

# ARCHIVED REPORT

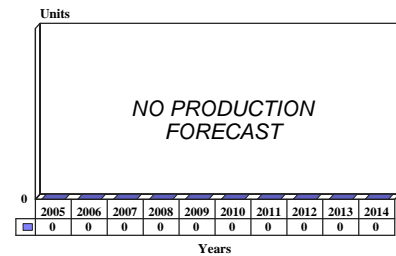
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## Eilat Class - Archived 4/2006

### Outlook

- Israeli Navy LPD program was probably no more than learning exercise
- New multi-mission combat ship (MMCS) program revived
- Procurement of MMCS due in 2008/2009
- This report will be archived and replaced next year

10 Year Unit Production Forecast  
2005 - 2014



### Orientation

**Description.** Guided missile corvette (FFL).

**Status.** In service.

**Sponsor**

Directorate of Procurement and Production  
 Ministry of Defense  
 PO Box 7063  
 Hakiryah  
 Tel Aviv 61909  
 Israel

**Total Produced.** Three

**Pennant List**

<u>Number &amp; Name</u>	<u>Keel Laid</u>	<u>Launched</u>	<u>In Service</u>
501 <i>Eilat</i>	2/1992	2/1993	4/1994
502 <i>Lahav</i>	9/1992	8/1993	10/1994
503 <i>Hanit</i>	4/1993	3/1994	4/1995

**Mission.** Anti-surface, amphibious support, anti-air and anti-submarine warfare, and missile patrol. In addition, a ship in this class may sometimes act as a commanding ship for a task force.

**Price Range.** The cost was reported to be about \$260 million per ship in the early 1990s. However, a price of \$325 million for all three ships without the combat system or some Israeli-supplied equipment was also quoted.

### Contractors

Northrop Grumman Ship Systems, Division HQ, <http://www.ss.northropgrumman.com/index.cfm>, 1000 Access Rd, PO Box 149, Pascagoula, MS 39568-0149 United States, Tel: 1 (228) 935-1122, Fax: 1 (228) 935-1126, Email: [info@ngc.com](mailto:info@ngc.com), Prime

Oto Melara SpA, <http://www.otomelara.it>, Via Valdilocchi 15, La Spezia, 19136 Italy, Tel: 39 0187 5811 11, Fax: 39 0187 58266, Email: [info@otomelara.it](mailto:info@otomelara.it), Subcontractor

Duramax Marine, 17990 Great Lakes Parkway, Hiram, OH United States, Subcontractor

Elbit Systems Ltd, PO Box 539, Advanced Technol, Haifa, 31053 Israel, Tel: 972 4 8315315, Fax: 972 4 8550002, Subcontractor

Tadiran Ltd, 3 Hashalom Road, Tel Aviv, 67892 Israel, Subcontractor

Boeing Military Aircraft and Missile Systems, PO Box 516, St Louis, MO 63166 United States, Subcontractor

Israel Shipyards Ltd, <http://www.israel-shipyards.com>, PO Box 10630, Haifa, 26118 Israel, Tel: 972 4 8460246, Fax: 972 4 8418744, Email: [assafbar@israel-shipyards.com](mailto:assafbar@israel-shipyards.com), Subcontractor

Kamewa AB, PO Box 1010, Kristinehamn, 68129 Sweden, Subcontractor

Raytheon Electronic Systems, Old Nogales Hwy, Tucson, AZ 85734 United States, Subcontractor

## Technical Data

	<u>Metric</u>	<u>U.S.</u>
<b>Dimensions</b>		
Length – Overall	86.4 m	281 ft
– Waterline	77.2 m	253 ft
Beam – Overall	11.9 m	39 ft
– Waterline	8.8 m	29 ft
Draft	3.2-4.2 m	10.4-13.7 ft
<b>Displacement</b>		
Standard		1,075 tons
Full Load		1,275 tons
<b>Performance</b>		
Speed (maximum)	63 km/h	34 kt
Speed (cruising)	37 km/h	20 kt
Operational Range	6,500 km at 37 km/h	3,500 nm/20 kt
Endurance	24 days	
Crew	64 (16 officers, 7 commissioned officers, 41 seamen), plus an air group with 4 officers and 6 CPOs	

	<u>Type</u>	<u>Qty</u>
<b>Armament</b>		
Guns	20mm L70 Oerlikon	2
	20mm Phalanx Mk 15	1
Missiles – SSM	RGM-84 Harpoon	2x4
– SSM	Gabriel II	8*
– SAM	IAI Barak	2x32*
Torpedo Tubes	324mm Mk 32	2x3
Torpedoes	Mk 46	6
Helicopter	SA-365G Dauphin	1
		*apparently not carried

<b>Electronics</b>		
Radars – Surface Search	Cardion SPS-55	1
– Air Search	TPS-44 (mod)	1
– Target Acquisition	EL/M-2218-S 3-D air search (or AMDR)	1
– Fire Control – Barak	EL/M-2221-GM	2
– Gabriel	MSIS IR, laser, TV fire control & detection	1
Sonars – Hull-Mounted	EDO-796 Mod 1	1
Towed	Coris-TAS	1

	<u>Type</u>	<u>Qty</u>
<b>Electronics</b> (continued)		
Electronic Warfare – ESM	Elisra NS-9003A intercept, jammer	1
– ECM	NS-9005PR noise, deception jammer	
– COMINT	Tadiran NATACS MMI	
– Decoys	ACDS tube chaff/IR	4x72
	Beamtrap tube smoke	2x24
	SLQ-25 NIXIE torpedo decoy system	1
Command & Control	Elbit AIO-III	
<b>Propulsion</b>		
Gas Turbin	GE LM2500	1
Diesel	MTU 12V-1163TB82	2
Propellers	Kamewa controllable pitch	2
Electric Plant	MTU-Siemens diesel generators	2

**Design Features.** The hull is designed using U.S. naval design criteria in combination with German Navy guidelines. The Sa'ar 5 class was the first warship class in the world to be totally designed in 3-D Computer-Aided Design (CAD). The ships are 86.4 meters (283.5 ft) long, and displace approximately 1,200 tonnes. Constructed of welded steel, the hull is subdivided into 11 transverse bulkheads and six fire zones. Particular attention has been paid to reducing radar, acoustic, and infrared signatures. Unusually in a ship this size, the diesel exhausts discharge underwater. The drawings released appear to show that the Sa'ar 5 class uses a deep-vee hull form with pronounced bilge keels. The hull has substantial flare forward mated with considerable tumblehome of the superstructure.

The main propulsion system is a CODOG (Combined Diesel or Gas) turbine system, comprising one 25,000-horsepower General Electric LM2500 gas turbine for high-speed operation and two 3,000 horsepower MTU 12V-1163TB82 diesels for cruising. The diesels are coupled to the propeller shaft by a Renk-Falk combining gear, which is configured so that each diesel can operate either one, the other, or both propellers. The gas turbine is geared to both shafts, driving either or both propellers.

Ship functions are controlled by an Integrated Platform Management System (IPMS), supplied by CAE Electronics. This is identical to the system installed in the Halifax class frigates of the Canadian Navy. The IPMS is a geographically distributed processing system that controls and monitors propulsion, ancillary machinery, auxiliaries, and electrical generation. It also monitors damage control and steering (including the autopilot), and has an integral telegraph system.

The aluminum alloy superstructure follows recent Israeli design practice in showing little concern for topweight considerations. There are two large tower masts, each bearing an array of radar and electronic support measures (ESM) systems. The superstructures

have been elaborately shaped to minimize radar cross-section. A large helicopter hangar is located in the rear of the main, with the quarterdeck cleared for helicopter operations. Extensive cooling equipment is provided in order to reduce IR emissions.

The command control system is the Elbit AIO-III. This is a federated system consisting of 17 color consoles with tactical displays for anti-surface warfare (ASuW) tactical pictures, over-the-horizon targeting (OTHT), aircraft control, task force command, electronic warfare system management, and library/database management, and for use as training aids. The Operational Control Console uses two 18-inch screens or a single 18-inch screen and two 9-inch raster scan displays. The system uses a VME databus and utilizes distributed processing within the consoles. Two main computers (one of which is redundant) provide central track-keeping facilities. Like systems are linked into Local Area Networks (LANs) using Ethernet interfaces. All software is written in Ada.

**Operational Characteristics.** The armament was intended to provide for all types of engagements. The main armament comprises two anti-surface missile systems: eight 54-nautical-mile-range Harpoon missiles in two quadruple launchers, and eight Gabriel IIs, which have a 20-nautical-mile range. The principal anti-air weapon is the Barak I. This surface-to-air missile has a range of 5.4 nautical miles. Barak is carried in a 32-cell vertical launch system. It is backed up by a 20mm Mk 15 Phalanx CIWS (Close-In Weapon System) and two 20mm Oerlikon mounts. Much of this proposed armament fit has never been installed, probably for topweight reasons.

ASW capability is provided by two triple-mount Mk 32 torpedo tubes, housing Mk 46 torpedoes. The ships also have a flight deck and hangar for one Dauphin AS-565 Panther helicopter. The flight deck is fitted with tie-down points. Although the helo is in theory capable of ASW operations, its assigned role is to function as an

over-the-horizon targeting system for the Harpoon missiles.

The electronics fit comprises the H-band Cardion SPS-55 surface search radar. Air search capability is provided by a highly modified derivative of the D-band TPS-44. The target acquisition radar is an improved, 3-D version of the ELTA Automatic Missile Detection Radar (AMDR) designed to automatically detect incoming sea-skimming missiles, evaluate the threat, and designate that threat to the ship's Barak anti-missile fire control channel. The fire control radar for Barak is the EL/M-2221-GM search, track, and guidance radar (STGR), a coherent tracking fire-control radar which is also capable of anti-air automatic gunnery fire control and anti-surface gunnery fire control. The ships are currently equipped with two EL/M-2221-GM STGRs; a planned third system has never been installed.

The Sa'ar 5 features an additional fire control/surveillance channel in the form of two multisensor stabilized integrated systems (MSIS) from Electroptics Industries (EI-Op). MSIS is fully integrated into the ship's C<sup>2</sup> system and controls the main gun and Gabriel. A laser pointer is also available as an option for small-caliber gunfire control at night, in addition to night vision goggles.

The COMINT/DF system is based on the NATACS system developed by Tadiran for earlier generations of

Israeli surface combatants. In its basic configuration, NATACS comprises two operator consoles, a search and DF (direction finding) console, and a second monitoring station. The above-decks equipment comprises a DF antenna, an active omnidirectional COMINT antenna, and two RF units. The DF antenna, in turn, comprises a pair of stacked Adcocks for different frequency bands, each of which consists of figure-eight-shaped loops.

The electronic warfare (EW) suite includes ESM and ECM (electronic countermeasures) systems developed by Elisra. The NS-9005PR noise and deception jammer uses two non-stabilized multibeam array transmitters (MBATs) based on the RAN-1010 MBAT, each covering 180°. The ESM is the Elisra NS-9003A/9005, which is designed to handle most transmission modes, including frequency agility, frequency hopping, pulse compression, and staggered or modulated (jittered) PRF (Pulse Repetition Frequency), over the 2-18 GHz range with a receiving sensitivity of -70 dBm and instantaneous 2 MHz resolution. Elbit has provided the decoy-launching system for the Sa'ar 5, based on a new trainable and stabilized 72-round launcher. Budgetary considerations permitting, the ship will eventually be equipped with four launchers, firing modified versions of expendables developed by Rafael.



INS Lahav

Source: Israeli Navy

## Variants/Upgrades

Post-Construction Modifications. Topweight considerations mean that the ships have been completed to a

much reduced standard from the original design. The Gabriel missiles are not carried, and the 76mm

Otobreda gun has been replaced with a 20mm Mk 15 Phalanx and the two Sea Vulcans with pintle-mounted 20mm cannon. There is considerable confusion as to whether the Barak missiles planned for these ships have actually been installed. The position of the satellite antenna over the rear 32-round silo strongly suggests that this battery is not used at present.

**Sa'ar 5.** The Eilat class is frequently referred to as the Sa'ar 5 class. This nomenclature appears to derive from the first class of Israeli missile-armed fast attack craft, which were named the Sa'ar class after the lead ship. These were built in two configurations, referred to as Sa'ar 1 and Sa'ar 2. Somehow, the name Sa'ar became a generic designation for all Israeli FAC-M.

**Sa'ar 5+.** The five proposed ships that were projected as replacements for the older FAC in the Israeli Navy have been described as "Improved Sa'ar 5 or Sa'ar 5+ class ships." The estimated cost of the five-ship program was \$1 billion, nearly all of which would be funded by U.S. military assistance. The new corvettes would be armed with 16 Advanced Naval Attack Missiles and 16 Next Generation Defense Missiles. The MBT division of Israel Aircraft Industries confirmed that these names were not generic designations, but represented missile concepts currently under development.

## Program Review

**Background.** The Israeli Navy began planning for the construction of corvettes in the early 1980s. The Sa'ar, Eilat and Reshef classes had performed very well during the Yom Kippur War in October 1973 and afterward, but their small size limited their weapons load and range. The Sa'ar 2 class had also seen 15 years of service and was obsolete. From 1978 to 1982, Israel built four Aliyah class fast attack vessels that carried small helicopters, and converted some of the earlier craft for ASW duties.

In the late 1970s, Israel Shipyards in Haifa, which designs and builds Israel's warships, designed an 850 ton QU-09-35 corvette, later referred to as the Sa'ar 5. There were to be two Sa'ar 5 designs, one optimized for ASuW and one for ASW. Following a review of the program, it was decided to develop a modified ship of the same class with the assistance of the United States. The new corvette, at first code-named the Lahav class (since initially that was to be the name of the first unit), incorporated almost all of the Sa'ar 5 design attributes with a number of new features. The Israeli Navy considered ordering two such ships in the early 1980s, but Air Force and Army modernization programs took priority. The Lavi fighter program was also causing problems, since it was using nearly all of Israel's Foreign Military Sales (FMS) credits and defense ministry procurement funds.

In the early 1980s, major building programs were under way by the Syrian, Saudi Arabian, and Iraqi navies, and the Israelis wanted to counter these threats. Israel approached the Navy for assistance in building three submarines and four corvettes in late 1983/early 1984. The negotiations stalled over Israel's request to have the United States build the submarines, because the U.S. did not want to undertake any domestic production of diesel submarines. Israel agreed to seek another builder for the subs. Israel Shipyards wanted to build the corvettes,

since it was short of work and laying off personnel. The yard was able to build corvettes, but had no submarine construction capability. The United States as a rule requires that FMS funds be spent within the country, and the corvette program was seen as a way to give U.S. shipbuilders badly needed work.

Israel chose Rockwell to be the U.S. program manager for the electronic and weapons systems for both the submarines and the corvettes. The Navy held discussions with 12 U.S. shipyards to select a finalist for the corvettes. Three yards – Bath Iron Works in Bath, Maine; Ingalls Shipbuilding in Pascagoula, Mississippi; and Todd Shipyards in Long Beach, California – were chosen to prepare final bids for building the corvettes. In 1987, Todd Shipyards filed for bankruptcy and Bath Iron Works dropped out of the competition, leaving Ingalls Shipbuilding the winner by default. That same year, the Israeli defense ministry canceled the Lavi fighter program, freeing money for the Navy.

In March 1988, the U.S. government reportedly agreed to finance the construction of three submarines and four corvettes. The submarines would be built in Israel, and the corvettes in the United States. The Israeli cabinet voted to approve the naval modernization program in April 1988. After the approval, though, the government postponed funding for the submarines and the corvettes. In mid-1988, rising costs forced Israel to cut back the program to two submarines and three corvettes, and the Israeli Navy and Ingalls Shipbuilding concluded most of their negotiations for building the corvettes by the end of the year. Additionally, Rockwell had arranged the final electronics and weapons package for the four ships by late 1988. The detail design phase, during which new signature reduction techniques were incorporated, ran through 1989.

Construction of the first corvette at Ingalls Shipbuilding began in 1990. All three ships of the class have now

been completed. The first ship, INS *Eilat*, finished contractors' sea trials in November 1993, then went to Israel for final fitting with an integrated command system and other classified electronics. It became fully operational in mid-1996, although it already had been commissioned in May 1994. The second unit, the *Lahav*, was delivered to Israel on March 31, 1994, and the third on September 30 of the same year. Prior to entering service, these ships were fitted with additional equipment at the Israeli dockyards.

The first-of-class sea trials were conducted in mid-1996. U.S. Navy sources suggest that they were largely successful, although the overall stability and seaworthiness of the ships were deemed "adequate for the Mediterranean where they will be deployed, but unsuitable for the Atlantic."

Since delivery of the ships, it has become increasingly obvious that they are chronically over-armed and that their designed equipment manifest cannot be fully utilized without incurring stability problems. A 76mm Otobreda L62 gun and two Sea Vulcan mountings have never been installed, as once planned, and the ships continue to carry the "interim" battery of a Mk 15 Phalanx CIWS and two pintle-mounted hand-swung 20mm guns. The short-range missile armament has never been installed, and the ships continue to rely on their Harpoons for anti-surface firepower. Finally, the Barak anti-aircraft missile has probably not been installed, and this (somewhat elusive) system remains confined to Israeli service, on a single ship.

Early in 2001, reports started to surface that the Israeli Navy was contemplating a major modernization program. In late May, the Office of the Israel Defense Forces confirmed the existence of such a program and, in June 2001, revealed that it included the replacement of the existing fast attack craft force with additional Eilat class ships over the following 10 years. In August 2001, the *Jerusalem Post* reported that the Israeli Navy was seeking an additional five corvettes of the Eilat class. These ships are officially described as "Improved Sa'ar 5 class ships." The estimated cost of the five-ship program was \$1 billion, nearly all of which would be funded by U.S. military assistance. The new corvettes were also designated the Sa'ar 5+ class, and would be armed with 16 Gabriel V Advanced Naval Attack Missiles and 16 Next Generation Defense Missiles. The MBT division of Israel Aircraft Industries confirmed that these names were not generic designations, but

represented missile concepts that were under development.

In January 2002, Northrop Grumman stated that it was investigating the possibility of an upgrade program for the existing Eilat class corvettes. At that time, Richard Schenk of Northrop Grumman Ship Systems revealed that negotiations with the Israeli Navy over the proposed Sa'ar 5+ program were substantially completed, saying that the company "can move forward with some additional Sa'ar 5 class ships."

Armament experiments continued with the Eilat class throughout 2002. These included trials of the Typhoon stabilized 25mm cannon system on board one member of the class. Notably, many recent photographs of these ships have shown them not to be carrying the Phalanx Mk 15 CIWS system previously prominent in "A" position.

In early 2004, the Israeli Navy announced that it was formulating a requirement for two new Multi-mission Combat Ships (MMCS) with an option on a third. The total program cost was estimated at \$1.4 billion, \$500 million each for the first pair of ships and \$400 million for the third. These ships will be substantially larger than the Eilat class, with some reports indicating a full-load displacement in excess of 3,000 tons. This announcement appeared to indicate that plans to procure additional Eilat class ships are now defunct.

Barely two months later, this announcement was followed by an order from Admiral Yedidya Ya'ari to scrap the staff-work on the multi-mission corvettes in favor of a 13,000-ton amphibious assault ship, capable of carrying some 600 troops and equipped with an AEGIS air warfare battle management system. By June 2004, this "vision" had evolved further into a light aircraft carrier capable of deploying a group of F-35 joint strike fighters, in addition to the other listed capabilities.

The proposal caused consternation and confusion within the Israeli naval ranks for the rest of 2004, and may have been responsible for a government decision to defer any Israeli navy modernization funding until 2008/2009. In the event, the amphibious assault ship was quietly abandoned and, by the end of 2004, the multi-mission corvette program had been reinstated in the form of a suggestion that the Israeli Navy should buy in on the U.S. Navy LCS program.

## Funding

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This program was funded under the Foreign Military Sales (FMS) program of the U.S. government between 1992 and 1995.

## Recent Contracts

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<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Elbit Defense Systems	N/A	1989-1990 – Contract for the development of operational software for the combat management system, and its integration.
Ingalls Shipbuilding	N/A	Mid-1994 – Option for ordering a third ship of the series exercised.
IAI/Rafael MBT	N/A	1996 – Barak 1 point-defense missile system for the Sa'ar 5 class.
Boeing Co	26.0	Jun 23, 1998 – Proposed sale of 16 Harpoon missiles for Sa'ar 4s and 5s.

## Timetable

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<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1984	Israel and United States begin discussions about new corvette program
	1984	Israeli Navy begins design studies for new corvette
	1984-1987	Israeli Navy holds discussions with U.S. shipyards
Mar	1988	U.S. and Israel reach financial terms for new corvette program
	1988	Litton/Ingalls designated prime contractor
Apr	1988	Israeli cabinet approves new corvette program
	1989	Development of operational software for combat management system
Feb	1992	<i>Eilat's</i> keel laid
Apr	1992	Deadline for exercising an option to order a fourth ship passes
May	1992	Successful test firing of Barak 1 missile against simulated target
Sep	1992	<i>Lahav's</i> keel laid
Feb	1993	<i>Eilat</i> launched
Apr	1993	<i>Hanit</i> laid down
Aug	1993	<i>Lahav</i> launched
Nov/Dec	1993	<i>Eilat</i> delivered to Israel, sea trials begin
Mar	1994	<i>Lahav</i> delivered
May	1994	<i>Hanit</i> launched, <i>Eilat</i> completed
Mid	1994	Option for ordering third ship of the series exercised
Sep	1994	<i>Hanit</i> delivered, <i>Lahav</i> completed
Feb	1995	<i>Hanit</i> completed
Dec	1995	Shipment of first DESEAVER offboard decoy control/launch system
Late	1996/1997	<i>Eilat</i> in full service
	2001	Possibility of additional Sa'ar 5 class ships raised
Jan	2002	Sa'ar 5+ negotiations reportedly initiated

## Worldwide Distribution

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**Israel.** 3 in service, 5 more projected.

## Forecast Rationale

The proposed Israeli amphibious assault ship was a massively impractical suggestion, devoid of any operational, strategic or tactical rationale and utterly beyond the capability of its parent navy to procure, support, maintain or even crew. On its face, the proposal was absurd to the point of insanity. However,

its purpose was probably political rather than directly concerned with real navy procurement.

By proposing a ship of the specified size and capability, Admiral Yedidya Ya'ari was probably attempting to force the Israeli Navy away from its small-ship

obsession to explore the options and capabilities that are offered by ships representing modern mainstream naval development. It is a fair bet that, while the proposed LPD was never a viable program, proving its unworkability taught Israeli planners a lot about power projection operations and the real capabilities of larger ships.

By the end of the year, the Multi-Mission Combat Ship program had been reinstated, although it is now unlikely

that any ships will be funded in the next two or three years. The new ships are substantially larger than the Eilat class, one report putting the new ships at 2,800 tons standard as opposed to the 1,075 tons standard of the Eilat. The MMCS designation appears to be an excuse to avoid calling the new ships what they clearly are – light frigates. It is obvious that the new ships will differ substantially from the Eilat class and, once adequate information is available, a new report on the MMCS will be generated.

## Ten-Year Outlook

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Since no additional construction is now projected, the forecast chart has been omitted.

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