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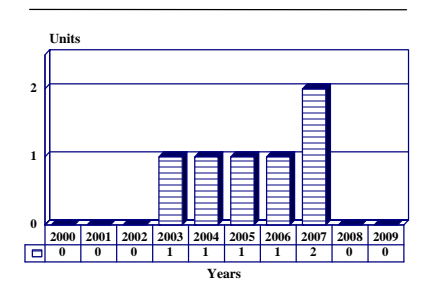
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## Singapore Corvette - Archived 4/2000

### Outlook

- Asia's economic crunch of 1997 postponed the project by a few years
- An order still expected by the end of 2000
- Class now expected to encompass four to six ships
- Design very stealthy; but questionable whether still a trimaran
- Will be built locally, under assistance/cooperation from offshore partner on whose concept the project will be based

10 Year Unit Production Forecast  
2000 - 2009



### Orientation

**Description.** Missile-carrying corvette or offshore patrol vessel with guided missiles (OGPV), possibly featuring trimaran (tri-hull) configuration.

**Sponsor.** The Singapore Ministry of Defense (MINDEF) through the Republic of Singapore Navy (RSN).

#### Contractors

Singapore Technologies Marine Ltd  
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Fax: +65 861 3028 & 861 1601  
E-mail: [business@singnet.com.sg](mailto:business@singnet.com.sg)  
Web site: <http://www.st.com.sg/STMarine>

The ship is expected to be built locally by Singapore Technologies Marine Ltd, even though bidders for the

project have reportedly also included Sweden's Kockums Naval Systems and Litton's Ingalls Shipbuilding division of the US, along with France's DCN.

**Licensees.** When the contract is awarded, SSM is likely to be designated the local prime contractor, with one of the overseas bidders having a secondary (partnership) role, on whose design the final product will be based.

**Status.** Final project definition, leading to contract approval. In the fall of 1999 the project was quoted as being at the "active bid" stage.

**Total Produced.** None yet. Initially the series was expected to comprise as many as 8 to 12 boats, but that number is now thought to be six or possibly as few as four.

#### Pennant List

<u>Number &amp; Name</u>	<u>Builder</u>	<u>Launch Date</u>	<u>Commission Date</u>
P-nn (TBD)	Singapore TM, Jurong	2003	2004
P-nn (TBD)	Singapore TM, Jurong	2004	2005
P-nn (TBD)	Singapore TM, Jurong	2005	2006
P-nn (TBD)	Singapore TM, Jurong	2006	2007
P-nn (TBD)	Singapore TM, Jurong	2007	2007
P-nn (TBD)	Singapore TM, Jurong	2007	2008

**Mission.** The Singapore Navy sees its primary role as safeguarding access to and freedom of navigation through the country's sea lines of communications. This effort serves the goal of defending Singapore's maritime-bound trade. Singapore's seaborne trade is valued at approximately three times its gross national product.

In this context, the new corvettes will have the specific task of managing the high-end threats.

In contrast, the existing smaller displacement fast attack craft are expected to address the issue of individual

## Technical Data

**Design Features.** The missile corvettes are expected to be about 80 meters long, while the initial designs featured a model of a 62-meter-long hull. Although the size of the ship may be slightly larger than planned in the 1990s, the hull length will probably be less than 100 meters. The bracket could be from 90 to 95 meters.

Stealth has been a major design driver all along, perhaps encouraged and emboldened by the experiences gained by the Swedish and French navies in their experiments on reduced radar cross section. The design studies seen thus far suggest a hybrid between DCN's Lafayette and Kockums' Visby class designs. The large, flat panels are angled and have few obtrusions such as windows, while the overall image has a sense of forward-looking aggressiveness drawn into the silhouette.

The third main bidder, the American Litton, is expected to offer its ubiquitous corvette design that draws its origins from the Israeli Sa'ar 5 type which it sold in three copies in the early '90s. That proposal is not likely to be a trimaran version but a more traditional monohull with a high degree of stealth techniques applied.

The ship had been expected to be built in trimaran form, i.e., utilizing a three-hull structure. However, it is uncertain whether this configuration will survive the current technological realities or the financial constraints this new technology places on the unit price of the ships. The only trimaran hull design currently under construction is the prototype/testbed *Triton* in Britain. The builder of that ship, Vosper, is not believed to be one of the final bidders on the Singapore project.

On the other hand, the Singapore corvettes are almost certainly being designed to be built from fiberglass and/or composite structures, with Kevlar added to vital areas for armor. This is significant because it not only reduces the overall weight somewhat as opposed to using a metal hull and superstructure, but it also makes it possible to perhaps assign mine-warfare duties to the

small vessels, including pirates. Piracy is a continuing problem, particularly in the Straits of Malacca and in the South China Seas.

**Price Range.** Unit prices ranging between US\$125 million and US\$250 million have been estimated for these vessels. Depending on the design to be selected and the level of technology to be applied – including the hull structure, the final price is likely to be closer to the upper end of the bracket.

ship if need arises, thanks to the anti-magnetic hull thus created.

The material choice is also key in the hull configuration. While it is a newer material than the conventional metal structures and thus may be less relied on for high-stress applications, it would provide a way to save weight if the trimaran hull configuration is indeed chosen. Otherwise the trimaran structure would produce a weight penalty over a traditional monohull structure simply because there would be "more body in the water."

A trimaran hull would also provide more stability for the ship than would a monohull design. Of course, the only factor working against a trimaran solution is the need for slightly more propulsive power in order to provide sufficient speed to reach planing. Right now the preferred prime movers appear to be diesel engines (presumably two), supported by electric motors used for slower speed trolling. It is also worth noting that once on plane, a trimaran hull does require less power to maintain the operating speed, thanks to the larger surface carrying it over the water.

A helicopter deck has been also part and parcel of the design from the beginning. The Navy is obviously prepared to fit these ships with a capability that extends their reach over nearby land areas while providing added flexibility.

As for the weapon systems, the ship is expected to have a dual-purpose medium-caliber gun, most likely a 57 mm Bofors, on its foredeck. The missile selection is likely to include Harpoon SSMs and the Evolved Sea Sparrow Missile (ESSM). Fixed torpedo tubes on the outer hulls will house four heavyweight wire-guided torpedoes pointing forward. Reloads will be carried on board as well.

In keeping with modern naval trends elsewhere, the Singapore Navy is also placing a great deal of emphasis on the reduction of manpower on its platforms, through a higher degree of automation. A new command, control and communications (C<sup>3</sup>) suite designed by ST

Electronics is being incorporated on these new ships. The aim is to combine ship management, weapon control and integrated communications in a single networked computing architecture. The concept, known as INDEP 21 (for "Intelligent Naval Defense Platform 21"), is expected to be a major factor in keeping the crewing requirement on these ships at the stated estimate of 60. One of the Fearless class patrol vessels has been designated as a testbed for this new concept.

Among the systems to be tested using the INDEP 21 concept are fiber-optic data transfer, application of common consoles for multiple tasks, a new integrated communications suite, embedded training systems, and advanced automation techniques.

**Operational Characteristics.** The Singapore Armed Forces has an operational requirement for a class of ships that will essentially act as replacements (in terms of overall fleet strength) for the aging Sea Wolf class ships while being a major step up in capabilities.

Overall, the new corvettes are expected to enhance the Singapore Navy's credibility in the region with regard to its control over the waterways through the Malaccan Straits and the South China Sea. These ships are substantially more capable for operation in more open seas than the fairly new Fearless and Victory classes, at a displacement nearly twice the size of both. The Navy has suggested that the missile corvettes will be tasked with the management of the high-end threats, leaving the patrolling of pirate boats and other smaller craft violators to the patrol and attack craft.

The new class will thus provide much improved seakeeping and will be built with considerable margins

for through-life growth so that larger, heavier systems can be comfortably installed on board later while the ships are already in service.

The ships will include a flight deck and hangar for the operation and support of an embarked helicopter, stated as either a light-duty helicopter or a remotely piloted vehicle (RPV).

Few specifics have been released concerning the ship's intended operational role. It is interesting, however, that reduced radar cross section has been a key driver in the design of the exterior appearance of this class from the beginning. This is evidently a function of the operating environment that the ships will be exposed to geographically. The broken coast lines and the large number of small islands in combination with narrow straits provide a setting where stealth can be an advantage.

It is also probably fair to say that in its effort to boost the overall credibility of the Navy and its forward presence in the region, the Singapore defense forces have opted to go with the very latest in naval design that money can buy. These advanced applications are being incorporated on ships that represent a natural progression in size from the existing fleet. Instead of making an even bigger jump to still larger ships that would not be as agile and would be even fewer in number, the navy has chosen to adopt the stealth technology on a corvette-sized platform for an optimum combination of seakeeping, flexibility and speed.

On the other hand, the weaponry selected thus far is fairly standard or even conservative for this size of a vessel, leaving the door open for future expansion.

	<u>Metric</u>	<u>US</u>
<b>Dimensions</b>		
<i>Length:</i>	80 m	262.5 ft
<i>Beam:</i>	11 m	36.1 ft
<i>Draft:</i>	3 m	9.8 ft
<b>Displacement</b>		
<i>Full Load:</i>		1,000 tons
<b>Performance</b>		
<i>Speed:</i>	65 km/h	35 kts
<i>Crew:</i>	60 (appr.)	
	<u>Type</u>	<u>Number</u>
<b>Armament</b>		
<i>Missiles – SSM:</i>	RGM-84C Harpoon	2x4
<i>SAM:</i>	Barak	4x8
<i>Gun:</i>	Bofors SAK 57 mm/70 Mk 3	1
<i>Torpedoes:</i>	TP-61 21 inch (533 mm)	4

	<u>Type</u>	<u>Number</u>
<i>Torpedo Tubes:</i>	Fixed	2x2
<i>Helicopter:</i>	Light or RPB	1
<b>Electronics</b>		
<i>Radar – Air/Surface Search:</i>	TBD	
<i>Fire Control:</i>	TBD	
<i>Sonar – Bow Mounted:</i>	Low frequency	
<i>VDS:</i>	Medium frequency	
<i>Towed Array:</i>	Passive	
<i>EW – ECM/ESM:</i>	Decoys	
<b>Machinery</b>		
<i>Prime Mover:</i>	Diesel; make + type TBD	2(?)
<i>Electric Propulsion:</i>	for trolling speeds	
<i>Propulsion:</i>	2 shafts; propeller drive	2

## Variants/Upgrades

**NGPV.** Alternative designator seen in the press in conjunction with the same class, the letters referring to “New Generation Patrol Vessel.”

**Visby Class.** Much of the design work proposed by Sweden’s Kockums is expected to be based on the experiences drawn from its Visby class corvette being built for the Royal Swedish Navy. The early sketches of the Singapore project also bear some resemblance to the Swedish program – besides being of approximately the same hull size, albeit with a larger displacement.

If the Singaporean solution does remain a trimaran-hulled design, however, the likeness to Visby class will

be most evident in the center hull. The Visby itself is a conventional monohull structure.

It also remains to be seen whether the Singapore ships will feature propellers or whether they will instead use waterjets, as does the Visby class. The Visbys also are powered by gas turbines, not only because of their lighter weight but also because of their lower noise and vibration levels compared to diesels. According to sources within the Visby program, the only issue concerning the gas turbines has been finding ways to guarantee the engines’ intake of air is debris-free and contains as little spray water as possible.

## Program Review

**Background.** The new-generation patrol vessel/corvette of Singapore has been the subject of speculation since the mid- to late 1990s. This city-state enjoyed strong economic growth throughout the 1980s and 1990s, and is poised to strengthen its defense forces in order to assure its position as the guardian of the main thoroughfare in the Southeast Asian maritime trade – the Malaccan Straits. Foreign trade – virtually exclusively by sea for this city-state – is valued at no less than three times Singapore’s own gross national product (GDP). However, the 1997 economic crunch that took hold of the entire Asian market had a devastating effect on the economy of Singapore, which relies to such large extent on imports and exports.

GDP thus grew by only a few percent in the late 1990s (with negative growth in some years). The defense forces’ plans to build new hardware therefore had to be put on the back burner.

Signs of the program being back on track were evident in the spring of 1999. The harsh economic realities may have been an eye opener. Recent development has focused less on stealth and speed and more on automating as many functions as possible in an effort to save manpower.

The Ministry of Defense (MINDEF) is believed to be progressing with plans to procure this class, now that the economy is showing signs of renewal. MINDEF declined any comment on the program in the spring of 1999 and even warned against publicly discussing it.

Nevertheless, the program is expected to proceed, even though the number of ships may be only six at best. The Singapore Navy knows it needs these ships in order to show its mettle and to send a message that it is in charge of its own destiny. For an economy based largely on foreign trade, shipping and shipbuilding, having the means to enforce its own command is key.

While the initial platform studies looked at designs of 75-90 meters, and the model of a few years ago was based on a design of 62 meters, the presently desired size is believed to be in the range of 90-110 meters.

This would indicate a ship more characteristic of a corvette than a patrol vessel, and may be one reason why the number of ships in the class has been reduced to six or maybe only four.

## Funding

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This project is presumably funded by the government of Singapore, with the expected contractor (Singapore Technologies Marine) bearing an unknown portion of the development costs.

## Recent Contracts

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No contracts are known to have been issued yet. The program is at the active bid stage (late 1999/early 2000).

## Timetable

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<u>Year</u>	<u>Major Development</u>
1994	Signs emerge of Singapore looking for a class of 9-12 stealthy missile corvettes
1997	First target date for order
1999	ST Marine exhibits stealth concept design "STEM 570S" at IMDEX Asia
1999	Singapore steps up program development effort with Fearless winding down
2000	Funding approval possible for first batch
2004	First vessel may enter service
2007	Last ship to be commissioned

## Worldwide Distribution

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**Singapore** (This class will be built only for the Singaporean Navy. Exports to other operators in the region are possible at a later date, but the prospects are purely speculative.)

## Forecast Rationale

Because Singapore is only now recovering from the economic depression that hit the region in the summer of 1997, an order for corvettes may be placed in late 2000 or early 2001. As to the number of ships to be included in this class, we are still forecasting a total of six, although it is entirely possible that no more than four will be built. The entire issue involves matters such as hull size, which appears to have grown from the earlier estimates to closer to 100 meters. The figures in the **Technical Data** section are thus only estimates, based on information obtained during the course of the program's existence.

Now that the Fearless class has been completed, the builder will have capacity available for building these new corvette-sized vessels.

It is becoming increasingly uncertain, however, whether the design will still be based on a trimaran hull. This

technology still appears to be too fresh for a major application like this with a navy the size of Singapore's, notwithstanding the importance that this naval force holds in protecting the West's vital shipping interests in Southeast Asia. Since Britain's Vosper is not believed to be even a bidder on the project and it is the only builder actively constructing a trimaran hull ship, it is difficult to see Singapore agreeing to be a guinea pig for a revolutionary new hull form that has not yet been tested in practical use.

Provided that an order is placed still in 2000, the first ship could go in water in 2003, with commissioning taking place perhaps 12-15 months later. The subsequent hulls could come at intervals of 9-12 months, which would bring this program to completion by about 2007.

## Ten-Year Outlook

### ESTIMATED CALENDAR YEAR PRODUCTION

Designation	System	Thru 99	High Confidence Level				Good Confidence Level				Speculative			Total 00-09
			00	01	02	03	04	05	06	07	08	09		
SINGAPORE OGPV/CORVETTE	MULTIFUNCTION CORVETTE (SINGAPORE)	0	0	0	0	1	1	1	1	2	0	0	6	