the ship.

**Operating Characteristics.** The SES hullform was chosen for this class because of the design's good sea-keeping qualities, stability in heavy seas, and high internal volume compared to monohull structure. Also, fuel consumption is lower as a result of the reduced water resistance. High sustained speeds can be maintained with comparatively low levels of installed power. The wetted surface of the sidehulls is much smaller than that of the catamaran design, thanks to the lifting effect of the air fans.

The lifting fans are located under the foredeck and suck the air into the central tunnel area. The skirt in the fore of the hull is held in place by the water and the tunnel's air pressure when the vessel moves forward. The aft skirt acts much like a bag, filled with air that is of higher pressure than that inside the central cushion.

The wave resistance of the SES hull is directly related to operating speed, with virtually no resistance present at high speeds, while at low speeds the wave resistance is comparable to that of a standard displacement or semi-displacement vessel. Thanks to the hull's ability to operate smoothly in rough seas, the crew is able to carry on its assigned tasks without degradation of performance in up to Sea State 5. Speeds of more than 45 knots reportedly can be maintained in waves up to 2 meters high.

Furthermore, the low draft of the SES offers an important advantage over other hull forms when operating in on-cushion mode. Having a draft of less than 1 meter is significant in shallow waters because it reduces the likelihood of grounding, as well as the

vessel's vulnerability overall, thanks to a smaller area being exposed to floating objects and their impact.

The twin hulls also have inherent advantages over monohull structure in survivability and redundancy. All systems on board the *Skjold* are built with operative redundancy in mind; for instance, the vessel can be operated in an emergency even with one engine room out of commission. The engines can both be monitored and operated from the engine room as well as the bridge.

On the bridge, one screen in the middle of the panel controls the ship's technical instruments and functions. Communications control is placed on the side near the windows. In cruise mode, the ship can also be operated on autopilot. Sound insulation on the bridge is very effective, and the impact of speed is not noticeable for the operators within. The engines operate at maximum speeds of 10,000 rpm, reaching top speeds of 53 knots under optimal conditions. An operating range of 700 nautical miles is reported at a speed of 40 knots.

According to NAVMATCOMNOR studies, an SES hullform also exhibits up to two-thirds reduced vulnerability to shock compared with conventional monohulls. This is considered a major advantage in the operational capability of these ships, which typically function in environments with significant exposure to mines.

During operations, the crew of the boat remains inside a nuclear-biological-chemical (NBC) cover that encompasses part of the ship, including the crew quarters, the operations room, and the bridge. The living quarters are much improved from the previous-generation fast patrol boats (FPBs) for the crew of 15 on board, providing the ship with an independent operational period of about two weeks at a time.

It is probable that the performance of the production version will be significantly inferior to that of the prototype. The production version will be much heavier, with a pronounced effect on speed, range, and seakeeping abilities. Previous experience with surface effect craft has shown them to be particularly susceptible to performance degradation when subjected to increased weight. This is ominous for the Skjold class and may explain why the design was rejected as a candidate for the U.S. Navy's Littoral Combat Ship. Also, as pointed out in this report, the Skjold's much-vaunted low radar cross-section is compromised by its large spray clouds and prominent wake. It appears that the Skjold may be hard to spot while it is stationary but any movement quickly reveals its position.

# Variants/Upgrades

**Njord.** A one-third scale model of an SES design was built by Kværner Mandal and launched in January 1993 for the development and testing of the SES concept. The hull was 40 feet long and built from single-skin fiberglass, as opposed to the heavier fiberglass foam sandwich used on the preproduction Skjold. The scale model reached 40-knot speeds in trials.

**P-960 Skjold.** The preproduction prototype is not equipped with the Senit combat management system intended for the rest of the class. Instead, it carries 46 tonnes of sand ballast to simulate the weight of the CMS, weapons, ammunition, and sensors.

A 76mm Italian Oto Melara Super Rapid gun was briefly installed on KNM *Skjold* instead of the Swedish Celsius 57mm Mk 3, which was widely believed to be the gun of choice. Incidentally, the Storm class attack craft, dating back to the 1960s, also have 76mm guns on their foredeck – albeit those made by Celsius. These guns were not considered for the new class since they were low-angle anti-surface weapons only and the Skjold design required a dual-purpose weapon.

The gun installed on the *Skjold* in 1999 had already been removed from the boat by the first week of October, following exhibition at the 1999 Defence Systems & Equipment International Exhibition and Conference in London in September 1999. The gun was reportedly shipped back to Italy.

Likewise, the preproduction model lacked the planned battery of the new NMS anti-ship missile. This missile will go on the new frigates being procured by the Norwegian Navy. The missile launchers are intended either to be located permanently in a structure behind the main tower under the weatherdeck or to be retractable, for launches from deck level.

The gas turbines on the preproduction unit are Rolls-Royce 571s as part of a CODAG (combined diesel and gas) arrangement. Ultimately, Pratt & Whitney engines in COGAG configurations were adopted.

While the total test period is expected to last up to 15 months, the first few months are admitted to be the most critical in evaluating whether the SES concept itself is worth reproducing in a larger series and if the class itself will be built. The remaining test period is expected to be used for fine-tuning the systems on board and operations in general.

## Skjold Class

**Project SMP 6081.** This was the name for the program to find a replacement for the Storm and Snøgg class fast attack craft and to update the Hauk class FPBs. This program involved the installation on these ships of the same Senit combat and control system that will be used on the Skjolds. The overriding idea was to bring the entire FAC/FPB fleet up to the same standard.

The project requirements of SMP 6081 included a stable weapons platform capable of operating in Sea State 3 at speeds up to 45 knots, and an operating range of 800 nautical miles at 40 knots. Furthermore, the program assumed an ability to operate outside coastal waters in a variety of scenarios, including operations among NATO members. Total funds available for this project were quoted as being roughly NOK3.2 billion in 1997. This amount was intended to include both the combat systems and the new hulls.

This program has now been abandoned, and the fast attack craft that were to have been modernized under it have been decommissioned and scrapped.

KNM *Skjold* Alongside a Cyclone Class PC (note the prominent wake)

Source: U.S. Navy

*Skjold* Showing Prominent Spray Clouds

Source: U.S. Navy

# Program Review

**Background.** Initial conceptual studies were carried out in 1990, with three different hull forms under consideration: conventional monohull, catamaran, and a surface effect ship (SES) configuration, which is essentially a catamaran with an air cushion in the middle. On July 1, 1995, initial Requests for Proposals were issued to three shipyards: Kværner Mandal and Mjellem & Karlsen of Norway, and Abeking & Rasmussen of Germany. On August 30, 1996, Kværner was awarded a NOK235 million ($36.7 million) contract for construction of a preproduction prototype, with an option for seven more.

## *Construction Approved*

Construction specifications were approved in July 1997. The "keel" was laid in August 1997 (the term refers to the modular structure consisting of large, prefabricated components), and assembly after this point proceeded relatively quickly. The lead ship was launched on September 22, 1998, and made its maiden voyage on January 22, 1999, when it operated on gas turbines for the first time, at different speeds, but made maneuvers using both gas turbines and diesel engines.

Throughout 1998 and 1999, the operational rationale for these craft was questioned, with a growing body of opinion suggesting that the class should be delayed until 2006 at the earliest.

## *An Unfamiliar Situation*

For those familiar with the European defense environment, late 1999 was marked by the unusual event of a Ministry of Defense trying to cancel – or at least severely delay – a major defense program while the national Parliament was trying to force said MoD to go ahead with that program. By March 2000 it appeared that Parliament was winning this battle when it issued a formal instruction to the Ministry of Defense to proceed immediately with construction of the seven remaining Skjold class ships. The only way this direct command could be financed was for the Norwegian MoD to forgo other programs it considered to be of equal or greater importance. One such candidate for cancellation was the planned Norwegian purchase of between 20 and 30 new fighter aircraft. The problem was that the one program considered completely indispensable, the Norwegian frigate, would consume most of the Navy's budget for the appropriate period, so the Skjold program could be financed only by raiding the budgets of the other services. This added a turf war to an already complex situation.

In May 2000, the Norwegian MoD announced that it was recommending abandoning the purchase of new fighter aircraft and delaying the Skjold program by another year. By July 2000, the program had been modified to the status of "indefinitely delayed." This was more political window-dressing than a real change, since "indefinitely delayed" and "canceled" are regarded as synonymous by most Europeans.

## *Tested by the U.S. Navy*

This appeared to mark the nadir of the Skjold class's fortunes. The first sign of a recovery was intense U.S. interest in the Skjold class as a possible platform for Special Forces operations. This interest developed during Operation Joint Winter in March 2001 when three members of the U.S. Navy Special Warfare Command spent a day on board the craft. In June 2001, a formal request was made by the U.S. Navy to lease the *Skjold* for a year to evaluate the craft's capabilities in this role.

Later the same month, the carefully crafted defense modernization plan worked out by Gen. Sigurd Frisvold and Nils Holme, Director General of the Norwegian Defense Research Establishment (NDRE) was effectively dismantled by the Norwegian Parliament, which restored five of the canceled Skjold class FAC-M to the budget and also reversed the decision to abandon many of the coastal defense sites. Although Parliament was generous in restoring canceled programs, it did not allocate any funding for them and left the Norwegian MoD to find the funds by canceling other procurements.

During 2002, the *Skjold* went through a series of exercises with the U.S. Navy intended to explore the capabilities of her design. A series of photographs taken during these trials were released (they are reproduced in this report) and allow a direct comparison between the *Skjold* and the Cyclone class PC. The most prominent feature of the comparison is the much greater visual signature of the *Skjold*. Its wake is extremely prominent and is visible under conditions where the Cyclones show little visible wake patterning. This must be a matter of grave concern, since a ship's wake will reveal its location from a range of many miles. There is little point in constructing a ship with drastically reduced radar cross-section if her wake points like an arrow to her location. Even worse, there are many areas of the world where such wakes are luminescent, effectively forming a glowing neon pointer to the allegedly covert presence.

This impression of high visual signature is reinforced by a bow-on shot that shows the spray generated by the ship's structure. This appears to be reinforced by the exhausts of the Rolls-Royce 571-K gas turbines that power the *Skjold*. The spray cloud generated by the *Skjold* is in stark contrast to the low water disturbance created by the Cyclones. The question must be raised as to the effect of these clouds of spray on the radar and infrared signatures of the *Skjold*. Again, there seems to be little point to spending large sums on reducing radar cross-section and thermal signature if the ship's powertrain and hull design throw up clouds that act as both radar reflectors and thermal blooms.

Based on the evidence in these photographs, the Skjold class is indeed fast but gains her speed at the expense of a greatly increased visual signature. Adding to these effects is the bulk of the craft, significantly greater than that of the Cyclones, even though the nominal displacement of the *Skjold* is comparable. Oddly, the U.S. Navy made no effort to repaint the *Skjold* in a color scheme that would reduce the impact of this bulk, and the ship remained painfully prominent. With her increased bulk, prominent wake, and distinctive spray clouds, it would be hard to imagine a craft less suitable for the insertion of Special Forces teams. The *Skjold* was returned to Norway in September 2002.

## *Consortium Formed*

On a more hopeful note, the Norwegian defense budget for 2003 contained the following statement on naval capital expenditure: "The most important activities in 2003 will be those connected with the procurement of five new frigates with their own maritime helicopters, preparations for the procurement of Skjold class MTBs (Missile Torpedo Boats), the upgrading of Hauk class MTBs, and the planning of new acquisitions for the Coastal Ranger Command. New minesweeping equipment for the Alta class minesweepers will also be given high priority." Elsewhere, it was stated that the Skjold class would consist of six ships (presumably five new construction and the prototype brought up to service standards); building was to begin in 2003, followed by deliveries from 2006 to 2009. These expectations were not fulfilled.

Subsequently, the Norwegian government entered into negotiations with a consortium of shipbuilding companies led by Umoe Mandal for the construction of five Skjold-class fast attack craft. In March 2003, these had reached a point where there was a tentative plan to start construction by August 2003. However, price remained a serious sticking point, with Norwegian Defense Minister Kristin Krohn Devold stating that unless an acceptable price for the five ships was offered, a construction order would not be placed. By July 2003, an agreement on price had been reached and a contract valued at $637 million was awarded. This covered the construction of five new Skjold class FAC-M and rebuilding the prototype to operational standard. This contract had to be approved by the Norwegian Parliament before it could be implemented, however.

This approval was quickly forthcoming and the construction contract was awarded in January 2004 to the Skjold Prime Consortium (SPC). SPC consists of Kongsberg, Umoe Mandal, and Amaris (an alliance of DCN and Thales). The contract award was quickly followed by a series of subcontracts for the various subsystems to be used on the five production ships. These included the armament, powertrain, and command systems.

In 2007, the Norwegian Navy again proposed canceling the orders for five Skjold-class missile attack craft in order to avoid drastic cuts in international operations. According to these reports, the cutbacks were part of a major series of economies that would also have seen Bodoe air base closed down. The Norwegian government refused to confirm these reports, but did state that a comprehensive defense review was being prepared. The reports started to circulate immediately after the revised national budget for 2007 was presented. There have been modest increases in the defense budget (including this one) under the current center-left government, but these increases are not sufficient to keep up with the increased cost of maintaining the structure stipulated by the Norwegian Parliament.

In the 2007 Defense Review the Navy was virtually pleading with Parliament to cancel these six ships, since they promised to be excessively expensive to maintain and had virtually no military value. The author of the Defense Review, Gen. Sverre Diesen, recommended abandoning the Skjold class missile surface-effect ship program; trimming personnel; closing 12 bases across the western, southern, and eastern regions; and relocating several other bases and command centers.

The Norwegian government decided to ignore these proposals completely and established a defense plan under which the Coast Guard will be given high priority, with littoral operations in the High North recognized as a crucial area of security. Ongoing equipment programs such as the NH90 helicopter, the Fridtjof Nansen class frigate, and the Skjold surface effect ship would remain on track, with new niche items such as unmanned air vehicles (UAVs) and NBC protection equipment being sought. Yet, once again, funding was not provided for these grandiose plans and Norway still faced an acute funding shortfall while being forced to accept six ships it does not want and has no use for.

These funding shortages may well have been the root cause of a further one-year delay in the completion of these ships. The first production-standard Skjold class ship was not commissioned until September 10, 2010, with the fifth ship, the *Glimt*, being commissioned in April 2012. The final ship was commissioned in November 2012. This delay put the program some 12 years behind schedule.

# Funding

This program is funded by the Norwegian Defense Ministry via the Royal Norwegian Navy. The project is managed by NATO's Navy Materiel Command Norway (NAVMATCOMNOR).

The contract awarded in 1996 amounted to NOK330 million, or about $36.7 million at the time. According to Norwegian press reports in 1999, the project had overrun its cost estimate by about 10 percent, presumably as a result of moving the NSM missile system from the foredeck to the rear deck.

The production contract awarded in January 2004 had a value of $556 million.

# Contracts/Orders & Options

| Contractors | Award ($ millions) | Date/Description |
|---|---|---|
| SPC Consortium | 556.0 | Jan 2004 – Construction contract for five Skjold class FAC-M. |
| Oto Melara | N/A | Jan 2004 – Supply of six 76mm L62 mounts in low-RCS mountings. |
| Saab | 20.0 | Jan 2004 – Supply of CEROS 200 fire control systems. |
| EDO Corporation | 10.0 | Feb 2004 – ES-3701 ESM systems for six Skjold class ships. |
| Pratt & Whitney | 40.0 | Feb 2004 – Supply of six powertrain sets, each with two ST-18s and two ST-40s. |
| Buck Neu Tech | N/A | Feb 2004 – Six shipsets of MASS decoy countermeasures systems. |
| VT Maritime Dynamics | N/A | Jun 2004 – Six stabilization system shipsets. |

N/A = Not Available

# Timetable

| Month | Year | Major Development |
|---|---|---|
| | 1987 | NDRE begins preliminary work on new fast patrol boat |
| | 1988 | Initial requirement for replacement of Storm and Snøgg class FPBs |
| Jan | 1993 | Kværner Mandal launches one-third scale model for concept testing |
| | 1994 | SES chosen as preferred hull configuration |
| Jul | 1995 | Initial Request for Proposals issued to three bidders |
| Aug | 1996 | Contract for building of first prototype awarded to Kværner Mandal |
| Sep | 1996 | Class name announced |
| Jul | 1997 | Construction specification approved |
| Aug | 1997 | Keel laid for first-of-class |
| Sep | 1998 | KNM *Skjold* launched |
| Dec | 1998 | Norwegian government puts purchase of more boats on hold |
| Jan | 1999 | First journey on own power |
| Mar | 1999 | Predelivery sea trials |
| Apr | 1999 | KNM *Skjold* handed over to the Navy (christening, commissioning) |
| Mid- | 1999-2000 | Evaluation trials, test operation |
| Jan | 2004 | Order for follow-on units |
| | 2007 | First production hull launched |
| Nov | 2012 | Last production hull delivered |

# Worldwide Distribution/Inventories

**Norway.** Six built.

# Forecast Rationale

The final Skjold-class fast attack craft was delivered in November 2012. However, the Norwegian Navy is now expected to be operating much farther from home and, in this environment, the Skjold class is of limited utility. Thus, no additional domestic procurement is likely. The type has no export market and is most unlikely to be repeated or continued.

The basic problem with the Skjold class is conceptual. The whole point of a fast attack craft is that the boat is expendable. Cost and personnel requirements need to be kept to a minimum in order to reduce the losses that are part of the ships' operational profile. Perhaps as a result of the class being conceived at a time when reduced signatures were seen as being a critical desiderata for warship design, the Skjold class is too sophisticated and expensive to be expendable and so is not suited to its envisioned role. There are much better options available (including the Chinese Project 022 and Russian Project 1241.8) at significantly lower price.

This report will be archived once delivery of the last of the six ships for the Norwegian Navy has been completed.

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