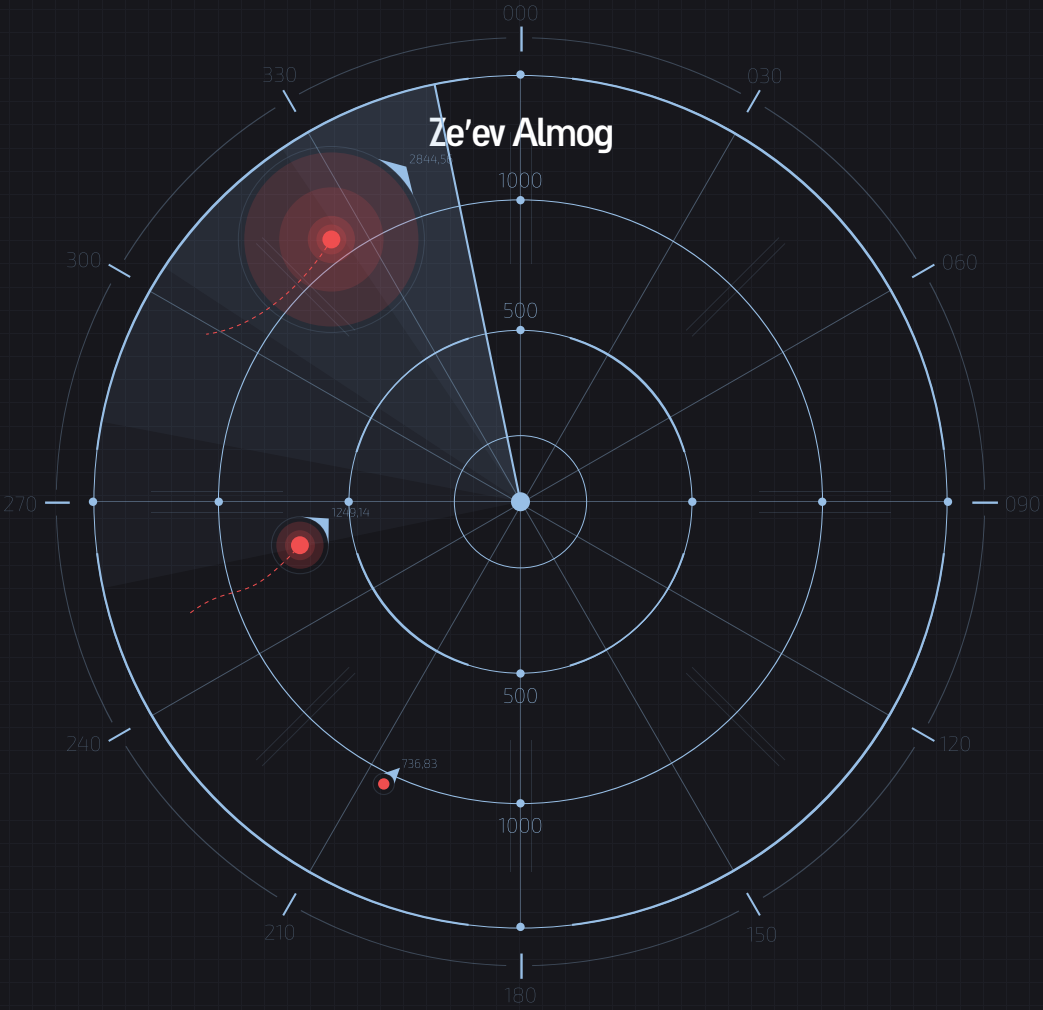


ISRAEL'S NAVAL FORCE: DEVELOPMENT AND BUILDUP FOLLOWING THE 1973 YOM KIPPUR WAR



Israel's Naval Force: Development and Buildup Following the 1973 Yom Kippur War

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Foreword

Maj. Gen. (Res.) Prof. Isaac Ben Israel

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The present article reviews the way Israel's modern Naval Force was shaped. The Israeli naval force, consisting of *Sa'ar-5* and *Sa'ar-4.5* missile boats, *Dolphin*-class submarines and naval helicopters, was, and still is, Israel's main offensive naval force. Its planning began in summer 1979, and its scope was approved as early as September 1979 (including, for example, 6 submarines and 24 missile boats). The planning was completed in 1985, but the construction contract was not signed until August 1989.

The force was designed to respond to new Arab naval threats, which grew significantly after the Yom Kippur War, primarily because the military means possessed by the IDF – at sea, in the air and on land – no longer met the reality of that time and the changing needs.

The new missile boats and submarines were built simultaneously, to create one consolidated force after the concept of a combined naval force, where each component (missile boats, submarines and naval commandoes) deploys in a combat arena that best matches its capabilities, and mutual support is provided.

In the main process of characterization and planning, the Israeli Navy adhered to a structured, methodical approach, in which all the professional and command echelons (vessel commanders and up, and parallel navy HQ staffs) were fully engaged. The naval commando unit became an integral element of the future offensive force. This method was the foundation of a thinking process that was exclusively based on command and professional experience. Representatives of the Air Force, the defense industries and the Technion were invited to participate.

The first *Sa'ar-5* missile boats and *Dolphin* submarines reached Israel in the 1990's, namely, 15 years (for the missile boats) and 20 years (for the submarines) after their planning was begun. The navy currently operates them with great success.

The author of this article, Admiral (Res.) Ze'ev Almog, is intimately familiar with the research topic. As Commander of the Israeli Navy, he headed the teams that characterized and designed the force's buildup, and acted from the very beginning to ensure that the entire plan be approved and budgeted.

In the present article, Admiral (Res.) Almog describes the development process of Israel's unique naval force, offering a fascinating historical description of the naval arena and the role the vessels operating in it have played in safeguarding Israel's security over the years. The article also deals with topics related to force build-up, the effect of technology, the importance of leadership, and the need to learn from past experience.

Major General (Res.) Professor Isaac Ben Israel
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Security, Tel Aviv University

In memory of my brother Yadin –
a man of sea, field and water

Introduction

The present article depicts the process by which the Israeli Navy was remodeled following the Yom Kippur War (1973). The historical description and analysis of the process is accompanied by a discussion of conceptual parameters that underlay the construction of military naval vessels and their integrated systems. These parameters were: 1) Quantitative and qualitative balance of forces between the adversaries in the naval arena, and extent of potential mutual threats. 2) Professional and leadership skills of the forces' commanding echelons in designing, constructing and operating naval vessels. 3) State-of-the-art technology and envisaged further developments. 4) Nature of operational arenas and combat doctrines. 5) The extent to which the authorities recognized the need for high-quality vessels. 6) Budgets allocated to the process. 7) Accumulated experience.

The article focuses on the development and construction of the Israeli Navy's main modern combat vessels: Missile boats – *Sa'ar-5* (*Lahav*-class) and *Sa'ar-4.5* (*Nirit*-class), submarines (*Dolphin*-class), and *Dolphin* naval helicopters.

Beginning in the 1960s, Israel's naval force has undergone a dramatic change. The navy's success in the wars that followed the Six-Day War – the War of Attrition, the Yom Kippur War, the Peace of Galilee War and the struggle to stop terrorist penetrations from the sea – proved that the Israeli Navy capabilities and performances had significantly improved. This established the Naval Arm as a significant factor in the IDF management of hostilities, and in safeguarding Israel's security. Three historical phases marked the development of the Israeli Navy.

Three historical development phases of the Israeli Navy

Initial Phase – from the War of Independence to the 1960s. The latter part of this period saw the introduction of Soviet Missile boats into the naval arena faced by Israel. At that time, Israel's naval force consisted of a small number of combat vessels of varied origins, and the concept that guided those in charge of naval combat mainly relied on the Israeli Air force. In fact, at that time the Israeli navy operated *de facto* as a coastal guard! In the nineteen-year period between 1949 and 1967, the Israeli Navy was rarely involved in combat, and

whatever operations it carried out behind enemy lines were modest and lacked any power to change the odds.

Second Phase: From the 1960s to 1973. Over this period, Israel fought three wars – the Six-Day War, the War of Attrition, and the Yom Kippur war – and formulated a new combat concept where the naval power operated independently of the Air Force. It became clear that the Israeli Air Force was no longer capable of preventing attacks at sea and from the sea, and could no longer guarantee Israel's sovereignty at sea. The naval arena had become an independent combat scene. The navy's mission was providing an independent operational response, based mainly on missile boats, a few submarines and low-intensity (guerilla) warfare.

Below is a short summary of the Israeli Navy activity in The Six-Day War and in the War of Attrition:

1. The Six-Day War – in which the Navy ORBAT was based on first-phase vessels and on the naval commando unit – proved a total failure. Although presented with an extraordinary opportunity, the Navy was unable to exhibit any concrete achievement. This failure could not be blamed on the absence of missile boats, which were still under construction, but on the way the navy was managed and its consequent demeanor. At that time, 12 missile boats were under construction in France. When the Red Sea Command was set up after the 1967 war, six additional Israeli-made *Sa'ar-4* missile boats were built, which were almost twice as large as the earlier French-made ones (*Sa'ar-2* and *Sa'ar-3*).
2. In the War of Attrition, the Israeli navy performed numerous successful operations, most of which were carried out by the naval commando unit. They included about 80 operations behind enemy lines, which paved the way for remodeling the Israeli Navy on three levels. a) For the first time since the War of Independence, the navy established itself as part of the IDF operational makeup; b) They boosted the GHQ trust in its naval commanders, and restored confidence in the navy's combatants; c) They proved that the navy was able to operate independently in all the combat arenas.

Naval Outcomes of the Yom Kippur War

In the Yom Kippur War, the Israeli navy won tremendous achievements on its two combat scenes – the Mediterranean and the Red Sea. The war cost the navy only three human lives.

The following main factors were behind the Israeli Navy success in the Yom Kippur war: 1) From the very beginning, the fighting in the two arenas was transferred to the enemy's shores and anchorages. An offensive strategy and deployment immediately replaced the previous defensive one. 2) Professional and resolute command, force management, and performance on all the levels: The naval forces stormed the enemy independently of aerial support. 3) Thorough preparation: The tactical combat doctrine formulated earlier and incorporated into the forces' training, proved appropriate and justified. 4) Judicious and structured combination of combat doctrine, weapons, proficiency and battle spirit. 5) For the first time in its history, the Israeli Navy relied – at least in the Mediterranean – on a modern ORBAT, equipped with state-of-the-art naval systems in reasonable quantities.

In spite of the above, the navy had to overcome a number of significant drawbacks: 1) Its main weapon systems (missile boats) had never been tested in battle, while the Egyptians had already gathered experience sinking INS Eilat and the fishing boat Orit. 2) The overall number of Israeli naval vessels remained inferior to that of the enemy, at a ratio of 1 to 3: Missile boats – 14 against 23, submarines – 0 against 12. 3) The enemy Styx missile warheads were significantly superior to the Israeli Gabriel warheads in a number of parameters: The range of the Styx was 2.5 times longer and its warhead had three times more HE; the Styx warhead was fully active, i.e. was equipped with a self-homing radar. 4) The Israeli naval forces deployed in the Red Sea were quantitatively and technologically inferior to those of the enemy (compared to any other combat arena in the war, as well as to the Israeli Navy ORBAT in the Six-Day War). The vessels deployed there did not have offensive capabilities and were in fact designated for defense, landing and transport. The ground and air forces deployed there were also few. The Red Sea arena, a remote, isolated, besieged desert arena, stretched over 350 km, and came under massive attack, whose purpose was occupying it. As early as the first day of the

war, 28 Egyptian MIG aircraft attacked Sharm El-Sheikh, and 45 helicopters landed along the Suez Gulf coast. The Israeli naval force deployed in the Red Sea included: 4-5 *Dabur*-class patrol and guard boats; 6 obsolescent LCT's; 6 *Tzir 'a*-class mini-boats (in Eilat); and one auxiliary ship, a highly vulnerable target. 5) At my demand, 45 naval commandoes deployed in Sharm El-Sheikh, albeit no earlier than the third day of the war. In spite of all these disadvantages, the naval arena was the only scene of a categorical IDF success in the entire Yom Kippur War. The outcomes of this success were as follows: 1) It prevented the opening of another front on the Mediterranean, which would have disrupted force mobilization, impacted the rear and hindered Israeli maritime trade and incoming provisions. 2) The Arab navies lost numerous (44) vessels on both arenas, and their ports and coastal infrastructure suffered significant damages. 3) Freedom of action and maritime passage were secured through the Suez and Eilat Gulfs. In the Mediterranean, freedom of action reached far beyond the IAF operational range. The Arab fleets retreated to their coasts and ports, enabling about 200 vessels to sail the Mediterranean routinely on their way to and from Israel's ports, carrying oil, weapons and merchandise. 4) The threat on Sharm el-Sheikh and its nearby straits was removed, and an option was created (which did not materialize) to land an armored division on the southwestern coast of the gulf, as an alternative to crossing the Suez Canal. This advantage was won by three naval commando penetrations into the densely fortified Hurgada anchorage. 5) The flowing of oil from the Suez Gulf to Eilat was resumed immediately after the war. Egypt, however, deprived itself of this option, having mined the strait at the entrance to the Suez Gulf.

The Israeli Navy's confrontation with the Egyptian and Syrian navies ended on 24 October 1973, with the following results:

Vessels lost	Egypt		Syria	Total	Israel
	Mediterranean	Red Sea	Mediterranean		No vessels lost (three casualties)
Missile boats	5	2	5	12	
Other naval vessels	2	4	2	8	
Armed fishing boats	2	19		21	
Captured naval vessels		3		3	
Total	9	28	7	44	
Naval bases penetrated	1*	5**		6	
Bombed/sabotaged coastal positions	6	3	4	13	

* Naval commandoes penetrated Port-Said port.

** Adabiyah naval base was captured; *Dabur*-class patrol boats penetrated Marsa Thalamat naval base; naval commandoes penetrated Hurgada naval base three times.

Third phase: The naval scene following the 1973 war – significantly increased naval threat

In the wake of the 1973 war, the naval scene underwent a substantial change, and the naval threats grew significantly. The enemy's naval ORBAT grew massively and improved considerably in terms of technology and coastal deployment. The defeated Egyptian and Syrian navies, as well as other Arab navies, accelerated the procurement of modern naval means developed worldwide, which became available to the Arabs. Following the war, and for a long period thereafter, the enemy's main ORBAT (missile boats, submarines and naval helicopters) grew by tens of percents. All the Arab navies were modernized and acquired modern western vessels and systems: 1) Long-range missiles (70-300 km) of various types, adapted to the naval arena. Nine types of modern warheads were introduced, designed for launching at sea, from the air and on land, replacing the Styx, the only type used against Israel in the Yom Kippur War. The missiles had improved accuracy and more potent warheads. Most of the missiles were provided by Western sources (French, Italian, American, Norwegian, and others). 2) Syria, Egypt and Libya set up coastal commands based on shore-to-sea missiles, naval helicopters and radar-controlled guns. 3) Dense

control, observation and fire control dispositions were set up, covering long ranges, and directed at naval targets beyond the horizon. 4) Israel's withdrawal from Sinai in 1979 severely cut down its strategic depth. At the same time, Israeli ships, including naval vessels, began sailing the Suez Canal. Even though the Suez Canal has been open for Israeli ships, there is no guarantee that the situation will remain the same if another war breaks out or if Egypt undergoes internal political changes (for example, if the Muslim Brotherhood seizes power, or if Iranian warships pass through the Suez Canal on their way to Syria).

Seaborne terrorism and Israeli counterattacks

The years 1970-1979 saw a rise in terrorist attacks against Israel at sea and from the sea. They targeted civilians (the Coastal Road attack, whose casualty count was the highest of any previous terror attacks), and sea-lanes (the attack on the tanker Coral Sea). Seaborne terrorism also threatened Israeli infrastructures, such as seaports and power stations. In 1979, after a decade of unsuccessful Israeli efforts to curb such attacks, the Israeli Navy adopted a new combat policy against terrorists penetrating from the sea: The observation points network (58 points) that had been previously deployed along the coast was replaced by offensive initiatives rather than defensive activity. This new concept combined surprise, continuity and diversity of initiated activity types. The Israeli Navy no longer focused on targeting the spots from which the terrorists set out to sea. It took them by surprise and continuously attacked them at their various staging areas and locations at sea. The naval commandoes were the spearhead of the Israeli Navy offensive anti-terror combat, in compliance with the concept that the best way to fight terrorism was by small special-force contingents. The main task of the missile boats and submarines was supporting those forces and performing defensive and interception missions. By adopting this new approach, the Israeli Navy succeeded in ending the penetrations from the sea. Indeed, from early 1979 to the present, a period of about 39 years, Israel's coasts have been the only sector untouched by terrorism. During the Peace of Galilee war, the navy supported the IDF land forces by delivering fire and landing forces on Lebanon's beaches as part of an overall effort to destroy terrorist

infrastructures in Lebanon. That was the most massive support the land forces had ever received from the sea. In containing terror from the sea and providing support during the Peace of Galilee war, the Israeli Navy fulfilled its mission with full success without suffering any losses in human life or vessels, even though it employed almost the same types of vessels and equipment it had been using since 1973. It was the combat policy and the way the forces engaged in combat that had changed.

SS Missile Threat

In the 1990s, Israel came under increasing threat of surface-to-surface missiles (SSM), which are unaffected by weather and light conditions or by AA fire. Missiles of this kind have targeted seaports and threatened airports. The Israeli Navy had already recognized this threat in early 1979, when it began formulating its new ORBAT concept and outlining the characteristics of its future vessels.

Missile hydrofoils (*Zivanit*-class) – a wrong operational concept for a main naval combat platform

In the years that followed 1973, the Israeli Navy adopted a new combat policy: A decision was taken to set up an ORBAT of 18 small and fast *Zivanit*-class missile hydrofoils (displacement – 100 tons), and use them as the Navy's main surface naval combat platforms. Six *Irit*-class "patrol missile boats" (displacement – about 800 tons), named *Sa'ar-5*, reinforced the *Zivanit* hydrofoils. The small crew required to man the *Zivanit* hydrofoils, their high speed, stability, affordable price and estimated low cost of operation, appeared extremely attractive to the two Israeli Navy Commanders in Chief of that time, Admiral Benjamin Telem and Admiral Michael Barkai. Based on those estimates, they regarded the *Zivanit*-class hydrofoils as an appropriate substitute for the older *Sa'ar*-class vessels (models 2, 3, and 4), which were to be decommissioned over the 1980s and 1990s.

Initially, the main reason for replacing the older vessels by *Zivanit*-class ones was based on mere technical considerations, namely, higher speed and better stability, larger number of vessels, etc. It did not represent a new operational or tactical concept, that takes into account

factors such as 1) Changes in the balance of power between the Israeli and the Arab navies; 2) Changes in the maritime and coastal arena; 3) International technological developments in naval equipment and systems after the Yom Kippur War.



Zivanit-class hydrofoil

However, when the *Zivanit* vessels arrived, they turned out to have an insufficient range and a limited time of operation/stay at sea, meaning that they would have to depend on Israel's few ports, and set out from them to engage enemy surface targets at sea. To strike surface targets over the horizon (the purpose for which long-range Harpoon missiles were installed on the *Zivanit* deck), the Israeli Navy would have to rely on aircraft – over which it had no control – that would take off from their land bases to detect and identify enemy targets at sea. This arrangement was awkward; what is more, experience taught the Navy that the Air Force had difficulty fulfilling this mission.¹

The *Zivanit* plan was approved by Chief of General Staff Lt. General Motta Gur and by Defense Minister Shim'on Peres, even though it

¹ It is worth mentioning that in the Yom Kippur War, the Israeli missile boats gave up in advance (against the original combat doctrine) the option of being assisted by the Air Force in bridging the range gap between the Gabriel and Styx missiles. Behind this was an uncertainty about the availability of aircraft. Notably, of the 44 enemy vessels destroyed or captured in the Yom Kippur War, only one Egyptian missile boat was struck by an IAF fighter aircraft, and even that only after the boat was intercepted by an Israeli missile boat. On another occasion,

had not been discussed by the Israeli Navy senior forum or by any other larger senior forum. The Israeli Navy launched a pilot for the development and production of two *Zivanit*-class vessels – one in the United States, and the other locally, at the Israel Shipyards. Very early on, before the vessels were tested, Lt. Gen. Gur and Defense Minister Peres approved the construction of eighteen such vessels. Curiously, the contract with Grumann for their construction was signed in December 1977, a whole year before the Israeli Navy issued its specifications for this vessel (December 1978), written by the Navy's Head of Weapons Department, Captain Eli Rahav. Construction of the first two *Zivanit* vessels was completed when I was Commander in Chief of the Navy. From the beginning, I strongly opposed their construction, as this was done without checking first their operational and technical compatibility with the Navy's needs. On 13 August 1978, I submitted to Navy Commander Admiral Barkai, and to CGS Gur, a well substantiated professional report written by an American naval officer, who had performed the acceptance tests for the hydrofoils developed by the US Navy before the *Zivanit*-class was procured by Israel. The report warned against the technical and conceptual failures inherent to the employment of hydrofoils as missile boats. The costs of the *Zivanit* construction kept growing. Defense Minister Ezer Weizman and CGS Rafael Eitan, who succeeded Peres and Gur, tried to persuade me to stop the project. I told them it was too late for such a move, as the Israeli Navy would have to pay fines for stopping the construction that would be higher than the cost of the construction itself. Moreover, the involved breach of contract would have severe legal implications, among other things for our relations with the US Navy, which had supported, at the request of the Israeli Navy, approving US FMS (Foreign Military Sales) funds for the vessels' construction.

Once construction of the two vessels was completed and they were commissioned, it became obvious that although the *Zivanit* was a small fast vessel, its capacity to carry anti-missile defense armaments

IAF aircraft did not attack Egyptian missile boats near Sharm El-Sheikh because of the AA fire directed at them from the boats.

was limited. Its high radar, acoustic and thermal signatures impaired its capability to evade missile attacks. The *Zivanit* was detected at a long range; its time of stay at sea was limited and it was under threat in the ports (during the 1st Gulf War and the 2nd Lebanon War, the Navy was obliged to evacuate its vessels from the Haifa port); the *Zivanit* was found to lack the capability of detecting enemy targets over the horizon, and was expensive to operate and maintain. Under these circumstances, I recommended canceling the procurement of 16 additional *Zivanit*-class boats that CGS Gur and Defense Minister Peres had approved, and exploring the possibility of selling the ready boats. The attempted sale did not come through, and the *Zivanit* boats were finally scrapped under Admiral Micha Ram. Eventually, a report of the Defense Establishment Comptroller listed the reasons for the *Zivanit* failure: “The decision in favor of the *Zivanit* was not preceded by thorough staff-work in the Navy, which would have weighed all the Navy’s missions and the different alternatives for responding to all the threats. The CGS decision and approval were not preceded by a discussion by the General Staff forum; no checks were made at the defense minister’s level” (Report No. 77 of the Defense Establishment Comptroller, 26 May 1982).

1979 – A turning point

Rebuilding the Israeli Navy ORBAT

The year 1979 marked a turning point in the Israeli Navy development. A peace agreement was signed with Egypt, which, as mentioned, allowed Israeli vessels to sail the Suez Canal for the first time. Consequently, the navy was faced with a pressing need to address three key issues. The first and most important one was embarking on a “third phase”, namely, building a new ORBAT of vessels that would be able to cope adequately with the threats that had emerged in the naval arena since the Yom Kippur War, and were likely to transform the Navy in the next generation. Two additional pressing issues had to be addressed: The first involved evacuating the IDF bases in Sinai, including naval bases and vessels that had been operating there for fifteen years, and redeploying them in Israel, all at a tight, politically dictated schedule – no later than April 1982. The second was containing terrorism

from the sea, which had become intolerable and required immediate solutions. These two pressing problems threatened to consume much of the time required to achieve the principal goal – rebuilding the Israeli Navy ORBAT. As the newly appointed Commander of the Navy, I resolved to address the three issues simultaneously. I assumed that settling the two latter problems would help gain the confidence of the decision makers, who had the authority to approve and budget the new naval ORBAT.

Following is a summary of the measures taken in 1979 to stop terrorist penetrations from the sea, and consequent upgrade of means and measures towards a total war: 1) The 58 coastal observation points set up following the Coastal Road attack were removed, as mentioned, having been proven ineffective. 2) The ongoing counter-terrorism actions accelerated the integration of new and improved vessels and combat means into the Navy's combat disposition. This enhanced the Navy's alert level and combat readiness, paved the way for implementing advanced methods and techniques, and cut down combat procedure times. Various new means became operational for the first time, and were employed in intensive operational activity of an unprecedented scope, frequency and duration in near and far enemy waters. These newly integrated means included *Ram* and *Dolphin* (small electrical underwater vehicles to carry or tow divers) in the naval commando unit, Hilton missiles on missile boats, and various means installed on *Gal*-class submarines. Each of these systems was tested and proven effective in combat, laying a well-planned and well-established foundation that enhanced the overall capabilities of the Navy and prepared it for a total war. 3) Since all the naval operations, at sea and on land, were carried out in populated areas, the Navy kept them isolated and controlled, to ensure – regardless of the risks involved – that no harm comes to innocent civilians. 4) In both the offensive and defensive operations, the naval forces did not suffer any casualties or damages throughout that year. Terrorist penetrations were completely stopped within six months.² 5) In early

2 Between the terror attack in Nahariya (21-22 April 1979) and the last foiled attempt to attack from the sea (18-19 November 1979), four terror attack attempts were made.

1979, reshuffles were made in the Israeli Navy command echelons, and in the summer of that year, fresh command staffs were assigned to the naval units and to key positions in the Navy HQ. Once the new agenda and organization became established, the Israeli Navy was ready to embark upon the challenge of designing its future force.

1979 – Preliminary measures taken towards building up Israel's naval force: In February 1979, after US Defense Secretary Harold Brown visited the IDF, approval was given to procure for the Israeli Navy two of the world's most sophisticated and advanced weapon systems of that time: The CIWS Vulcan Phalanx anti-missile gun, installed on twelve *Sa'ar-4* missile boats, and the underwater-launched Harpoon missile system, installed on *Gal*-class submarines. Once these systems were installed, the Navy's operational readiness was enhanced by several degrees. The experience gathered in using them benefitted their later installation on future vessels (*Sa'ar-5*, *Sa'ar-4.5* and Dolphin submarines). In May 1983, after this launcher system was installed on *Gal* submarines, and following the first underwater launch of a Harpoon missile, the system was declared operational. Eventually, *Gal*-class submarines were also equipped with an underwater diver retrieval system, which was successfully tested. The system was intended for use by the naval commando unit. Numerous other systems of the *Gal*-class submarines were simultaneously upgraded, and the submarines were involved in an unprecedented number of operations.

6) *Barak* ABM: Approval was given to develop a missile that would offer protection against missiles attacking from any direction. The missile was also to protect vessels against aerial attacks, destroy small missiles (22kg warhead), and accurately strike coastal targets. The qualities and structure of the *Barak* ABM (vertical launch followed by homing in on the attacking target) eliminated the need for a heavy surface gun on deck, freeing deck area and saving weight.

7) In February 1979, construction was completed of two *Chochit*-class missile-boats (*Sa'ar-4.5* carrying a helicopter) designed by the Israel Shipyards. The initiator of the idea to build them was Admiral Michael Barkai, but CGS Rafael Eitan had not approved or budgeted their construction until I was appointed Commander of the Israeli Navy. In fact, once missile boats were equipped with long-range Harpoon

missiles (1978), the need arose for an on-board dedicated helicopter to locate and identify over-the-horizon targets in close real-time coordination with the ship's command. Since the *Sa'ar-4* boats had no AS capabilities, using the helicopter as an AS means was also contemplated. For 4.5 years, *Chochit*-class missile boats built at the Israel Shipyards sailed with a hangar and a helipad on board, while the Air Force delayed the procurement of a suitable helicopter. At that time, about 30 navies worldwide had long been operating ship borne helicopters. At my request, my friend Admiral Tom Hayward, the US Chief of Naval Operations, persuaded Admiral Yost of the US Coast Guard (eventually the Coast Guard Commandant) to sell to the Israeli Navy the two first prototypes of the Dolphin helicopter (the French Dauphine naval helicopter installed with two American General Electric engines). Their supply to Israel was scheduled after completion of their evaluation tests in the United States. Admiral Yost also arranged for me to land on a small US guard boat at sea. In 1982, during an official visit to Chile, I landed with Colonel Ze'ev Liron, then the IDF Defense Attache to Chile, on the crowded deck of a frigate during a flotilla exercise in the Pacific near the Chilean coast. The flight and the landing occurred on a rough sea and a dark and heavily foggy night, with extremely limited visibility. The experience gave us an idea of the limits of this naval helicopter's landing capability in rough sea conditions, but also proved that this was possible. In 1984, after Maj. General Amos Lapidot had replaced Maj. General Ivry as Commander of the Israeli Air force, the IDF procured its first naval helicopters, following evaluation by the Israeli Air force and the Israeli Navy. Once the evaluation stage was over, in 1986, Commander Gal Amit, then deputy commander of the missile boat flotilla, noted down the following: "It is noted that the naval helicopter's evaluation proved successful, [revealing] its potential and operational contribution".

8) In October 1979, after two *Sa'ar-4* missile boats were sold to Chile (for \$72 million), the Israel Shipyards built in their place two new *Noshav*-class missile boats, similar in size to the *Chochit*-class missile boats, but without a hangar and a helipad. *Nirit*-class missile boats (length 64m, width 7m, displacement 488 tons) followed the *Noshav*, with more improved electronic systems: command and control,

detection, classification and identification, fire control system, radar, sonar, electronic warfare and communications. The engines and propulsion systems were also upgraded. The boat was 4 meters (13 ft) longer than the *Sa'ar-4* missile boat, to accommodate the new systems. The *Nirit* carried 32 Barak missile launchers, 16 anti-ship missiles, a 76mm cannon in the stern, and had the capacity to carry 16 Harpoon missiles. It reinforced the navy ORBAT and facilitated its reorganization.



Sa'ar-4.5 Nirit-class (without helicopter)

Reorganization of the naval units' command echelons

The impressive number of missile boats and new systems integrated into the Navy's ORBAT called for reorganizing the missile boat units and their command echelons, as well as those of all the Navy's other seafaring units. With this in mind, the following changes were made: 1) The two missile boat flotillas (#3 and #5) were joined to form a single flotilla (flotilla #3), that was in charge of all the missile boats. Responsibility for the missile boats' command and operation was separated from the responsibility for their professional support and guidance. A Chief Missile Boat Officer was appointed to take charge of the formulation and inculcation of missile boat combat doctrine, under direct command of the Navy Commander. In times of emergency, this officer commanded a missile boat unit. This move

promoted and added depth to deliberations related to future missile boats, especially in matters concerning the combat doctrine of Harpoon missiles, helicopters and anti-submarine (AS) warfare. 2) All the landing craft, cargo vessels and auxiliary ships were concentrated in Ashdod naval base, and additional units were set up in that base. Procedures were determined and manuals were prepared for the operation of large ships during training, grouping and wartime. 3) In early 1979, the three main naval bases (Haifa, Ashdod and Eilat), received the status of arena HQs, with consequent extension of their commanders' responsibilities and powers in and around them, up to 30NM from the coast (in the Red Sea arena, which covered the entire Gulf of Eilat, command responsibilities were extended up to Sharm El-Sheikh). The base commanders assumed full responsibility for all the naval forces and land installations deployed in their arenas, and for their combat preparedness. It is worth mentioning that earlier, the arena commanders were not responsible for the vessels deployed in their bases. For example, the missile boat and submarine flotillas posted in Haifa base were under direct command of the Navy Commander in Chief. After the reorganization, those flotillas were placed under direct command of the Haifa base commander, and he became part of the command chain. If previously the base commander had no authority over the vessels in spite of his senior rank (Commodore) and rich experience, he was now in charge of alert, operation, maintenance, combat preparedness and post-combat debriefing of all the vessels and facilities that belonged to his base. This resulted in significantly improved control and better functioning of subordinate echelons and of vessels and installations deployed in the relevant arena and its bases.³ The reorganization prompted and encouraged commanders to take local initiatives, and enhanced routine security and preparedness for war. 4) In October 1979 (around the same dates as the 1973 Yom Kippur War), a combined-arms exercise, *Nahug*, was conducted under responsibility of the Israeli Air Force, to test the IAF effectiveness in defending Israel's coasts against an attack from the sea. The Navy's

3 With the exception of the terror attack on Nahariya (see above), the enhanced control and better functioning prevented further terror attacks from the sea.

close defense forces (a coastal detection system, *Dabur* patrol boats and LCTs) were subordinated to the Air Force command. The Navy simulated an enemy attack on the Israeli coast (from enemy weapon ranges), with two missile boat squadrons, two submarines and nine naval commando teams. The exercise showed that the Air Force was unable to contain the simulated attack from the sea, and the entire coastal disposition was breached. This proved once again that the Air Force had limited ability in defending Israel's coasts, and that enemy attacks had to be preempted by engagement at sea, before they reached missile range from the Israeli coast.

Third stage combat concept, in response to growing threats from the sea

Three main factors stood behind the construction of naval vessels and their integrated systems: 1) Quantitative and qualitative balance of power in the naval arena, and mutual perceived threats. 2) Existing and developing technology. 3) Nature of the combat arena. Accordingly, the need arose to analyze the naval threat, which had dramatically grown and intensified since 1973, and assess its significance before a new combat concept could be formulated. The analysis revealed the following: 1) For the first time, enemy missile boats and submarines were capable of targeting Israeli territory from the sea by long-range naval missiles. Such missiles could be launched covertly from international sea-lanes and disrupt Israel's maritime traffic and vital infrastructures. Enemy vessels could also mine the access ways to Israel's ports. 2) At the same time, Israel had little ability, if at all, to locate, identify and attack enemy submarines and missile boats operating at great distances from remote areas at sea, as they were beyond its air or land control. 3) In times of emergency, Israel's seaports were vulnerable to SSM and terrorist attacks from the sea and on land. Vessels anchored in them were at risk, and might not be able to set out to sea on national defense missions.

After 1973, responses were devised to meet evolving threats. Strategic concept: In the absence of aerial and ground defense alternatives, the navy had to revise its combat concept and accordingly design combat means that would be able to defend Israel's territory

and protect its population, infrastructures and vital sea-lanes, as well as prevent or foil attacks from the sea. Having a maritime strategic depth would allow Israel to land forces and deliver fire at the rear of neighboring enemy countries, and deter geographically remoter ones. Thanks to that strategic depth, Israeli naval vessels would be able to avoid coastal areas that are exposed to threats from the sea (SSM and terrorism) and cruise in the high seas, keeping their distance from our shores. In 1979, the Israeli Navy therefore determined to make the best of the maritime strategic depth by integrating modern missile boats and submarines, equipped with numerous long-range missiles with highly accurate warheads that make for a substantial firepower. Those missile boats and submarines would stay away from ports and would be able to operate on the surface and under water. They would also provide fire cover to commando and ground-force landing operations on enemy territory. To be able to fulfill these missions, both missile boats and submarines would carry means to defend themselves and evade naval, aerial and coastal threats. They would leapfrog from one combat scene to another, detect and identify enemy surface targets over the horizon, and target enemy submarines. They would attack enemy ports from a distance, and keep the enemy engaged in self-defense. They would prevent reinforcement of expeditionary forces and strategic equipment and guarantee free passage to Israel's commercial fleet.

Operational concept: Alongside the strategic planning, in 1979 the Navy formulated and adopted the concept of a joint naval combat, where missile boats, submarines and naval commandoes operate in cooperation. While each of these offensive power elements would be able to operate independently in combat areas that best suit its nature and capabilities, it would also assist and be assisted by other components operating in the same arena, leaning on real-time communication and coordination. The missile boats would operate in the high seas, the submarines – near enemy coasts and along access ways to enemy ports, and the naval commandoes within the ports and on the shore. In emergency, the missile boats would be the first to leave port and cruise areas defined as “vital waters”, namely, forward areas that are far from the enemy's coastal observation points and air patrols and from the Israeli coast. Those areas, located at a distance of 100-300NM

from the Israeli coast, are most likely to be used by the enemy to launch missiles at Israel. The missile boats would independently put together a naval situation picture, and be ready to set out and strike the enemy. In preparing the situation picture, the missile boats would be assisted by submarines deployed near enemy shores, by the Navy HQ and by other sources in the rear.

Methodology and preparations for building a modern ORBAT: Prior to taking specific decisions regarding the types of vessels and systems that would constitute an optimal response to the new naval threats that followed the Yom Kippur War, the Israeli Navy had to determine the nature, size and properties of the new ORBAT in a structured and methodical way. To achieve this goal, it leaned on the most advanced professional expertise available in Israel and abroad, and on its past experiences and command lessons. The preparatory process was conducted as follows: 1) Between February and September 1979, visits and appraisals were conducted in navies and industrial plants in Italy, France, Germany and the United States, as well as in Israeli plants such as the Israel Shipyards, IAI, Rafael, Elbit, and others. The involved staffs explored and became familiar with global technological trends, and examined platforms, weapon systems and helicopter types. 2) Between May and September 1979, senior Israeli Navy officers (submarine and missile boat commanders and up) participated in seven seminars organized by the Navy HQ to discuss issues regarding missile boats and other naval combat systems. 3) In addition to weapon systems and other key systems used by the navy, the forum discussed past, present and future combat concepts, with a view to determine an optimal response to the evolving naval threats. Among the seminar participants were also representatives of various IDF units, scientific institutes and defense industries, the IDF R&D and Planning directorates, the IAF, the Technion and other defense industries.

Seminars and visits to foreign industries and fleets, to determine the characterization of the surface vessel and submarine ORBAT

The seminars dealt with seven specific topics: 1. Platforms; 2. Propulsion systems; 3. Weapons and other offensive systems; 4. Anti-missile systems; 5. Electro-optics and optoelectronics; 6. Electronic warfare systems; 7. The joint naval warfare concept. I summarized this series of seminars held by the Israeli Navy in 1979, and the principles listed by me served as guidelines for a team appointed to work out the future missile boat's characteristics. These guidelines were: 1) The operational concept behind the characterization and design of the future surface vessels must take into account the nature, conditions and imminent threats of the combat arena, rather than focus on a vessel as a technological system readily available locally or internationally. 2) The final design and configuration of the surface vessel must foresee the nature of encounters with various adversaries, the operational scene, and the means required to confront and deter the enemy during an encounter. 3) Given the ongoing dynamics of change in power balance, technology, and even arena makeup, the design of the future missile boat must be flexible and adaptable to changes and upgrades that are likely to impact every aspect of the naval combat scene, beyond the year 2000.

Objectives, missions and capabilities and of the future missile boat

1) The missile boat, being the Israeli Navy's main surface vessel, will engage in surface combat throughout the naval arena, with the purpose of destroying enemy vessels threatening Israel's coasts and vital maritime traffic.⁴ 2) The chief mission of a missile boat is striking enemy surface vessels, primarily enemy missile boats. 3) The main combat arena of the missile boat is the open sea. It must have superior detection, identification, speed, range capabilities, and accurate weapons. It must be extremely effective in defending the expanse between enemy ports

4 "Vital maritime traffic" refers to ships carrying cargoes defined as vital, and not to sea-lane protection.

and Israel's coast, and destroying any enemy vessel⁵ about to penetrate it and attack the Israeli coast or Israel's vital maritime traffic. 4) The future missile boat will thus confront the main threats faced by Israel from the sea, and be a focal element in winning naval combats. It will afford free action and maneuverability to Israeli forces deployed in the naval expanse described above, and allow the Navy to fulfill its other missions, such as supporting actions on land and protecting Israel's vital maritime traffic. 5) Although the primary mission of the missile boat is engaging in offensive actions in the open seas, it must also be able to defend and support other units under enemy attack – submarines, commandoes, landing forces and other missile boats operating in those areas. All within the limits of the missile boat's capabilities, and considering other naval forces deployed in the coastal areas and in the ports.⁶

Objectives, missions and required capabilities of the Navy, and future naval ORBAT

In June 1979, a meticulously formulated document listing the purpose and missions of the Israeli Navy was circulated among the GHQ members, to ensure that it fully complies with the GHQ conceptual frame of mind. On 30 September 1979, I gave an extensive presentation before the GHQ forum, which was followed by a discussion. Subsequently, CGS Eitan issued a document that determined and approved the objectives and missions of the Navy. This document had invaluable in-principle significance and practical implications, defining the nature of the Navy's bearing and activities for many years to come. The listed missions of the Israeli Navy were as follows: 1) Defending Israel's coasts. 2) Supporting ground forces by flanking from the

5 To achieve this, the future missile boat must be multi-purpose. Namely, it must be able to defend itself and survive all the main threats in its combat area, and not only surface vessels. It must therefore be able to detect and attack submarines and defend itself against aerial attacks. This definition defines its main sphere of action, which had not been included in the preceding *Etgar* program.

6 In the Second Lebanon War, this principle was severely violated when INS *Hanit* (*Sa'ar-5* class) was sailing areas that were under coastal observation (at a 16 km distance from the shore), and was hit by an Iranian shore-to-sea missile (originally the Chinese C-802), operated by Hizballah.

sea. 3) Protecting Israel's vital maritime traffic. 4) Targeting enemy ORBAT and ports. In September 1979, the capabilities required to carry out these missions were redefined, and the Navy's combat doctrine, emergency deployment and states of alert were revised and approved by the GHQ. Consequently, a desirable naval ORBAT was determined:⁷ 1. 24 missile boats; 2. 6 submarines; 3. 30-40 *Dabur*-class patrol boats; 4. 4-6 AS vessels; 5. 14 naval helicopters; 6. 8 LCTs; 7. Anti-missile cannons, until ABMs are developed; 8. An additional military anchorage to be built on Israel's southern Mediterranean coast.

Underlying the buildup of Israel's naval forces was the following rationale: The Arab fleets were modernizing and growing quantitatively and qualitatively at an unprecedented rate, which the Israeli Navy was unable to match – at least in numbers. The marked technological upgrades those navies underwent were cause for extreme concern, and had to be addressed urgently and in-depth. Israel's national security doctrine maintained that war would be ultimately won on land, requiring a strong air force. Given Israel's limited resources and the resultant IDF budget distribution, a feasible budgetary response had to be found for the quality gap at sea, to resolve both the operational and budgetary issues. Consequently, the following guidelines were established for the naval ORBAT buildup: 1) Focus must be placed on achieving a qualitative operational and technological edge, without increasing the number of vessels and systems required to win an Israeli-initiated confrontation on at least one naval arena. 2) The size and quality of the future ORBAT will not exceed the minimal power required to defend Israel's territory, naval facilities and coasts against a threat from the sea. 3) Other available power elements will be taken into account, such as the IAF and other missile boats (*Sa'ar*-4, expected to remain in service until the 2000s). 4) The future ORBAT must be capable of performing and supporting other naval missions, such as protecting vital maritime traffic, force landing, providing fire support to the ground forces and striking strategic targets – including in the periphery, guiding the air force above the sea and demonstrating

7 CGS office, 30 September 1979.

presence and sovereignty. 5) The ORBAT will be built to optimally boost – directly and indirectly – the IDF ability to win a war on land.

Objectives and capabilities of next-generation missile boats

Obviously, the existing ORBAT was unable to accommodate those guidelines. In November 1979, I therefore summarized the process described above in a document titled “Objectives and capabilities of next-generation missile boats”.⁸ The document laid out basic assumptions and in-principle guidelines, based on an assessment of the naval threats and analysis of the envisaged balance of powers and technologies, vis-à-vis the defined objectives and missions of the Navy as approved by the CGS. The document was to remove uncertainties and avoid misunderstandings in interpreting the principles and assumptions underlying the characterization of the future missile boats, as follows: 1) The missile boats’ main combat arena is in the open sea, near enemy targets and in “vital water” areas of the Eastern Mediterranean. These are also the areas where missile boats will spend longer times on missions such as patrol, early-warning and surface combat. 2) The missile boats’ secondary combat arena is the central and western Mediterranean, where their missions will comprise protecting vital maritime traffic around international sea-lanes and near the North African Coast (especially AS defense). 3) Missile boat patrols, demonstration of presence and policing will cover the entire Mediterranean and Red Sea expanse. 4) Coastal areas and ports are secondary operational areas for missile boats, given the inherent limited ability to operate in them. In enemy territory, where defense systems are densely deployed, missile boats will only engage in assisting other naval forces (submarines, commandoes and landing craft) and ground forces, under an air umbrella. Missile boats will seek to cut down their stay near Israel’s coasts, since a late reaction to an enemy attack may prove too late. 5) The missile boats will have the capacity to spend several weeks at sea on missions such as identification, early warning and combat. They will preferably set out for combat from their position at sea (vital water areas or near an

⁸ Navy Commander’s Office, November 1979.

enemy coast) rather than from their homeport. A missile boat must operate autonomously and independently of ports and port services, which might be temporarily neutralized by the enemy.⁹ 6) Main targets – surface vessels, particularly enemy missile boats, at close range and over the horizon. Additional targets – enemy submarines. The missile boats will use their AS capabilities to detect and target submarines in vital water areas and while escorting vital cargo traffic. 7) In coastal target attacks, the mentioned drawbacks and the importance of the targets will be taken into consideration. 8) High operational speed – maximum speed en route to a combat scene or between combat scenes in the eastern and central Mediterranean. 9) Tactical speed – no less than that of the *Sa'ar-4*. 10) Overall available means: a) Offensive weapons – various missiles, cannons and AS means, capable of striking enemy targets at close range and over the horizon in a dense electronic warfare environment. b) A helicopter for surface and underwater identification, surface harassment attacks, and electronic countermeasures. c) The helicopter hangar may be used for covert storage of other dedicated equipment¹⁰ without disrupting the ship's integral armaments. d) Defense and survival means – anti-missile cannons, ABMs,¹¹ AAA, as well as active/passive electronic warfare means. e) Command, control, detection and identification means, to match the foreseen technological scenario of the next decade. 11) The platform to be built will be fit for combat in the Mediterranean and in the Red Sea all year round, and be able to withstand strong storms in those areas. Specifications: a) Patrol and attack, to complement other combat forces – submarines, commandoes and aircraft. b) Modularity,

9 This concept, initially put forward in 1979, was substantiated in the First Gulf War (1991), during the disengagement from Gaza (September 2005 and since) and in the Second Lebanon War (July 2006). Enemy rockets and missiles targeted Israeli navy anchorages, and they had to be evacuated.

10 Permanently and not ad-hoc. Other than housing the helicopter, space will be allocated along the hangar walls for additional gear and integral hoisting equipment. In the newly designed missile boats, unlike other missile boat types, they will not take the space of regular armaments, nor will special hoisting equipment have to be installed. In addition to other advantages, this is to cut down alert and combat preparation times.

11 ABMs such as the *Barak* were under development, to defend against missile attacks, standoff bombs, aircraft and fast surface vessels.

to adjust to changes in future combat systems, but also for flexibility and multi-purpose performances in possible non-standard missions (such as commando, combatant transport, operating grenade-launchers/bazookas, etc.) c) Automation, to reduce the size of operational and maintenance teams to the minimum. d) Uniformity of size, structure and characteristics.

Characterization of the next-generation multi-purpose missile boat

In December 1979, the Navy appointed a committee to determine the properties required in the future missile boat.¹² The committee members were four naval captains. Two had an operational background – Captain Rafi Apel, Head of Weapons Division, and Captain Ze'ev Yehezkeli (deceased), Chief Missile Boat Officer. The other two had a technological background – Captain Elhanan Hatarsi, Head of Vessels Division, and Captain Peleg Lapid, Head of Electronics Division. In March 1980, a first list was issued of operational specifications required in the future missile boat. The committee sent the first draft of the *Sa'ar-5* characterization¹³ to the participants of the earlier command echelons' seminars. After integrating the forum members' comments, the committee presented the document before a Navy forum, where additional comments and suggestions were brought up. Based on all those comments, the draft was updated and re-distributed. The characterization of the future missile boat was based on the following rationale: 1) The boat's volume and decks will be exclusively used to accommodate indispensable military payload – offensive and defensive means and survival means, that is, nothing but systems that are crucial for winning a surface battle. 2) The ship's dimensions will be adjusted to the size of the payload required to win superiority in a combined surface combat along the lines predicted for the 1990s and 2000s, excluding any non-vital additions. 3) To preempt the enemy in the open sea and in "vital waters" during emergency deployment and in wartime, the ships will be capable of staying several weeks at sea, based on the average duration of past offensive wars.

12 Navy Commander's office, 5 December 1979

13 Chief Missile Boat Officer's office, 25 February 1980.

The *Sa'ar-5* missile boat has exclusive techno-operational properties owing to the fact that its specifications and configuration were designed to answer the question "What systems would optimally combine offensive and survival capabilities?" Initially, the Navy committee proposed that the optimal weight of the payload should be 145 tons. However, I deemed it right to instruct the committee to go down to a 100 ton payload and not exceed a 1,000 ton displacement, to avoid antagonizing the decision makers, primarily for budgetary reasons. In fact, I assumed that a 1,000-ton ship would be sufficient to meet the operational specifications we had formulated.

The characteristics recommended by the committee were:

- 1) Equipping the weapon systems with long-range detection and identification means, to detect potential fire platforms. The ship's weapon systems must be capable of destroying the enemy before it detects, identifies and attacks it. The targets are surface vessels and submarines; aerial attacks are the IAF responsibility.
- 2) Equipping the vessel with assorted defense means against standoff missiles or other homing munitions that might be launched at it from surface vessels, submarines and aircraft, to ensure protection of the vessel against such attacks before the launching platforms are detected.
- 3) The *Sa'ar-5* will have numerous offensive armaments for all the ranges and purposes covered by the offensive means at our disposal. They will include: 16 sea-to-sea Harpoon or other advanced missiles; 64 AS/AA Barak missiles, also effective against coastal targets and fast small vessels; 1 Vulcan-Phalanx AS system; 10 AS torpedoes; A helicopter, optionally equipped with AS weapons. Together, these systems will enable employing the most suitable weapons against varied targets at different ranges (in a cost-effective manner), and saturating the arena with assorted armaments that would challenge the adversary's defenses.
- 4) Automation and computation systems will be installed, to cut down the ship's crew to 60 people at most, and shorten reaction time. Such systems would also be used for simulation in preventive maintenance, training and instruction on board.
- 5) The ship signatures will be significantly low (due to the hull's geometry and radar-cloaking coat, engine silencing, cooling systems, propulsion means, etc.). Recent technological breakthroughs made in these spheres

will enable lowering the ship's signatures considerably despite its relatively large size. 6) Inter-compatibility of the ship's systems will be enhanced. The length of the ship enables erecting two masts at an optimal distance of 17m. The *Sa'ar-5* will have a most advantageous mechanical compatibility, particularly a high electromagnetic and acoustic one, due to its surface area and displacement, the integrative planning of its systems, and their overall compatibility with the hull and the propulsion system. This will allow for a high operational output of all the ship's systems. 7) Versatility: Many of the *Sa'ar-5* key systems are multi-purpose. For example: a) The helicopter may be used for the following purposes: detection and identification of surface vessels, AS warfare (modular), electronic jamming, transport of combatants and commanders, targeting SS missile batteries, and rescue and salvaging missions. b) The passive sonar towed-array can also be used to detect snorkeling submarines and surface vessels (passively, at long ranges), and attacks of homing torpedoes. c) The *Barak* ABM, which protects the vessels against missile attacks from different directions, may also be used against close aerial attacks. Its 22kg warhead is effective against small naval vessels, and can accurately strike coastal targets. The *Barak's* radar and optronic lines-of-sight could also be used as active and passive detection and identification means in daylight and at night, in any weather conditions. d) The helicopter hangar may be used for covert ad-hoc storage of dedicated weapons without disrupting the ship's integral armaments. e) The CoDog (Combined diesel or gas) double propulsion system attains a 17kt cruising speed with its two diesel engines, or may reach a maximum speed of about 34kts with its single gas engine. This enables cruising for long periods at an economic speed (for example, in "vital water" areas), rapid transfer to another combat arena, or closing in on an escaping enemy target. The command and control unit of the propulsion system is installed in both a computerized control room and on the ship's closed bridge. f) The mast as a structure: In the *Sa'ar-5* (and in the *Sa'ar-4.5*), the traditional pole-like mast is replaced by a structure designed to shelter most of the ship's external antennas, protecting them from saline water sprays, and facilitating maintenance at sea.

Simultaneous design and construction of missile boats and submarines: An integrative project

1) For the first time in the history of the Israeli Navy, missile boats and submarines were characterized, designed and built simultaneously, to complement each other and create one integrative whole. This approach conformed to the Combined Naval Warfare concept derived from the imminent naval threats, and was meant to avoid a time gap in submarine commissioning, as had already happened in the past. The two vessel types shared several features such as a capability to spend long periods at sea, numerous armaments, and a small crew. In designing and building the missile boats and the submarines, the latest existing and emerging naval technologies were used, with a view to achieve maximum compatibility between the two vessel types, as well as mutual versatility (e.g. dedicated equipment cabinets).

2) The comprehensive approach and the personal involvement of numerous officers in command positions yielded innovative and original proposals for the specifications of the two vessel types. Proposed new specifications were discussed in various forums and tried in war games and exercises at sea. They were presented before three CGS's and four defense ministers, who approved them all.

Below is a description of a war game and consequent decisions that preceded the approval of this advanced ORBAT. The decision-making process for the *Lahav*-class (*Sa'ar-5*) missile boat is described first, followed by a description of a similar process regarding the *Dolphin*-class submarines.

“Yessod Mutzak” war game: Testing the considerations and decisions towards approval of an advanced ORBAT

In April 1980, the GHQ Planning Directorate devised and carried out a naval war game, “*Yessod Mutzak*”, to test the rationale underlying the construction of the new naval ORBAT. It examined the following matters: 1) Objectives and missions of the Navy. 2. Balance of power between the Arab fleets and the Israeli Navy. 3) Protection of vital cargoes. 4) Israeli naval deployment in the Mediterranean. 5) Air force participation in naval warfare. 6) The Red Sea as a secondary arena. 7) Preventing delivery of weapons from enemy countries in the

periphery to Israel's neighbors. 8) Naval flanking. 9) Anti-submarine warfare. 10) Equipping vessels with AA defense means. 11) Attack of remote strategic targets.

The insights gained in the "*Yessod Mutzak*" war game yielded several conclusions. Balance of power between the Arab fleets and the Israeli navy: 1) The missile boat ORBAT must be reinforced. 2) Missile boats should be capable of staying at sea for long periods and engage surface vessels autonomously. 3) Weapons and combat doctrines should be upgraded. Protection of vital maritime traffic: 1) Most of Israel's vital maritime traffic sails the Mediterranean. 2) Merchant vessels carrying vital cargoes whose delivery cannot be delayed will be protected by the deployed ORBAT, and will not be defined in advance as a mission in itself. 3) Merchant vessel protection tasks will be determined and prioritized ad hoc, and will be carried out by a contingent from the Mediterranean ORBAT in cooperation with the IAF. 4) It is necessary to determine the ranges involved in such operations and the ORBAT and weapon systems they require. 5) During naval combat, the IAF may be required to provide the following support: a) Vessel detection by Hawkeye E-2C (*Dayah*) aircraft and visual observation patrols. b) Attacking enemy vessels by aircraft and combat helicopters. c) Attacking coastal targets, such as ports, detection and early warning facilities, coastal defense facilities etc. d) Access-way mining. e) Defending Israeli Navy vessels against aircraft and helicopter attacks. The mode and extent of the IAF participation in naval warfare might be affected by the following factors: a) Enemy vessels equipped with sea-to-air missiles might hinder aerial support, especially at night. b) Limited independent identification ability, especially at night. c) Weather conditions. d) A need for air support at long ranges and for long periods of time.

Approval of the Navy's operational concept and of the *Sa'ar-5* specifications

On 22 July 1980, a GHQ meeting was called following the "*Yessod Mutzak*" war game, to discuss the Navy's operational concept and the *Sa'ar-5* specifications. After the meeting, the CGS officially approved the Navy's operational concept and instructed proceeding

with the *Sa'ar-5* development.¹⁴ In August 1980, after a round of comments and updates by missile-boat commanders and their peers (Lt. Commanders) and higher-rank officers, a second edition was issued of the *Sa'ar-5* specifications. On the same month, the Ministry of Defense Director General appointed a dedicated Vessel Program HQ, which comprised representatives from the Navy, and from the following MOD divisions: the naval division of the Procurement Directorate, the Economic Adviser's office, the Budget Division, the International Defense Cooperation Directorate (SIBAT) and the R&D division. The staff members consulted industrial plants who were likely to be involved in developing the vessel and its systems, studied the data, and wrote a staff paper in preparation for the *Sa'ar-5* project approval.

The Ministerial Committee for Security Affairs headed by Prime Minister and Defense Minister Begin approves laying out a detailed plan for the *Sa'ar-5*

In February 1981, the Ministerial Committee for Security Affairs headed by Prime Minister and Defense Minister Begin approved laying out a detailed plan for the *Sa'ar-5*. The forum received a presentation of the staff paper mentioned above.¹⁵ The committee's decision read as follows: "It is decided to approve laying out a detailed plan of the vessel. Production authorization will be given on condition that a partner is found for the project, and once it is confirmed that such a partner exists. If not – a final decision will have yet to be taken".¹⁶

14 Office of the CGS/Supreme Command HQ, 22 July 1980.

15 Among the meeting participants who supported the approval were Deputy Prime Minister Lt. Gen. (Res.) Yadin, Minister of Agriculture, Maj. Gen. (Res.) Sharon, Deputy Defense Minister, Brig. Gen. (Res.) Zippori, the CGS, Lt. Gen. Eitan, and Defense Ministry Director General Brig. Gen. (Res.) Ma'ayan.

16 Government Secretariat, 27 January 1981. Following this decision, I visited several countries and navies in search for a partner that would participate in financing the *Sa'ar-5* production, as determined by the government. However, all those countries felt that the vessel was far too sophisticated for their needs. In contrast to them, the Israel Shipyards, headed by Mr. Aharon Sakharov, committed in writing to finance the development of *Sa'ar-5* missile boats, at a cost of IL 300 Million, based on the assumption that they would be reimbursed once the Israeli Navy orders the vessels.

Extensive staff work and varied surface naval exercises to determine the *Sa'ar-5* weapon systems

In February 1981, the Israeli Navy launched an extensive staff work under the Head of the Navy Weapons Division (Captain Rafi Apel), to determine the *Sa'ar-5* weapon systems. The staff work was accompanied by combat exercises at the flotilla and naval-arm level, exercises performed in a tactical training facility, and inter-arm exercises.

Operational requirements for the future missile boat (response to a letter by the Chief Scientist)

In November 1981, a document titled "Operational Requirements from a Future Missile Boat"¹⁷ was submitted at the request of the Chief MOD Scientist.¹⁸ The document comprised the following: 1) Analysis of the naval arena. 2) Characteristics of the Arab fleets' weapon systems up to 1990. 3) Potential enemy modes of operation. 4) Strategic naval targets on Arab coasts. 5) Israeli Navy collaboration with the US Sixth Fleet. 6) Missions and vital importance of the naval helicopter. 7) Objectives and missions of the Israeli Navy. In February 1982, a document titled "Book of The Naval Arm Main ORBAT Buildup" was submitted to the GHQ, based on the in-principle makeup of the naval forces decided upon by the GHQ in September 1979.

Naval Arm – Main ORBAT: Comments of CGS Eitan

1) Missile boats (8 *Sa'ar-4*, 10 *Sa'ar-5*); 2) 4 submarines; 3) 6 ASW vessels; 4) 14 naval helicopters; 5) Commando forces; 6) 40 *Dabur*-class patrol boats; 7) LCTs – as required by the land forces; 8) Coastal detection and control disposition. In April 1982, this model was presented to the GHQ, and the CGS concluded¹⁹ as follows: "1) Construction of a vessel over several years will be considered, to withstand encounters with large fleets at great distances. 2) In terms of power and deployment area, we are unable – now or in the future – to respond to every imminent event in the Mediterranean. For occasional or specific emergency needs, we will have to make concentrated efforts

17 Head of Weapons Division, 10 November 1981

18 Chief Scientist, 2 June 1980.

19 CGS office/Supreme Command Staff, 4 May 1982.

at sea and in the air, to guarantee delivery of vital supplies to Israel by sea. 3) The Navy's future ORBAT and makeup will be determined relative to our ability to protect ourselves by maximum use of our existing power, and not according to ultimate needs, as those cannot be assessed due to changes occurring in enemy fleets. 4) No new port will be built. The Navy will continue using the existing ports.²⁰ 5) An alternative ORBAT proposal will be submitted to the CGS. It will include LCTs, which have been omitted from all the proposals discussed in the past. 6) The main Naval components are: a) Surface vessels, submarines, LCTs and naval commandoes; b) The Navy's missions will be reassessed based on examination of the expected effect of adversary air forces in the Mediterranean, including their implications for vessels at great distances. c) At this point, no one can contest the Navy's contention that the *Sa'ar-5* would be the best response. In the longer term, the operational concept in which *Sa'ar-5* vessels operate outside the IAF umbrella must be re-examined. d) The *Zivani*t remains an integral part of the naval ORBAT. The fact that it is in use by the Israeli Navy increases the likelihood of selling it on foreign markets. e) The alternative presented above is accepted with the following modifications: (1) Without a port; (2) 6 helicopters; (3) 8 LCTs; (4) 4 submarines, two of which at sea. One submarine to be bought and not built at the Shipyards, which have no experience in submarine construction".²¹

20 As Commander of the Navy, I objected to building a port in the Gaza Strip, as suggested by CGS Eitan, or in *Gush Katif*, as suggested by Defense Minister Sharon. Those areas were under threat of rockets and even small arms fire. I argued that a military port, which also served as a reserve emergency storage depot, should not be built on the frontline, in the enemy's direct line of fire. The Prime Minister agreed with me, but the Minister of Defense and the CGS disagreed. In fact, although the Prime Minister instructed building a military port in Ashkelon, the port was finally not built, and the Navy continued relying on the civilian port of Ashdod. Notably, the cost of the new port's construction was to be covered by U.S. FMS funds, as stated in the "Ramon" program.

21 The mentioned number of submarines was of crucial significance, even though CGS Eitan's original decision of September 1979 had mentioned six submarines. The instruction to buy rather than build one submarine was a spur of the moment decision, indicating the CGS' lack of familiarity with this matter.

“*Tasrit*” Naval War Game: results and conclusions

Between February and July 1982, the Navy conducted a war game, “*Tasrit*”, in which an IAF representative and Operations Analysis scientists from the Technion participated. The war game was designed to evaluate the makeup of the new Navy ORBAT. The conclusions of the exercise showed clear preference for an ORBAT based on *Sa'ar-5*. The Chief Missile Boat Officer, Captain David Harpazi, issued the format of the “*Tasrit*” war game.²² Purposes of the exercise: 1) Analysis, evaluation and comparison of optional ORBATs, as a basis for decision making about the future naval ORBAT. 2) Devising solutions for possible future events, based on different ORBATs. 3) Obtaining comments, assumptions and assessments of numerous Navy personnel on a series of doctrinal, operational and technical questions, to confront or confirm any issue based on a variety of stands and opinions. Performance: The Chief Missile Boat Officer directed the work. An operations analysis team processed and analyzed the data. The team members were: 1. Lieutenant Alex Koklianski; 2. First Lieutenant (Res.) Uri Shamir – a Technion Operations Analysis professor; 3. First Lieutenant (Res.) Alex Friedman. Exercise outlines: 1) Five surface ORBATs involving similar costs were determined. 2) Four scenarios were proposed for 1989, based on the objectives and missions of the Navy. 3) Ten teams were set up. Every two teams received one of the five proposed ORBATs. 4) Each team devised solutions for the four scenarios, using the ORBAT at its disposal. The teams summarized the solutions in writing and presented them to an assessment team comprising the following officers: 1. Navy Commander, Admiral Ze'ev Almog; 2. Navy Chief of Staff, Commodore Eli Rahav; 3. Head of Naval Intelligence Research Department, Captain Michael Koren; 4. Head of Naval Weapons Department, Captain Raffi Apel; 5. Chief Missile Boat Officer, Captain David Harpazi; 6. Head, *Sa'ar-5* team, Captain Ze'ev Yehezkeili; 7. Commander, Haifa Naval Base, Commodore Avraham Ben-Shoshan; 8. Commander, Ashdod Naval Base, Captain Avraham Ashur (deceased).

²² Chief Missile Boat Officer, 8 February 1982.

Results of “*Tasrit*” war game and conclusions drawn from it: Aerial platforms: 1) A helicopter is required to ensure winning a battle. Data obtained from an Airborne Combat Information Center or from a Hawkeye E-2 are insufficient for over-the-horizon fire. 2) The Navy will not receive aerial support before complete air supremacy is achieved in the surrounding area. 3) The helicopter must have ASW capabilities. Surface-attack capabilities are of second priority. 4) Preferred option: two helicopters per vessel and mini-RPVs. Submarines: 1) Israeli Navy submarines are capable of threatening merchant sea-lanes leading to enemy ports. 2) 3-4 additional submarines may grant an offensive capability in addition to deterrence. Intensive operation of enemy ASW helicopters around enemy ports will impede our submarines’ freedom of action; 3) Submarines will prove effective only in numbers that would enable providing a reasonable operational response on a continuous basis, given operability and availability considerations. ASW: 1) ASW capabilities must focus on defense of specific vital coastal targets or vital vessels. 2) Improved enemy sea-mining capabilities will require extra coast-defense efforts, including a significant ASW capability. 3) Building a significant ASW escort force is of utmost importance both in wartime and under naval blockades. Commando force: 1) The commando flotilla may substitute a submarine in combined battle; cooperation between missile boats and commandoes may prove sufficient. 2) The unique advantage of commando operations is the extreme pressure they create on enemy defenses in the first stages of war. Therefore, simultaneous surface and under water commando operations should preferably be launched against the enemy’s main ports. Offensive capability: 1) In a naval battle, the effect of a missile capable of penetrating soft and thin defenses will be crucial. 2) Striking coastal enemy infrastructures may neutralize adversary forces at the main frontline. 3) Having an ability to damage strategic enemy infrastructures at long ranges will give the Navy vital freedom of action in countries located beyond the Air Force operational range. Such damage may prevent those countries from getting involved in hostilities in our region.

Summary of participants' recommendations: Preference for ORBATs based on *Sa'ar-5*. CGS Eitan accepts the *Sa'ar-5* concept

At the end of the “*Tasrit*” war game, its participants expressed clear preference for ORBATs based on *Sa'ar-5* missile boats. After receiving the war game conclusions, CGS Eitan commented²³ that “the execution was extremely thorough”, and decided to bring the *Sa'ar-5* issue before the Minister of Defense. With regard to examining the long-term aspects of the *Sa'ar-5* concept, the CGS wrote: “I accept the *Sa'ar-5* concept with the necessary military payload as presented by the Navy”. He added, “I accept the claim that the *Sa'ar-5* concept provides a response for the operative/tactical range; for longer ranges, a response will be devised according to need and to the developing options”.

Defense Minister Sharon determines: The Navy HQ is the exclusive authority to characterize the naval vessel. Appoints three officials to check the development and production costs of the Navy's favored vessel under the “*Shahar*” budget

In November 1982, Defense Minister Sharon called a meeting to discuss the development and production of the Navy's ORBAT. The forum included (at their own request) Admiral (Res.) Shlomo Er'el, Commodore (Res.) Gideon Raz (deceased) and Commodore (Res.) Eli Rahav, none of whom was in active service in the navy at that time. At the end of the meeting the minister determined that “the Navy HQ has an exclusive professional responsibility for characterizing the naval vessel”, rejecting de facto the reservations of the three guests. The minister also noted, “The view expressed in the meeting by some of the speakers, namely, that a decision on the construction of a future naval vessel will be mainly influenced by the budget to be allocated²⁴ was a

23 CGS document of 10 November 1982

24 Shlomo Er'el was appointed the Defense Establishment Comptroller shortly beforehand. In this capacity, he was not authorized to express an opinion on the content of the decision but only on the procedures and decision-making process (in most of which he had not taken part). Receiving his professional opinion on aircraft or tanks would have been similarly inconceivable.

misconception”.²⁵ Sharon instructed that once the command discussion group for development and production concluded its work, the MOD CEO, Maj. General Tamir, the Head of the National Security Unit and the Head of the Planning Directorate would check the budgetary implications of the conclusions against the available resources and the “*Shahar*” plan (the IDF Force Build-up Plan). Based on this examination, one of two options will be adopted: 1) “We are unable to undertake constructing a new vessel”, meaning that *Sa’ar-4* missile boats will be upgraded and continue to be built. 2) “*Sa’ar-5* vessels will be built at a slower pace than originally planned”. Sharon also decided the following: Submarines: The State of Israel will not invest in local development of submarines. The existing three-submarine force will remain in service, and the option of purchasing another submarine will be weighed at the end of the decade. LCTs: The minister of defense does not deem possible the construction of seven LCTs under any configuration of the “*Shahar*” plan. However, given the current difficulties faced by the Israel Shipyards and the need to maintain an independent vessel-construction capability, preparations should be made to build two LCTs at Israel Shipyards. ABMs: Although this is an important issue, the project will be included in the procurement program only if an investor is found to cover most of the cost. Naval mini-RPVs: Employment of mini-RPVs should be explored. Naval helicopters: The minister of defense gave his in-principle approval for the purchase of up to three naval helicopters that would be operated from *Chochit*-class vessels. He commented, “The air force and the navy should tighten their cooperation on helicopter operation from land”.

The Tropp (Economic Adviser to the Defense Establishment) Committee recommends developing the *Sa’ar-5* until 1989 and purchasing eight vessels by 1992

Following the meeting at the Defense Minister’s office, a committee was appointed, headed by Zvi Tropp, Economic Adviser to the Defense Establishment. The committee’s task was examining the two options mentioned in the Defense Minister’s instructions, (numbered 1) and

25 Ministry of Defense, 11 November 1982.

2) above), and recommending one of them. In March 1983, the Tropp committee, working under Defense Minister Sharon's instructions, recommended²⁶ "developing the *Sa'ar-5* until 1989, purchasing eight vessels, two of which during the *Shahar-2* period (up to 1992), and looking for additional resources that would enable purchasing three vessels under the *Shahar-2* budget. The Tropp committee also looked into the possibility of purchasing a *Noshav*-class missile boat, which was then under construction at the Israel Shipyard, to decrease the damage caused by the extra time required to develop and build *Sa'ar-5* vessels to the Navy's operational readiness, and to create jobs in the Israel Shipyards in the short-term."²⁷

The Dutch Navy laboratories substantiate the Israeli Navy recommendations for the design and cost of the *Sa'ar-5*. The Israeli Navy considers the U.S. company J.J.M.M. for the project

Between March and August 1983, the Dutch Navy Laboratories conducted a feasibility study of the *Sa'ar-5*.²⁸ The study confirmed that the vessel's design as proposed by the Israeli navy was good, and

26 The Zvi Tropp committee members were the MOD CEO, the Head of the National Security Unit and the Head of the Planning Directorate. The committee appointed a work team headed by Tropp, whose members were representatives of the National Security Unit, the Planning Directorate, the Budget Directorate and the Navy. Over four months, the committee examined, at the Minister's instruction, the budgetary ability to carry through the *Sa'ar-5* project, and the budgetary and operational implications of the other options.

27 The Israel Shipyards began building a *Noshav* (*Sa'ar-4.5*) missile boat of its own initiative and with its own resources, although as Navy Commander I cautioned its management that the Navy could not guarantee it would have the resources to purchase it. The Tropp Committee attempted advancing this option, without success. In 1989, after I undertook the management of Israel Shipyards (which had been on the verge of bankruptcy in 1986), I persuaded then Navy commander, Admiral Ben Shoshan, to allocate the resources required to complete building the *Noshav* hull, based on a newly designed modernized model named *Nirit* (improved *Noshav*), at a "bargain price". The vessel was to complement the combined *Sa'ar-4.5* and *Sa'ar-5* ORBAT planned for the 1990s.

28 Negotiations were launched with the Dutch Navy through my personal ties with the Dutch Chief of Naval Logistics, the late Admiral Willem ("Bill") Kool, with whom I became acquainted at the U.S. Naval War College. Admiral Kool assisted in promoting and significantly reducing the cost of the work carried out for the Israeli Navy by the modern Dutch naval laboratories.

its costs were reasonable. Moreover, following the study, the vessel's hull contour was significantly improved at the recommendation of the Dutch navy and of German and American companies. Requests for proposal (REP) were simultaneously sent to various companies around the world, to find out if they were interested, and receive their quotes for an initial design based on the required specifications.²⁹ The designer selected was the world-famous J.J.M.M., one of whose head figures was Tommy Diamant, a naval architect and a former Israeli citizen. A company such as this works along the customer's specifications, leaning on acknowledged naval engineering specifications and standards. The ship was pond-tested at the impartial Swedish SSPA with very good results.

CGS Levi confirms the need to purchase submarines (Dolphin) with US FMS funds; he also accepts the “package deal” idea, i.e. constructing missile boats in the United States and submarines in Israel/Germany

In August 1983, CGS Moshe Levi concluded the following: “The operational need for submarines (Dolphin) is definite and hereby approved; Realization will be based on US FMS funds in the usual way”.³⁰ In September 1983, given the US Navy's categorical objection to building conventional submarines in the United States, and the need to abide by the legal terms of the US FMS, I brought before the CGS a proposal to bind together the missile boat and submarine projects into one “package deal” in the construction program up till 1995. The program was to be financed by US FMS funds, and be executed through a principal American contractor, who would involve the Israel Shipyards in building some of the platforms, and the IAI in integrating their combat systems. The submarines would be built in Europe and/or in Israel, with US FMS funds. The CGS gave me permission to bring this proposal before the US Navy Commander, Admiral Watkins

29 The Navy HQ issued the REPs to save time and advance the planning, as part of the requirement to “check the capacity to realize the plan”.

30 CGS office, 18.8.1983. The submarine issue came up again on 14-24 November 1983, and is discussed separately below. It is mentioned here to provide the background for the Defense Minister's discussions of the overall Navy ORBAT outlines.

and Secretary of the Navy Lehman. I brought the proposal before them in the presence of Maj. General Menahem Meron (deceased), the IDF Defense Attache to the United States, and they both received it with enthusiasm. At the demand of the US Navy chiefs, I signed a document in which I undertook to refrain from proposing in future that the submarines be built in the United States. Consequently, the US Navy released to the Israeli Navy technologies that were required for the construction of its new vessels, which had been on hold until then. The proposed “package deal” was later discussed again with the US Secretary of Defense. In September 1983, newly appointed Defense Minister Arens requested an update on the decisions concerning the Navy ORBAT. On 15 September 1983, the Navy program for the *Shahar* budget period was presented to Minister Arens. Commodore Alex Faran and Captain Yitzhak (Coral) Almog of the Israeli Navy attended the presentation. The minister was informed that the *Sa'ar-5* feasibility tests and specification analysis had been completed.

CGS Levi and Defense Minister Arens approve the Navy's request to finance a preliminary design for the *Sa'ar-5*

The Navy informed the defense minister that the time had come to begin a preliminary design, prior to performing a detailed design. To proceed with this stage, which was to take until 1985, \$10 million were required. Once preliminary design was completed, construction could begin and would continue until 1990, at which time the Navy would receive the first vessel. The discussion of this issue continued on 5 October 1983, and was concluded as follows: “The Defense Minister [Arens], adopts the CGS' [Levi] recommendation, and approves performing a preliminary design for the *Sa'ar-5*, at a cost of \$10million”.³¹ On 9 October, Deputy CGS David Ivry wrote the CGS a letter in which he protested the Minister's decision to approve the preliminary design of the *Sa'ar-5*.³² In November 1983, CGS Levi informed Defense Minister Arens that “all the preconditions for the decision to perform a preliminary design have been met, and

31 Military Secretary to the Defense Minister, 5.10.1983. That was the first practical decision followed by actual allocation of resources towards the *Sa'ar-5* construction.

32 Deputy CGS, 9.10.1983.

there is no reason for further delay". Indeed, on 10 November 1983, the Defense Minister reconfirmed "taking the contractual measures required for the preliminary design approved by him in the past"³³

Tour of the US in search of a shipyard to build the submarines (against the US Navy stand)

Between 14 and 21 November 1983, an Israeli delegation visited several US shipyards to find out whether they were willing and capable of building submarines (despite the US Navy objection to building them in the US). The delegation comprised representatives of the Defense Ministry, of the MOD New York Delegation, and of the Israeli Navy (including Commodore Alex Faran – Chief of Naval Logistics, Captain Yaakov Arbel – Head of Naval Development Division, Mr. Arie Laor – Head of Naval Systems at the MOD Procurement Directorate, and Mr. Ehud Aharon of the MOD New York Delegation). The visit followed the CGS decision of August 1983 to build Dolphin submarines with FMS funds, and further to the planned construction of *Sa'ar-5* missile boats at the Israel Shipyards (as recommended by the Tropp committee in March 1983). Behind the need to involve American shipyards in the *Sa'ar-5* construction were the following reasons: 1) Pressure to make extensive use of FMS funds. 2) Transfer of advanced technologies to Israel Shipyards. 3) Participation in the vessel's preliminary design meant creating an option of independent production in the future.

The Zussman Committee recommends performing the *Sa'ar-5* preliminary design in the United States. The Defense Minister and the MOD CEO give their approval

On 3 December 1983, MOD CEO Maj. General (Res.) Menahem Meron appointed a committee headed by Economist Prof. Pinchas Zussmann (Siko, deceased), with Zvi Tropp and Commodore (Res.) Hanoch Ben Eliyahu (former chief of naval logistics) as members, to recommend a company that could be entrusted with performing the *Sa'ar-5* preliminary design. This followed a decision taken in

33 CGS office, 10.11.1983

June 1983, to hire US Companies for the *Sa'ar-5* preliminary design (given the need for American technology), based on the Defense Minister's approval of using FMS funds for this purpose. The committee was appointed after the Israel Shipyards had appealed against the decision, demanding to perform the preliminary design in Israel. The MOD had issued earlier a tender for the *Sa'ar-5* preliminary design through the Israeli MOD Delegation in New York. Four companies competed for the vessel's preliminary design and four competed for designing its combat systems' integration. On 4 January 1984, the "Siko Committee" recommended hiring a US company for the preliminary design. On 16 January 1984, the MOD CEO approved the Committee's recommendations.³⁴ On 20 January 1984, the Minister of Defense gave his approval to the recommendations.³⁵

Senior US Navy officials express appreciation for the Israeli Navy *Sa'ar-5* specifications, planning and construction methods

In February 1984, the *Sa'ar-5* project and its specifications was presented to senior US Navy officials by Israel's Naval Attaché to Washington – Captain Micha Ram (deceased), the head of the *Sa'ar-5* project – Captain Yitzhak Almog, and the head of underwater electronics section – Commander Shmuel Shelef. We requested to receive their authorization to release advanced classified technologies to the Israeli Navy (especially technologies related to the vessel's electromagnetic, acoustic, and optronic signatures, and to underwater detection systems). This authorization was required, among other things, to evade difficulties the US Navy might make for the American companies performing the vessel's preliminary design. The US Navy seniors expressed their appreciation for the Israeli specifications and planning and for the method adopted for the *Sa'ar-5* construction.

A contract is signed for a preliminary design of the platform and its systems

On 30 March 1984, a contract was signed with J.J. McMullen, for a preliminary design of the platform and its propulsion systems in

³⁴ MOD CEO's letter, 16 January 1984

³⁵ Military Secretary to the Minister of Defense, 20.1.1984.

cooperation with the Israel Shipyards; a contract was also signed with Rockwell, for the integration of the *Sa'ar-5* and Dolphin submarine weapon systems, in cooperation with the IAI missiles division.³⁶ In May 1984, the *Sa'ar-5* project team issued a staff document for the Navy ORBAT buildup, as part of the general IDF ORBAT buildup.

Letter by Admiral Almog to the Defense Minister warns against foot-dragging in allocating the resources required to realize the navy ORBAT buildup

In August 1984, I wrote Defense Minister Arens a letter, in which I complained about foot-dragging in the allocation of resources for the navy ORBAT buildup. I warned that unless the matter was immediately resolved, the Navy would enter the 1990s unprepared and unfit.³⁷ On the same month, the TLR (top-level requirements) for the *Sa'ar-5* design were approved as a by-product of the operational specifications on which the preliminary design was based. My letter was followed by three meetings, in which the Navy ORBAT was discussed by the CGS and the Defense Minister.³⁸ Between the second and third discussions, and after the Air Force and the Navy had reached agreement about current and future Air Force participation in naval combat, the CGS held an interim meeting (at the Defense Minister's instruction) in preparation for the meeting that was to be held at the Defense Minister's office. In the interim meeting (21 August 1984), budgetary alternatives for the Navy ORBAT were presented to the CGS.

36 Letter of the New York Delegation head. Although the two companies were leaders in their field, they employed specialized subcontractors for specific matters such as signatures, electromagnetic compatibility and pond tests. Before defining a scope of work (SOW) for the design company, five alternatives were examined, of which the Navy initially chose two, based on discussions of milestone follow-up, before proceeding to choose the best final alternative at the second stage.

37 Letter dated 7 August 1984: "Navy's envisaged preparedness in the 1990s".

38 Letter of the military secretary to the Defense Minister, 7 August 1984.

Table 1: Navy ORBAT Buildup Budgets (\$ millions)

Ser. No.	Topic	Total		Shahar 1		Shahar 2		Shahar 3	
		Local	Credit	Local	Credit	Local	Credit	Local	Credit
1	Total needs	331.0	820.0	97.0	96.0	140.0	441.0	94.0	283.0
2	Total resources	331.0	820.0	97.0	96.0	140.0	441.0	94.0	283.0
3	Gaps	—	—	—	—	—	—	—	—
4	Missile boat construction	28.0	158.0	2.0	10.0	10.0	79.0	16.0	69.0
5	Missile boat systems	91.9	240.3	22.6	7.0	49.0	114.0	20.3	119.3
6	Submarine	25.3	334.7	5.6	56.0	6.2	204.0	13.5	74.7
7	<i>Pleshet</i> LCT	47.0	13.0	17.0	5.0	30.0	8.0	—	—
8	Naval helicopter	—	58.0	—	18.0	—	20.0	—	20.0
9	ABM – “ <i>Mishkal Negev</i> ”	79.0	6.0	25.0	—	28.0	6.0	26.0	—
10	Weapon upgrades	17.5	—	16.8	—	0.7	—	—	—
11		42.3	10.0	8.0	—	16.1	10.0	18.2	—

Alternative 0+ is approved

In the meeting held on 21 August 1984, the CGS approved the alternative known as “0+”, which included the following ORBAT: 4 *Sa’ar-5* missile boats and 3 Dolphin submarines, as well as helicopters, ABM development and upgrade of existing missiles, but no LCTs. In the meeting, the CGS noted that the program had already been approved in the past, although there were objections to it from the start. The CGS concluded the following: 1) The Navy would present to the Defense Minister the alternatives that fit into the budgetary framework approved by the CGS. However, additional alternatives may be proposed in future, subject to impending changes to the budget. 2) Alternative 0+ may be adopted as proposed by the Navy. The CGS agrees, however, to give up LCTs even within this alternative, and use the extra budget to bring forward the upgrades to the *Sa’ar-4*. 3) Alternatives 3 and 4 proposed by the Navy (assuming additional budgets in *Shahar 2*) should include a larger number of submarines, and not only additional *Sa’ar-5* missile boats. 4) The CGS approves the Deputy CGS’ decision to add \$10 million (in NIS) to *Shahar 1* and \$23 million (in NIS) to *Shahar 2*, and advance \$48 million from *Shahar 2* to *Shahar 1*. 5) The Financial Adviser to the CGS and the IAF will run an examination

and submit data on the total cost of purchasing four, six and eight helicopters for the *Sa'ar-5*. 6) The decisions and budgetary allocations for ABMs will remain unchanged.

Summary comparison of the alternatives

Table 2: Comparison of Alternatives (numbers stand for Shahar 1, 2 and 3)

Alternative Criterion		<i>Noshav</i>	<i>Chochit</i>	800t. AS	800t. Helicopter	<i>Sa'ar 5</i>
Detection and identification	Surface	3	2	2	1 2	1
	Underwater	—	—	2	1 2	1
Attack	Surface	2	2	2	1 2	1
	Underwater	—	—	2	2	1
Defense and survivability	Surface	3	3	1	1	1
	Underwater	2	2	1	2	1
Combined operation with existing ORBAT		2	1	2	1 2	
Versatility		3	2	2	2	1
Maintainability		3	3	1	1	2
Manpower		3	3	1	3 1	
Cost		1	1	1	3 1	

The alternatives presented in the third meeting called by the Defense Minister (24 August 1984), included the following vessels: *Sa'ar 4*, improved *Sa'ar 4*, and *Shalhevet* (a 550 ton displacement vessel). They were compared with the *Sa'ar 5* alternative, including budgetary options. In the meeting, Commodore Gideon Raz was given another opportunity to present his different approach to the Naval ORBAT, which was based on surface vessels of the the *Zivanit*-class order and *Sa'ar-4* missile boats.³⁹ The CGS once again noted that the program had been approved in the past, notwithstanding alternative proposals based on improved *Sa'ar 4* had been brought up by those who objected to it.

³⁹ It is recalled that the “Defense Establishment Comptroller’s report on *Zivanit* and *Sa'ar 5*” of 26 May 1982, severely criticized the staff work that should have been performed for the *Zivanit* program (See p. 14). CGS Eitan and Defense Minister Weizmann had accepted my recommendation not to continue building *Zivanit*-class vessels. Raz’ proposal was therefore anachronistic and completely outdated at that time.

Conclusions of Minister Arens

Minister Arens concluded the following:⁴⁰ 1) “The vessel’s dimensions will be determined considering the systems it must accommodate. The vessel itself should be mainly regarded as a platform. The concept of a 1,000-ton vessel should not be dismissed outright [!]. 2) In contemplating the makeup of the Navy ORBAT, the primary consideration should be whether we are confident of having the budget required to realize the program. To find out whether the *Sa’ar-5* development and production program is viable in terms of budget, [Minister Arens] requests receiving a breakdown of the budgetary resources and of the costs involved in developing and purchasing the ORBAT components. 3) Extending the development process over a long period of time (for example, as a result of budgetary constraints) often proves to be a mistake, among other things because it increases the development costs”.⁴¹ On 24 August 1984, the Planning Directorate, working under the Minister’s instructions, examined an alternative budget for the ORBAT buildup, which included a 10% security margin to make up for budget uncertainties. On 28 August 1984, the different alternatives were brought before the CGS, who determined that alternative 0+, which included building *Sa’ar-5* boats

40 Defense Minister, letter of 27 August 1984.

41 The two Defense Ministers – Sharon and Arens – were favorably disposed towards the Navy ORBAT. However, Arens’ arguments (August 1984) contradicted those of his predecessor Sharon. Sharon had said (11 November 1982): “The view of certain speakers, that the decision to build future vessels will be mainly influenced by the allocated budget, is wrong”. Arens thought differently than Sharon, and objected to his words, “After studying the budget, the process of building the *Sa’ar-5* will be long and more extended than planned”. It is recalled that at Sharon’s instruction, the Tropp Committee ran an extensive examination of the available resources, after which it submitted its recommendations (March 1983), which were accepted by CGS Levi, namely, adopting Option 0+. The question therefore arises why Arens, after having been updated, once again instructed, “Checking whether the *Sa’ar-5* development and production program was viable in terms of budget”, and why he requested an analysis of the budget resources and of the costs of the ORBAT components’ development and procurement, even though this had already been done by his predecessor. Luckily for the Navy, CGS Moshe Levi served as Deputy CGS and CGS under three successive defense ministers, was aware of the metamorphosis the decisions were undergoing, and kept alive the earlier decisions...

and submarines but no LCTs, was selected. The calculated available budgets for missile boat construction were:⁴²

Table 3: Alternative 0+ without LCTs (project canceled)

Item		Navy \$525 million	Planning Directorate \$321-416 million
Number of vessels	<i>Sa'ar-5</i>	4	2-3
	Improved <i>Sa'ar-4</i>	8	4-6

Rabin is appointed Defense Minister; the selected *Sa'ar-5* configuration (out of five alternatives contemplated in the preliminary design review) is shelved (once again)

When Defense Minister Rabin entered into office in September 1984, he asked for a memorandum describing the status of the *Sa'ar-5* project.⁴³ Between 2 and 14 December 1984, the design companies McMullen and Rockwell presented their Design Review No. 1 for the "*Lahav*" (*Sa'ar-5*), in which they checked the vessel's configuration and froze its specifications.⁴⁴ The configuration that was finally selected as the sole configuration to be used in the design work was a 76-meter long vessel, with a continuous superstructure. Displacement was determined at 1,040 tons, with margins of 1,000 to 1,100 tons (see third column of table below). In the course of the design review performed in November 1984, MacMullen compared the division of

42 Planning Directorate, 24 August 1984.

43 The memorandum, "*Lahav* (*Sa'ar-5*) missile boat – status" dated September 1984 was written by captain Yitzhak Almog ("Coral"), Head of the *Sa'ar-5* project, based on a letter I had written to Minister Arens on 7 August 1984, titled "Navy preparedness for the 1990s". Among other things, the letter pointed out the massive increase in the number of enemy missile boats, whose ratio was expected to reach about 10:1 (136:14) in 1991, with 54 vessels of higher quality than ours.

44 The design review was performed in the United States with the participation of the *Sa'ar-5* project team headed by Chief of Naval Logistics, Commodore Alex Faran and Captain Raffi Apel. They were joined by Israel Shipyards engineers Michael Avraham (deceased) and Dan Rabin, officers of the Weapons Department and Logistic Division including the Head of Development department, Captain Dr. Yitzhak Shaham. It is recalled that five alternative *Sa'ar-5* configurations had been examined, and I finally decided, as already mentioned, to "freeze" the configuration that was later used to proceed with the preliminary design.

dedicated spaces on the *Sa'ar-5* configurations with those of the most advanced US destroyer under construction at that time (DDG-51). The comparison revealed that the operational design of the *Sa'ar-5* was significantly more effective than that of the US Destroyer. From an operational point of view, the *Sa'ar-5* area was used more effectively: the area dedicated to combat systems covered 39% of the total vessel area, namely about 1.8 times more than in the US destroyer (22%).

Table 4: Division of dedicated space (percents of total area, *Sa'ar-5* – 39%)

Space	74m Cont. Superstructure	76m Cont. Superstructure	76m Split Superstructure	76m E.H. Concept	74m Extended 0
Combat Systems	38.7%	39.0%	37.5%	38.4%	34.1%
Ship Control	2.1	2.1	2.0	2.2	3.2
Living	12.9	12.5	13.4	12.0	12.3
Commissary	5.0	4.8	4.8	4.6	5.3
Storerooms	2.4	2.3	2.6	1.8	5.3
Access	7.3	6.6	6.4	6.2	8.6
Propulsion	22.6	22.9	23.2	23.4	21.7
Aux. Machinery	7.4	8.4	8.6	8.3	6.7
Ventilation	1.6	1.4	1.5	1.5	1.5
Unassigned	0.0	0.0	0.0	1.6	1.3
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%

I present the “package deal” formula in a meeting with the US Secretary of the Navy and the US Navy Commander. Both undertake to support financing the Israeli Navy ORBAT buildup project, and authorize releasing advanced technologies to Israel

In my capacity as Commander of the Israeli Navy, I met the US Secretary of the Navy John Lehman in the United States in December 1984, in the company of Israel's Defense Attaché to the United States. In the meeting, a “package deal” formula was agreed on, according to which missile boats would be built in the United States, and submarines in Europe and in Israel. Secretary Lehman and US CNO Admiral Watkins undertook to support allocating financial resources for the project along the lines of that formula, and authorized releasing advance technologies to the Israeli Navy (such as a passive sonar towed-array and reduced signatures of *Sa'ar-5* Missile boat (“*Lahav*”-class).



Sa'ar-5 Lahav class

Length: 85.6 m.

Width: 10.3 m.

Displacement: 1062 tons

Maximum speed: approx. 33 kts

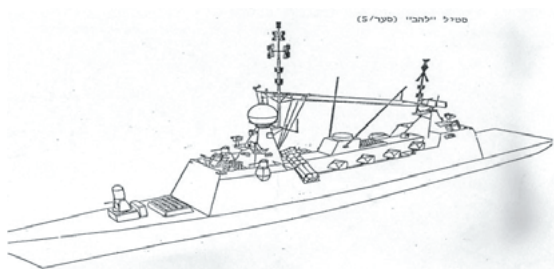
Propulsion: 2 diesel engines, 2 gas-turbine engines

Armaments:

- 8 improved missiles
- 8 Harpoon missiles
- 64 *Barak* missiles, Israeli made.
- 76 mm cannon
- 25 mm AA guns
- Torpedoes
- Helicopter
- The ship will be equipped with an unmanned helicopter

Crew: 62 people (including aircrew)

Command, control and automation systems in uniform cabinets



Sa'ar-5 payload (total – 100 tons)

Offensive means 35 tons	<ul style="list-style-type: none"> – 8 Harpoon missiles – 8 Improved missiles – 32 “Barak” missiles – 2 AA guns – 10 torpedoes
Defensive means 23.5 tons	<ul style="list-style-type: none"> – Consumables – 32 “Barak” missiles – Underwater array – <i>Vulcan Phalanx</i> CIWS
Detection and Identification 27.5 tons	<ul style="list-style-type: none"> – Complete basic detection array – Complete underwater array – 6-ton helicopter
C ³ 7.5 tons	Complete Command & Control array
Infrastructure 6.5 tons	Complete array

Dolphin Submarines

While the Israeli Navy was entering the third stage of its naval force buildup following the dramatic growth in the Arab naval threat after the Yom Kippur War, a decision was taken to design and build new missile boats and submarines simultaneously, to complement each other. As already mentioned, this approach matched the Navy's emergent “Combined Naval Combat” concept. In the meantime, a significant part of the existing naval ORBAT, particularly the submarines, were becoming obsolete. The navy was intent on preventing the damage it had experienced in the past, when a two-year gap occurred between the operation of the T-class submarines (April 1974) and the Gal-class submarines (July 1976), which brought Israeli submarine activity to a complete halt.

The Dolphin project proved lengthy and exhausting. It began in summer 1979, when the Navy began gathering data towards preparing a preliminary characterization. Twenty years had passed before the first Dolphin submarine arrived at Haifa Port on 27 July 1999. The Navy had to overcome numerous hurdles and contend with many objections before the program could be realized. Certain individuals attempted to abort it even after construction had begun. Ironically, the

most significant event that prompted the project's realization was the First Gulf War of 1991. It was the last straw (for Israel and Germany both) that kicked off the submarine project, and authorization was finally given to proceed with their construction.

The successful generation of Gal submarines, which preceded the Dolphin submarines, reached the Navy at a difficult moment, when the necessity of their operational capabilities was not taken for granted. The achievements of the Navy's other combat forces (missile boats, commandoes and *Dabur* patrol boats) in the Yom Kippur War overshadowed the submarine flotilla and its unique potential, and opinions about the vital need of submarines were divided. Frustration grew as various accidents happened to the Gal submarines on arrival to Israel (the worst was the grounding of INS *Gal*, which took a long time to repair), weakening the motivation of the flotilla's officers and NCOs. They lost their self-confidence and their prestige was extremely low. The events also reopened the wound of the *Dakar*'s loss, which had left the authorities psychologically reluctant and concerned about the operation of submarines. In spite of all this, the submarine flotilla, with the unwavering backing of the Navy command, succeeded in taking a number of steps that totally changed the picture.

Steps taken to invigorate the submarine flotilla

The most significant steps taken were the following: 1) The population of potential volunteers for submarine service was expanded to include high-school graduates (and not only graduates of vocational schools). 2) Extra emphasis was placed on prevention of technical failures. 3) The submarines were frequently and intensively assigned patrol missions in enemy waters. 4) Patrol durations were extended. 5) The patrol products were presented to the GHQ forum, to win its members' trust. 6) Top-quality missile boat commanders were appointed submarine commanders. 7) To be qualified as a submarine commander, candidates needed previous experience as missile boat commanders. 8) The submarine flotilla was subordinated to the Haifa Naval Base Commander, to ensure that current problems are promptly dealt with. 9) A monthly report was introduced, which listed and described

recurrent problems and failures. The report was submitted to the Navy Commander and to other relevant officers.

The submarine flotilla commanders and combatants willingly carried out diverse operational missions, including non-standard ones, with outstanding determination and enthusiasm, particularly during the Peace of Galilee Operation in Lebanon (1982). This won them recognition and appreciation in the Navy and throughout the IDF, as well as a reputation of being a trustworthy elite unit. A new operational climate emerged in the submarine flotilla that was primarily an outcome of a newly developed operational concept and a unique combat doctrine. During operations, the flotilla officers proved effective and diligent, leading to the development and perfection of Gal submarine weapons. Considerable effort was invested in developing weapons for Gal generation submarines, thus upgrading their operational capabilities. The rather small Gal submarines underwent numerous modifications and upgrades which surpassed by far the number of modifications normally made in active submarines.

Numerous *Gal* submarine upgrades serve as a basis for the Dolphin submarine characterization

The weapons developed for the Gal submarines were a point of departure and reference for the characterization of many weapons later adopted and installed in the Dolphin submarines. As already mentioned, Israeli security budget constraints, difficulties in local currency financing, and the categorical objection of the US Navy to build conventional submarines on American soil – all motivated me to propose a new formula,⁴⁵ according to which most of the naval

45 This new formula, proposed in August 1983 to Admiral Watkins and Navy Secretary Lehman, turned out to be a winning formula that satisfied all the parties involved, for the following reasons: 1) Mr. Lehman and Admiral Watkins, in the presence of Israel's Defense Attaché, the late Maj. General Maron, accepted it enthusiastically. It saved them the ongoing hassle about building conventional submarines in the US (I signed an MOU in which I committed not to build Israeli submarines in the US and refrain from operating Israeli submarines in cruising areas of US submarine). Consequently, authorization was immediately given to release advanced technologies to the Israeli navy, which were crucial for the *Sa'ar-5* and Dolphin submarines, such as a passive sonar towed-array that the US Navy had firmly refused to release before the MOU was signed. 2) An

ORBAT (missile boats and submarines) would be financed by FMS funds. The US Navy reservations, and the prerequisite for building submarines outside the United States, namely in Israel and/or in Germany, promoted that formula.

My commitment not to build submarines in the United States leads to American readiness to finance their construction in Germany – under the binding FMS terms

Ongoing negotiations between representatives of Israel's defense establishment and American officials revealed that once the United States authorities were convinced that the Israeli Shipyards were capable of building submarines, the US Navy, led by the Secretary of the Navy, would step in and assist Israel. They promised to persuade the Administration to channel FMS funds to submarine construction in Israel, and even convert US dollars into Israeli shekels to that end. Top US Navy officials undertook to promote amending the relevant congress act, to enable covering the cost of submarine design/construction in Germany by US FMS funds. To meet the required quota of FMS expenditure on American soil as determined by the Administration, and to compensate American shipyards that were also pressuring the US Navy to build conventional submarines in the United States, I proposed building two *Sa'ar-5* vessels in the United States and two in Israel, as well as 2-3 submarines in Israel and in Germany. This created a significant link and mutual conditioning between the capability to realize the *Sa'ar-5* production program and the submarine production program (offset funds could be used to finance a substantial portion of the systems that were being developed in Israel for missile boats

unbreakable link was created (in terms of budgeting and construction) between *Sa'ar-5* missile boats and Dolphin submarines, to the Israeli Navy's satisfaction. 3) A major part of the two projects was budgeted by FMS funds, which satisfied the entire Israeli defense establishment. Had the Navy not received that budget, it is doubtful that the GHQ would have been able to allocate resources for the construction of new vessels at that time (in 1984-1985, inflation in Israel was at its highest). 4) All the relevant industries in Israel (Israel Shipyards, IAI, Rafael, Elbit and others) and abroad – in the United States and later also in Germany, benefited from the projects. This was definitely a win-win formula.

and submarines; this guaranteed they would be tailor-made for Israel's needs, and enhanced their confidentiality).

An American committee determines – with German and Dutch support – that submarines may be built in Israel

A professional US Navy committee, supported by a detailed written opinion of the German HDW Shipyards and I.K.L. design company (both specializing in submarines design and construction), concluded that Israel had the technical and organizational capability to build submarines, assuming, of course, that Israel Shipyards made appropriate preparations for the task. The heads of the Dutch shipyard W.F., which had planned the Dolphin submarine concept in parallel to I.K.L., expressed the same opinion. I.K.L. and W.F. announced they were ready to transfer the knowhow required for building the infrastructure, and supervise its construction. In fact, these professional conclusions prompted me to propose the formula presented, as mentioned, in November 1984 to the US Secretary of the Navy, under authorization of the Israeli MOD CEO, in the presence of Israel's Defense Attaché to Washington and the head of the MOD Delegation in New York. Secretary Lehman, who was enthusiastic about this proposal, persuaded Secretary of Defense Caspar Weinberger to appoint the Darby Committee, which conducted a thorough survey in Israel and Germany. The committee's conclusions supported the need and capability to build submarines in Israel. This paved the way for Navy Secretary John Lehman to visit Israel of his own initiative as the guest of Defense Minister Rabin (April 1985), and declare that he accepted the "package deal" (building missile boats in the US and submarines in Israel and Germany). On the same occasion, he also announced ownership transfer (51%) of Israel Shipyards to an American shipyard that would be selected to coordinate and take part in the construction project in the United States and in Israel. Defense Minister Rabin approved this formula in-principle.

Several developments had occurred before the submarines secured an important position within the Navy: The underwater-launched Harpoon missile version became available; improvements were made to the guided homing torpedo; and Gal submarines carried out successful

secret operations near well-defended enemy coasts, proving that they were effectively integrated into the combined naval combat concept (especially during the Peace of Galilee operation). Once all these conditions were met, the submarine force became a significant factor in the Israeli Navy effort to achieve naval supremacy, and a major power element of the IDF strategic deterrence.

Dolphin Submarines: Decision-making procedure

In July 1979, the submarine flotilla commander, Commander Doron Amir (deceased), was asked to prepare a document providing a general characterization of the Navy's future submarines. In September 1979, at a General Staff meeting, the CGS concluded that the recommended naval ORBAT should include six submarines.⁴⁶ In October 1979, an initial characterization of the future submarines was circulated in the Navy. The first significant meeting on the Dolphin project was held with people from outside the navy in November 1979. Commodore (Res.) Avraham Dror (Ivan), the officer in charge of the *Gal* submarines' construction, who had kept contact with the German submarine designer Professor Gabler, communicated to him the initial characterization, and asked for the comments of I.K.L. on the matter. The company's two senior managers, Prof. Gabler and Ing. Noze, visited Israel covertly for a few days. They held discussions with a small forum of experienced senior officers of the submarine flotilla, in which I participated as Commander of the Navy, and inquired about ongoing and potential concepts, based on the initial characterization proposed by Commander Doron Amir. This yielded a general concept for the new submarines. In May 1980, a committee was appointed to characterize the future submarine.⁴⁷ The committee was set up in the Navy GHQ under responsibility of the Logistics Division. Its members were Captain Elhanan ("Ecca") Hatarsi – Head of Development Department at the Logistics Division, Commander Shaul Horev – the submarine flotilla commander, and Commanders Shmuel Shelef and Moshe Biran of the Logistics Division. In summer 1980, the committee, headed by Shaul Horev, met in Sharm El-Sheikh and

⁴⁶ CGS letter of 30 September 1979

⁴⁷ Navy Commander's letter of 18 May 1980.

prepared an updated version of the characterization (known as “the Blue Book”). In July 1980, following the “*Yessod Mutzak*” exercise, CGS Eitan confirmed at a General Staff meeting that a submarine ORBAT was required in addition to missile boats, and concluded: “A general study should be conducted to determine the capability and effect of the number of submarines planned to enter the ORBAT”.⁴⁸ In March 1981, the Logistics Division issued the first characterization of a Dolphin-class submarine,⁴⁹ which became the first “Blue Book” titled “Submarine – A Characterization.”⁵⁰

Directions of development for a future submarine

The main development directions for the future submarine were: 1) Extending the length of stay and combat at sea. 2) Confronting enemy vessels at long ranges. 3) Ability to target helicopters, AS aircraft and sea-targets. 4) Propulsion and combat systems with integrated computer hardware and software. 5) Maximum automation and redundancy, to reduce crew numbers and enhance safety. 6) Using advanced and well-established submarine construction technologies. 7) Ability to keep developing the combat systems throughout their life-span, in keeping with expected changes in the combat arena. 8) Incorporation of commando weapons into the submarine. 9) Displacement of about 1,400 tons, with properties similar to those of the *Gal*-class during operations in the shallows, and increasing effective submersion depth to the maximum.

On 26 April 1982, CGS Eitan concluded as follows a discussion of the Navy ORBAT: “Four submarines, two of which at sea. One submarine to be purchased rather than built by the Israel Shipyards, which have no experience in submarine construction”.⁵¹ On 30 July

48 CGS letter of 22 July 1980.

49 Logistics Division, 1 March 1981.

50 The project book was re-issued when a project team was set up, and upon reaching the initial design and contractual stage for the construction of a series of Dolphin submarines. The purpose of the book was: 1) To serve as a general reference book offering a main body of information to meet the working needs of navy and MOD people. 2) To be a basis for a multi-year project and enable tracking its main developments, events, decisions, and stages.

51 CGS' office and Supreme Command HQ, 4 May 1982.

1982, CGS Eitan concluded the following: Four submarines, priority should be given to purchasing a fourth submarine shortly”.⁵² This decision was prompted by the strong impression the submarines had made on the General Staff during the Peace of Galilee Operation, providing effective support and being readily available during the predominantly land operations. This reconfirmed the calidity of the April 1982 decision, which had preceded the war. On the other hand, the instruction of 30 July 1982 put the Navy in a difficult position. On the face of it, the instruction meant increasing the submarine ORBAT and should have delighted the Navy. After all, it allowed the navy to legitimately search for a new submarine. However, the CGS meant to procure a single ready-made submarine, while the navy had been making efforts for two years to characterize a future submarine, whose design and construction would benefit from the operational and technological experience gathered in the *Gal* submarines. On 11 November 1982, Defense Minister Sharon concluded: “Submarines – the State of Israel will not invest in local development of submarines. A three-submarine ORBAT will be maintained, and the option of purchasing [one] submarine will be explored at the end of the decade”.⁵³

Tour of Germany and the United States to explore the option of purchasing new submarines

Between 23 January and 8 February 1983, a Navy and MOD Procurement Directorate delegation toured Germany and the United States, to explore options for purchasing new submarines (as determined by

52 The Supreme Command HQ's letter stated: “The conclusion of 4 May 1982 remains valid”. Notably, this decision was “a shot from the hip”. As already mentioned, it reflected lack of knowledge and understanding, and was something of “a bear’s hug”. Had it been adopted, it would have taken the Navy back to times and situations it strove to leave behind, for three reasons: 1. Timetables. The General Staff meant to purchase one submarine in the short term, while designing and building a single submarine meant a project with much longer timetables. 2. Financial cost. Purchasing a single submarine of an existing type is quite different from getting prepared to integrate a newly developed submarine (infrastructures, maintenance and docking facilities, spare parts, etc.). 3. Getting equipped with new submarines meant acquiring several submarines and not just one, as instructed by the CGS.

53 MOD, letter of 11 November 1982.

the CGS and the Minister of Defense).⁵⁴ The specified goals of the visit were: 1) Exploring the option of purchasing submarines based on the Navy specifications. 2) Recommending a procurement method. In March 1983, a summary report of the tour was prepared with a view to look for ways to realize it.⁵⁵ The delegation recommended continuing staff work on the following: 1) Approving the project and budgeting it accordingly. 2) Setting up a project team without delay. 3) Ordering a feasibility study at a cost of \$350,000 over six months, to be simultaneously carried out by: a. I.K.L. (in Germany). b. GD/Quincy Shipyard (in the United States). 4) Holding a series of discussions in the Navy, to update the existing characterization based on the delegation's recommendations. 5) Authorizing signing a contract with GD/Quincy for the construction of three submarines (in the United States).⁵⁶ In August 1983, CGS Moshe Levi concluded a discussion of the Dolphin submarine as follows: "The operational need of submarines is definite and approved. Realization will be based on FMS funds, in the customary way".⁵⁷

Approval is given to appoint a submarine project head; the US persists in its categorical objection to building the submarines in America

At the recommendation of the Deputy CGS and the Head of the Planning Directorate, CGS Levi approved appointing a project head – initially a commander and later a captain – from the active Navy staff. In September 1983, the management of GD/Quincy Shipyards announced

54 The delegation members were: Commodore H. Ben-Eliyahu – Chief of Naval Logistics, Captain Y. Arbel – Head of Naval Development Department, Commander S. Horev, Submarine Flotilla Commander, Mr. A. Naor, MOD Procurement Directorate/Navy, Commander S. Shelef, Naval Logistics/Development Department, Israeli Defense Attaché to Germany (in Germany only), Lt. Commander M. Biran – Machine Section (in Germany only), Assistant Naval Attaché to the Defense Attaché in Washington (in the United States only), a representative of the MOD New York delegation (in the United States only).

55 Logistics Division, March 1983.

56 At that point Quincy expressed great interest in building the submarines, and later that year even proposed performing the initial design. The shipyard was building nuclear submarines for the US Navy.

57 CGS' office, letter of 18 August 1983.

that it withdrew its candidacy for building Israel's [conventional] submarines "for corporate policy considerations". I brought the matter before the US CNO, who firmly backed Quincy's decision. In view of the US Navy objection to building conventional submarines in the United States, and the need to abide by the legal terms of the FMS, I submitted to the CGS my proposal to bind together the missile boat and submarine project into one "package deal". My proposal was based on the following principles: Target date for the end of construction – 1995; the program will be financed by FMS funds via a main US contractor; the American contractor will engage Israel Shipyards in the construction of certain platforms, and the IAI in weapon system integration. The submarines will be built in Europe and/or Israel with US FMS funds. The CGS gave me permission to present this proposal to the US CNO James Watkins and to Navy Secretary Lehman. The proposal was also discussed with the US Defense Secretary (see below – October 1984). In November 1983, we approached other potential American shipyards, which were not involved in building nuclear submarines for the US Navy.⁵⁸ Initially, many of them showed interest. In December 1983, after meetings with an Israeli MOD and Navy delegation, three shipyards (Lockheed, Todd, and Tacoma) agreed in principle, but later avoided submitting proposals without approval of the US State Department.⁵⁹ We had reached an impasse and had to find a way out of it without delay.

58 GD/Quincy Shipyards were obviously under pressure of the US Navy. We had initially thought there was concern about leakage of nuclear submarine technologies, whose secrecy was paramount given the US national security concept of a "second strike" capability. We therefore went on looking for American shipyards that were not involved in submarine construction. Behind this stood our dependence on FMS funds.

59 At that point, the US Navy once again fiercely objected to building conventional submarines in the US. It turned out that this applied to any submarine type, including conventional ones, and to external bodies as well. In the background of this objection was an ongoing public debate between the US Congress and the Navy around the high cost of nuclear submarines, which originated in pressures created in Congress and in US Shipyards to build conventional submarines for the US Navy.

***Gal* submarines become obsolete (1992) and provisions must be urgently made for building Dolphin submarines. A preliminary design contract is signed**

At that stage, the *Gal* submarines' life-span was on the agenda. The Navy, backed by the Planning Directorate and the Deputy CGS, pointed out that whatever the operational benefits of the *Gal*-class submarines, they did not justify keeping them service beyond 1992. This was due to their technical condition – especially that of the hull, and to the fact that their weapon systems had limited operational capabilities and were becoming obsolescent. Moreover, the massive technical overhaul they needed would be a tremendous financial burden. Since the new submarines had to be ready for commissioning by 1992, a timetable was devised, according to which the configuration planning was scheduled for as early as 1983 and construction was to begin in 1988, with a view to complete the program by 1992. This paved the way for drafting a preliminary design contract based on European currency. In December 1983, contracts were signed with two designers – I.K.L. – Germany and Wilton Figenord Shipyards – Holland.⁶⁰ Each was to perform simultaneously a preliminary design for the Dolphin submarine. The two designers undertook to submit to the Israeli Navy the main part of the design based on the Navy's specifications no later than May 1984. This was to enable the Navy Command and the MOD Procurement Directorate to determine the following: 1) Necessary updates to the operational requirements. 2) Which of the two preliminary design proposals was preferable. 3) Which company should be selected to proceed with the submarine's design.⁶¹

60 Wilton Figenord Shipyards entered as a candidate for preliminary design following a visit to Israel (at my invitation) of the Dutch Navy Chief of Logistics, the late Admiral Bill Kool, a personal friend of mine, and after GD/Quincy withdrew from the process.

61 There were several reasons for approaching two companies simultaneously: The Navy wished to receive the companies' feedback on its characterization and update the characterization book accordingly. It sought to extract the best from each proposal and explore ways to integrate, if needed, the best ideas of one proposal into the other. Secondly, the Navy wished to guarantee receiving at least one proposal, should one of the companies withdraw for various reasons, primarily political ones. The third reason for including WF Shipyards in the process had

Between June and July 1984, the Navy and the Technion analyzed and appraised the two preliminary design proposals, in order to formulate a rationale for selecting the favorite designer. The differences between the two companies were found to be negligible. In July 1984, the project team presented to me, as Commander of the Navy, the recommendations they intended to bring before the "Larger Navy Command Forum": 1) The Dutch design configuration was closer to the Navy characterization. 2) The German company had an advantage, having met its past commitments in planning the *Gal* submarines.

After the two concepts were presented to the Navy Commander, the two companies' representatives were invited to present their work and demonstrate their capabilities before the "Larger Navy Command Forum". In August 1984, the project team met with the companies and communicated to them the Israeli Navy's requests for improvements in the submitted concepts. The team also commented on the scope of work (SOW) for the preliminary design work. On the same month, I.K.L.'s representative, Eng. Noze, implied that difficulties may arise in receiving authorization to build and sell submarines to the Israeli Navy.

Exploring the option of building submarines at Israel shipyards

As a possible solution, Noze suggested exploring the option of building the submarines at Israel Shipyards, with the support of a German shipyard highly experienced in submarine construction. To discuss this idea, Haim Alroi, deputy head of the MOD delegation in Bonn, met in Kiel with representatives of Howaldtswerke-Deutsche Werft (HDW). He asked them to study the available options and submit a document that would specify what should be done in each of the following alternatives: 1) Building all the submarines in Kiel. A price per submarine was determined for three submarines of 1,200 ton displacement, to be built in Kiel. The price included the platform and the propulsion systems but not the following: a) Combat systems, b) Combat system trials at sea, c) Documentation, d) Training, e) Royalties, f) Any kind of assistance and support by HDW personnel.

to do with the crucial importance of convincing the Germans to adopt a new concept for the pressure hull.

2) Building a first submarine in Kiel and two others at Israel Shipyards. HDW was to provide the plans, the construction equipment and the materials (excluding the six items detailed above).

Conclusions and recommendations of a Defense Establishment committee appointed to check the various options

The committee examined all the available options for building the required Navy ORBAT at Israel Shipyards, including LCTs, missile boats and submarines. With regard to submarines, the following alternatives were considered: 1) Building all the submarines in Israel based on a European design. 2) Building the first submarine in Europe and the others in Israel. 3) Beginning construction in Europe and completing it in Israel. Under consideration were the following points: 1) Israel's need for an advanced shipyard, to meet both civilian and military market requirements. 2) A possible merging of the Navy shipyard with Israel Shipyards. 3) Finding an American partner for Israel Shipyards, to facilitate channeling FMS funds to submarine construction in Israel, taking into account the financial aspects of building the required infrastructure in Israel Shipyards. Against these considerations stood the question of whether it was worthwhile to invest the resources required to develop submarine construction capabilities in Israel, while the global market was saturated with shipyards capable of constructing submarines. Moreover, it appeared extremely difficult to find foreign navies who would be willing to build their submarines in Israel. The idea of building submarines at Israel Shipyards was finally dropped and shelved. On 12 September 1984, W.F. Shipyards, representing Dutch Design Group (DDG), submitted their work to the "Larger Navy Command Forum". The lessons learned from the German and Dutch concepts were applied in updating the Dolphin characterization.

Updated Dolphin characterization based on the German and Dutch concepts

The following steps were taken following the representations: 1) The Dolphin characterization was updated based on the lessons learned from the two concepts. 2) Scope of work (SOW) documents were

prepared with the two designers for the preliminary design and other contractual aspects. 3) The companies submitted their final price quotes for that design stage.⁶²

In October 1984, during a work meeting with Defense Minister Rabin and an MOD team, US Defense Secretary Weinberger acknowledged Israel's need for submarines, and stated that the way to carry the project through would be decided by a special joint committee that will be set up for that purpose.

Defense Secretary Weinberger appoints the Darby Committee to examine the need, the costs and optional alternatives for Dolphin submarine construction

Indeed, Secretary Weinberger appointed the Darby Committee, which eventually confirmed Israel's need for submarines, and gave a realistic estimate of the Dolphin project cost. By this, it turned out to be another link in establishing the *Lahav*/Dolphin package deal I had proposed. Following the committee's visit, a decision was taken to set up a joint Israeli and US Navy team, to explore options for producing submarine parts in the United States, and assembling the vessels outside the United States with FMS funds.

I authorize signing a contract with I.K.L. for preliminary design of the Dolphin submarine. The terms of the contract are determined.

On 16 November 1984, in my capacity as Commander of the Navy, I authorized signing a contract with I.K.L. for a preliminary design based

62 One explicit Israeli condition for signing a contract with a designer was that it commit to perform the project's detailed design, as well as transfer knowhow, guarantee export of equipment involved in the design, provide the shipyard with the required knowhow and advice, and offer the Israeli Navy the required technical services over the submarine's life span. The German company I.K.L., committed to the above, but the Dutch W.F. did not. I.K.L., which was keen on being entrusted with the project, was ready to adopt the Dutch steering method (X-shaped enhanced maneuverability), even before it learned that the Dutch were about to reject the job – one day before their scheduled arrival in Israel – given the Dutch Foreign Ministry's objection to issue export authorizations even for a preliminary design, for political reasons.

on the document titled “Dolphin”.⁶³ On 22 November 1984, a contract was signed with I.K.L., whose implementation was scheduled within six months, to allow coordination with the preliminary design contract signed with Rockwell for the combat systems. On 26 November 1984, the following points were determined with regard to the preliminary design: 1) I.K.L.’s appointment as the designer was confirmed. 2) Maximum submarine displacement – 1,550 tons. 3) The submarine’s design must conform to the given budget limit. 4) The option of selecting a European country to assist in construction will be kept open. In December 1984, I met Navy Secretary John Lehman in the United States, with Israel’s Defense Attaché to Washington, Maj. General Uri Simhoni, and the head of the MOD delegation in New York, Avraham Ben Yossef. In the meeting, a package deal version was formulated, which established building missile boats in the United States and submarines in Europe and in Israel.⁶⁴ At the end of 1984, the basic assumptions regarding the implementation of the Dolphin program were: 1) Since the project will be financed by FMS funds, significant portions of the work must be carried out in the US, to meet the legal terms for using this resource (unless the US government approves deviations). 2) The knowhow required for designing and building small conventional submarines, as well as the sources for some of the submarines’ specific equipment are located in Europe. 3) Once large orders are made from the United States, massive procurement can be made from Europe, and part of the work can be channeled to Israeli industries, under the agreed terms of financing. Preference should therefore be given to signing one comprehensive contract for the submarines and their integrated systems. 4) The components of the missile boat and submarine combat systems should be standardized, for logistic and evaluation purposes. To this end, and in order to utilize existing infrastructures, Israel must insist on involving its industries in producing those systems. 5) From a business point of view, the contract for the supply of submarines and their systems

63 Navy Commander’s Office, 16 November 1984.

64 As already mentioned, after I signed the MOU version proposed by Admiral Watkins, innovative and highly advanced technology was immediately released to Israel, especially technology related to the *Sa’ar-5*.

would benefit from competition. Therefore, the different design stages must appear as separate direct deals in the contract specifications, to create competition within the overall procurement package. 6) The first submarine is to be commissioned no later than 1992; the time interval between each commissioning should preferably be one year, for maintenance considerations.

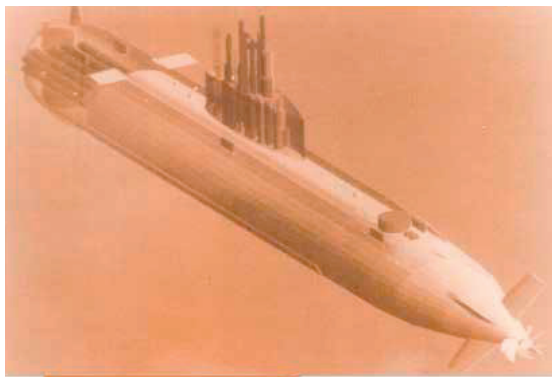
CGS Levi outlines a policy for negotiations with the United States to enable realizing the submarine project

In January 1985, following a presentation by the Dolphin submarine steering team, CGS Levi concluded the following:⁶⁵ 1) The data should be presented to the Americans, and preparations must be made to continue negotiations after the American team's presentation. 2) The CGS endorses Deputy CGS Ivry's standpoint and guidelines affirming that the idea of building the submarines in the United States should not be understood as a tactical move but as an insistent demand. If over the negotiations it turns out that the Americans propose other alternatives, we will weigh them, taking into account the existing constraints – particularly time constraints, before reaching a decision.⁶⁶ 3) The CGS emphasizes that we must act within the financial limits decided on in previous planning meetings. If the costs prove to be higher, we will have to economize by building less expensive submarines. 4) The issue will be brought before Defense Minister Rabin prior to the negotiations.

65 CGS office, 8 January 1985

66 For an unknown reason, these guidelines, issued after several rounds of negotiations with the Americans, ignored all the understandings and benefits agreed on with them, including pressing for a Congress amendment of the foreign aid act, and the MOU signed by the Israeli Navy Commander. I felt we were burying our heads in the sand in a way that would lead to further unnecessary delay. After all, the Americans undertook to resolve the issue; what was the point of communicating mistrust and bargaining with them?

Dolphin submarine model



Total length: 57 meters.

Displacement: (surface cruising): ~1,500 tons

Displacement: (submerged): ~1750 tons.

Propulsion: diesel and electric engines

Maximum speed: 20 kts.

Maximum snorkeling speed: 12 kts.

Crew: up to 45.

Torpedo tubes: 10

Admiral Ben Shoshan's takes office as Commander of the Navy

In March 1985, immediately after his appointment as Commander of the Navy (1.2.1985), Admiral Ben Shoshan presented the Navy's operational concept to Defense Minister Rabin. In a follow-up meeting with Minister Rabin (May 1985), the Defense Establishment Comptroller, former navy commander Admiral (Res.) Erel, expressed his objection to the Navy's approach and its proposed response to the evolving naval threats. In a third meeting with the Minister of Defense, Admiral Ben Shoshan presented the naval threat faced by Israel, as well as the IAF capability to take part in naval warfare.

Defense Minister Rabin acknowledges the need for an offensively geared navy, and for building *Sa'ar-5* missile boats. The United States' Defense Secretary approves proceeding with the project along the "package deal" guidelines

At the end of the meeting, Defense Minister Rabin acknowledged the need for an offensively geared navy. He approved building *Sa'ar-5*

missile boats, adding that the rates of development and equipment acquisition depend on resource constraints. Based on the Minister's summary, the Deputy CGS instructed the General Staff to include the Navy's plans in the multi-year program budgeting. During Minister Rabin's visit to the United States (July 1985), the US Defense Secretary endorsed the package deal formula for the *Lahav* and Dolphin projects. After a series of discussions, and once all the authorizations had been given, the Defense Minister instructed: "The *Lahav*/Dolphin contract will be signed with a US Shipyard as chief contractor, with Israel Shipyards as secondary contractor". A procurement budget for the future *Lahav*/Dolphin ORBAT, amounting to \$80-100 million per year over ten years (mostly in FMS funds), was allocated over the 1986 work-plan discussions with the Defense Minister. In November 1985, Minister Rabin met again with US Defense Secretary Weinberger in the United States, with Navy Commander Ben Shoshan and New York Delegation Head Ben Yossef attending. In the meeting, the package formula for the *Lahav* and Dolphin projects was re-affirmed, and the parties decided to set up a joint American-Israeli committee, chaired by Admiral Almstead, to examine the project costs. Admiral Almstead's representative, Dr. Sackheim and his team began examining the costs in March 1986.

Third design review under Admiral Ben Shoshan

During the November 1985 visit to the United States, a third design review was conducted for the *Sa'ar-5* (*Lahav*) by the Navy Chief of Logistics and his team, the Head of Weapons Department, and the *Sa'ar-5* team, under supervision of my successor, Navy Commander Admiral Ben Shoshan. In the review, the vessel's displacement (1,130 tons) and payload (109 tons) were approved.⁶⁷ In February 1986,

67 The vessel's payload was determined as 109 tons based on latest data regarding the combat systems' weight, provided by the various developers following the combat systems' preliminary design by Rockwell. Before my retirement, and after freezing the configuration I had adopted (out of five options considered in preliminary design No. 1), I conveyed to Ben Shoshan a personal recommendation I received from the Dutch Admiral Kool, based on pond tests and examinations performed in Holland. Admiral Kool suggested that in order to optimize the payload and reduce costs, the ship's displacement should be increased by about

Israel's Defense Minister instructed approaching American shipyards for price-quotes, and the New York MOD delegation duly sent an R.F.P to eight shipyards in the United States.

The Navy ORBAT is included in the IDF multi-year program (“*Shchakim*”); The Navy is authorized to draft a contract with a shipyard for construction of the *Sa'ar-5*

In the *Shchakim* (multi-year IDF ORBAT development program) discussions held with the CGS and presented to the Defense Minister in September 1986, the following was decided: 1) Extra \$100 million will be allocated to the Navy's future ORBAT program in 1989. 2) The Navy should be allowed to sign contracts with various shipyards beginning in 1987, to enable detailed planning and procurement, in accordance with the budget distribution presented by the Planning Directorate. 3) The matter will be put on hold until the Sackheim investigation is completed. In October 1986, a design review was performed for the *Lahav* platform and integrated systems, followed by a freeze of combat system specifications. In December 1986, the Sackheim committee issued its cost evaluation report, whose main points were: 1) Analysis of the military threats indicates that implementing the modernization program presented by the Israeli Navy is necessary. However, construction of the Dolphin could be postponed by two years. 2) The procurement configuration formulated by the Israeli MOD abides by the legal terms of US foreign aid; however, in order to receive the necessary authorizations in the United States and in Germany political involvement is required. 3) The differences between the American and Israeli teams' estimates are insignificant, amounting to no more than 7%.

100-200 tons. On that occasion, I also advised Ben Shoshan not to reveal this option to the engineers before the next design reviews, for fear they would hurry and take advantage of it.

Total costs of the *Lahav* and Dolphin projects, based on estimates, quotes, and post-negotiation evaluations (\$ millions, October 1986 prices)

Table 5: Total cost of the *Lahav* and Dolphin projects

	Subject	Estimate		Price quotes (Shipyards)		Post-negotiation estimates
		Sackheim	Israeli Navy	Todd	Ingalls	
1	<i>Lahav</i>	671.2	718.0	783.6	800.5	749.8
2	Dolphin	607.1	655.0	676.2	663.7	643.8
3	Total	1,278.3	1,373.0	1,459.8	1,464.2	1,393.6

In March 1987, several American shipyards submitted price quotes in response to the R.F.P. issued over a year earlier. The quotes were found to be very close to the estimates of the Sackheim committee and the Israeli project teams, as shown in Table 5.

CGS Levi affirms that he accepts the Navy concept and that it corresponds to the general security concept

In February 1987, the Navy reviewed the future naval battlefield before the GHQ forum. CGS Levi affirmed that he accepted the Navy concept, and that it corresponded to the IDF security concept. The decision to procure the future ORBAT remained valid, and ways to implement it were being explored.

Attempts to foil the Navy's plan: State Comptroller draft report

On 1 July 1987, about two and a half years after the Defense Minister had concluded the matter, Navy Commander Admiral Ben Shoshan received from the State Comptroller a "Draft summary of inspection findings" regarding "The decision-making procedures for the Navy ORBAT development", signed by the Chief of IDF inspections.⁶⁸ A brief scan of the "inspection" document sufficed for Admiral Ben Shoshan to trace the clear footprints of Admiral (Res.) Shlomo Erel, Commodore

68 I. Bretschneider, State Comptroller's office, Chief of IDF inspections, 1 July 1987. The report was prepared between March and October 1986.

(Res.) Gideon Raz and Commodore (Res.) Eli Rahav, reflecting another attempt to thwart decisions of the Security Establishment presumed to be final. For an unknown reason, the State Comptrollers' inspection teams accepted their statements word-by-word, without verifying or checking them with the concerned parties – the former and current Navy Commanders, who through unrelenting continuous efforts had succeeded convincing the MOD top echelons to approve the future ORBAT. The 30-page long “inspection draft” sent to Admiral Ben Shoshan was soon found to be wanting in facts and insights. It was far removed from reality or from the whole truth! Noticing the omissions, misleading information and professional errors, Ben Shoshan, who was on the verge of seeing eight and a half years of effort come into fruition, immediately understood that his only option was responding professionally and to the point to the “inspection document” he had received.

The Navy appoints a team to prepare its response to the State Comptroller's inspection document inspired by Admiral Shlomo Erel, Commodore Gideon Raz and Commodore Eli Rahav

A professional response team was therefore appointed. Its members were senior Navy officers, well versed in the material at hand, who had been involved in a significant part of the “decision making procedures for the development of the Navy ORBAT”. The team members were Captain (Res.) Raffi Apel (Chairman), previously head of Weapons Department, and at that time head of the Budgets Department; Captain Amiram Rafael (deceased) – Acting Head of the Weapons Department, an electronics engineer by profession; Commander Beni Hod, Aid to the Navy Commander, and Commander Ida Mintz – head of the Planning Section at the Standards and Organization Department.

In September 1987, the Navy's response to the Inspection Report was sent to the state comptroller's office. This is not the place to repeat in detail the full replies provided for all the arguments brought up in the “Inspection document”, but one paragraph from Admiral Ben Shoshan's reply is worth quoting:

“The decision making process for modernizing the navy ORBAT, concerning *Lahav* missile boats, Dolphin submarines and their integrated systems, is the most thorough and comprehensive, and perhaps the most methodical process ever carried out in the history of the IDF in general, specifically by the Navy. The concept and characterization, which were formulated and validated in numerous tests and simulations (partly due to stalling and delays in implementation of decisions), are unanimously agreed upon by the regular Navy staff. They have also been acclaimed and openly appreciated by some of the world’s most advanced navies, such as the Dutch and American navies, who were involved in the characterization and the planning, and have contributed to us much of their experience and technological and scientific achievements. They won the appreciation of some of the world’s most advanced companies (in the United States, Germany, Holland, and other countries), who took active part in designing the vessels. Curiously, significant key elements of the preparatory work carried out before taking any decision regarding the nature, size and makeups of this ORBAT, never reached the inspectors, and in any case were not mentioned in the report.⁶⁹ The year 1979 is almost entirely missing from the inspection report! **Another puzzling point is that the inspectors did not meet with or were assisted by former Navy commander Admiral (Res.) Ze’ev Almog, who for six years (1979-85) steered the staff-work for the modernization of the Navy ORBAT, nor did they seek the direct assistance of the current Navy Commander, Admiral Ben Shoshan, who has been working on the project for the past two and a half years (my emphasis, Z.A.)** Presumably, these two senior officers would have been able to assist the inspectors in gathering material that was vital for completing the picture. In contrast, the report gives disproportionate weight to people outside the navy or the professional circle, who have interests of their own and ulterior motives that have nothing to do with the issue at hand”.

69 43(!) of 71 central events/decisions regarding this matter, which occurred over the report period towards deciding the ORBAT, were missing from the State Comptroller’s report.

Consequent to the Navy's sharp reaction, Maj. General Aviezer Yaari, in charge of the Defense Establishment Inspection at the State Comptroller's Office, amends the draft inspection report submitted by his staff

On 27 October 1987, Maj. General Aviezer Yaari, in charge of the Defense Establishment Inspection at the State Comptroller's Office, submitted to CGS Dan Shomron a summary report of the inspection performed by his team. Consequent to the Navy's sharp reaction to the team's draft report, Maj. Gen. Yaari hastened to interview Admirals Almog and Ben Shoshan. Two facts stood out in Yaari's updated summary report. The first was that many (albeit not all) facts and events that had been omitted from the first draft were now included in it. The second regarded Maj. Gen. Yaari himself, who, out of personal fairness, felt that the faults had to be corrected – better late than never. This is what he wrote:

“In the late 1970s, questions regarding the aging of the Naval ORBAT of the 1960s and the 1970s were already on the agenda, as was the issue of building a future Naval ORBAT for the 1980s and 1990s. At that time, the main naval ORBAT comprised *Sa'ar-2*, *Sa'ar-3*, and *Sa'ar-4* missile boats, three submarines, and other vessels such as Dabur boats and LCTs. With Admiral Almog's appointment as Commander of the Navy in 1979, the Navy formulated a new concept for its future ORBAT, whose focal point was building larger vessels, *Sa'ar-5* missile boats. In the Navy's opinion, those boats would be capable of carrying the necessary means and weapons to cope better with most of the existing and developing threats on the naval arena of the 1980s and 1990s, and beyond 2000. Those missile boats, together with modern submarines, additional smaller vessels and air support, would make it possible for the Navy to accomplish its missions. The Navy Command has consistently adhered to this concept, and the appointment in 1985 of a new Commander, Admiral Ben Shoshan, an enthusiastic supporter of this approach, even bolstered it. An opposing view to that of the Navy, mainly supported by former senior naval officers, was brought up and discussed several times. That second view objected to the *Sa'ar-5* construction plan for operational and budgetary reasons. Its proponents argued that getting equipped with a larger number

of the existing missile boats (*Sa'ar-4*) or improved *Sa'ar-4* and submarines would be a better way for the Navy to accomplish its missions. Although missile boats smaller than the *Sa'ar-5* would not be as versatile, they could specialize in various types of naval combat, receive more massive air support, and operate a larger number of submarines. Another extreme view was expressed by one air force commander, according to which the air force could – with adequate preparation – undertake the Navy's missions, but its details and significance were never explored further. Ever since the early 1980s, CGSs Rafael Eitan and Moshe Levi, and Defense Ministers Begin, Sharon, Arens and Rabin, called meetings, in which the Navy presented its assessments, plans and demands. In those forums, the opponents of the *Sa'ar-5* expressed their views as well. Throughout that period, the CGSs repeatedly affirmed and approved the ORBAT buildup proposed by the Navy, while the Defense Ministers had not reached a clear-cut decision on this matter until June 1985. **At that time, Minister Rabin determined that the Navy must possess offensive capabilities, and accepted the recommendation to launch a project for the construction of *Sa'ar-5* missile boats** (my emphasis, Z.A.). Even then, no budgetary framework was approved to enable entering into contractual agreements for the construction of new naval vessels. In fact, until September 1987, when the State Comptroller's representatives discussed the draft report with the Navy command, authorization had not been given to sign a contract for building new vessels. By that date, only a preliminary design of the missile boat and the submarine had been performed, at a level that enabled signing a contract for the vessels' construction. The findings revealed that the decision making echelons considered the Navy as the exclusive professional body qualified to determine the types of vessels the Navy would use in combat, in spite of occasional doubts, some of which were openly expressed, concerning the rationale behind the strong conviction that *Sa'ar-5* missile boats were actually the desired solution. In this case, preference was given to the solution proposed by the Navy, although the different approach was brought up for consideration before the decision makers”.

Maj. Gen. Yaari: The decision-making echelons must possess the tools required to professionally test and evaluate the stands proposed by the military

“It should be noted in this context that the decision-making echelons (the CGS, the Defense Minister and the government) must possess the necessary tools to professionally test and evaluate the plans and stands brought before them, whether by the Navy or by any other arm and corps. [This is necessary] as it is their responsibility to determine the missions of those corps and arms, and the skills they must have to perform those missions. As they also determine what resources should be allocated to this end, the status of an arm or a corps can and should be that of a senior adviser, but by no means an exclusive adviser.⁷⁰ In this case, the advice given and accepted may have been optimal, but it may also have been the other way round. This is particularly significant given the complexity of the missions, skills and resources combined. In principle, therefore, the decision-making echelon may, perhaps must, direct a corps towards a course that corps disagrees with professionally, if this is required from the broad perspective of Israel’s security, taking into account security policy considerations and implementation plans”.

⁷⁰ I thought that Maj. Gen. Yaari was completely wrong in this case, as his definition of the status of an “arm” (the Navy or the Air Force) did not agree with the definition of the IDF GHQ as a “unified command”, of which the arms’ HQs are an integral part. Maj. Gen. Yaari was also wrong professionally, since his inspection team had not read, or had ignored, the Defense Establishment Comptroller’s report of 26 May 1982, which praised the thorough staff work the Navy had performed prior to deciding in favor of the *Sa’ar-5* missile boat. The inspectors were impressed by the numerous simulations and war games performed at sea and on land, and particularly by the professional opinions of leading experts (in the United States, Holland and Germany), who confirmed the Navy’s conclusions, and expressed their appreciation for them. These opinions were conveyed to the Defense Establishment decision makers. I thought that Yaari should have explicitly admitted that the decision-making echelons were frequently indecisive or too weak to implement their own ostensibly firm unequivocal decisions, or had not delved deeply into the question at hand, and were incapable of making the right decision, even though that was their duty and responsibility. All this is vaguely implied near the end of Yaari’s summary.

Maj. Gen. Yaari criticizes the prolonged decision making process towards realization of the Navy ORBAT

“Two phenomena have emerged as a result of the overextended decision-making process concerning the nature and realization of Navy’s future ORBAT: 1) The existing naval ORBAT is becoming obsolete, and the submarines and part of the missile boats are to be decommissioned in the early 1990s. Although the missile boats’ life-span may be extended by growing further investments, the options of equipping them with modern armaments is limited. 2) The cost of the ORBAT buildup has been constantly increasing. In March 1985, the price of four *Sa’ar-5* missile boats was estimated at about \$500 million, while in July 1987, it reached about \$790 million. In March 1985, the price of three submarines was estimated at about \$500 million, and in May 1987 – at about \$570 million.⁷¹ Avoiding a decision about the modernization of the naval ORBAT means in fact taking a decision. As long as the CGS instructions that were integrated into the IDF multi-year program and the Defense Minister’s conclusion of June 1985 that the Navy should have offensive capabilities stand valid, any foot-dragging in implementing it means that such naval buildup is becoming increasingly unlikely, at least in the 1990s. Even those who have other ideas about the makeup of the Navy ORBAT agree, each from his own standpoint, that drawn-out delays in modernizing the ORBAT may undermine the Navy’s ability to accomplish its missions. The State Comptroller is of the opinion that a decision must be taken without delay whether to proceed with the program or discard it, taking into account all the implications of such a decision. **It is unreasonable and inappropriate that the implementation of a valid decision about an offensive navy based on *Sa’ar-5* missile boats and submarines should be delayed to the point that the content of that decision might lose its original meaning.**” (My emphasis, Z.A.)

71 This price increase, amounting to \$290 million for *Sa’ar-5* missile boats and \$220 million for submarines over two and a half years, was a direct outcome of Yitzhak Rabin’s indecisiveness, and the unrelenting attempts of Shlomo Erel and his associates to torpedo the project and see it annulled.

The Tal Committee

Further to the conclusions of Maj. Gen (Res.) Aviezer Yaari in the State Comptroller's report, Defense Minister Rabin and CGS Dan Shomron approached Maj. Gen. (Res.) Yisrael Tal (deceased), Assistant to the Minister of Defense, and requested him to chair a committee of senior MOD and IDF representatives, to re-examine and submit its recommendations on the Navy buildup plans. On 29 January 1988, CGS Shomron appointed a team "To examine the Navy buildup plans". Its members were: Maj. Gen. (Res.) Israel Tal (Chairman), Admiral Avraham Ben Shoshan – Commander of the Navy, Prof. Pinchas Zusmann (Siko) – economist and MOD CEO, Brig. Gen. Avraham Oren – Head of the MOD Procurement Directorate, Brig. Gen. Uzi Eilam – Head of the Administration for the Development of Weapons and Technological Infrastructure, Brig. Gen. Shlomo Shamir – Assistant for Planning to the Head of the Planning Directorate, and Brig. Gen. Zvi Kantor, Commander, Air Force Base 8. The committee was instructed to submit its recommendations regarding the Navy buildup plans that should be implemented for the 2000s, in view of the following: 1) Foreseen nature of naval combat in 2000: Threats, response options, and the operational concept the team deemed appropriate. 2) The existing ORBAT and the predicted life-span of its various components. 3) Assessed capability to enter into contracts towards realizing the proposed solutions, namely, terms of payment over time as determined in the FMS program, and commercial and political aspects. 4) IDF general buildup programs, and inter-arm priorities determined by the General Staff. 5) The team's recommendations should encompass various alternative main combat systems, i.e., missile boats, submarines, ASW, detection and identification capabilities, and IAF attack capabilities against enemy vessels. 6) The team should also recommend how to divide the resources invested in each of the above capabilities in a balanced way. The team was allowed to summon anyone as a witness and choose to hear the opinion of any military or civilian individual

in the State of Israel.⁷² The team was to submit its recommendations to the CGS by 15 March 1988.

Commodore Gideon Raz and Dr. Ariel Levite attempt to undermine the Navy ORBAT concept by submitting to the Tal committee an alternative program

Commodore (Res.) Gideon Raz and Dr. Ariel Levite of The Institute for National Security Studies (INSS) at Tel Aviv University had prepared earlier, in July 1987, a document titled “Where is the Navy going? Reflections on the doctrine and force buildup of the Israeli Navy”, which they submitted at that point to the Tal Committee (The Jaffee INSS, Memorandum 19, July 1987). The document aimed to undermine the Navy concept regarding its future ORBAT, a concept that had been developed and formulated over nine years.

72 The committee had access to publications, studies and documents written by Dr. Ilan Amit, Gideon Raz and Dr. Ariel Levite (including later complements); Eli Rahav, “*Sa’ar* Boats – Principles of the Naval Force Buildup; The National Security College, Naval Arm; Dov Shapir (Berele), “Highlights and priorities in the Navy ORBAT buildup for the 2000s; Haim Shahal (former chief engineer at Israel Shipyards and of the Cherbourg boats) – Fast Attack Military Boats; Prof. Bodner of the Technion – Complementary comments; Dr. Dov Sackheim – Meeting Minutes; Arie Gavurin, Completion of a proposal for examination of an alternative for the Navy; Commodore Eli Levi – Query concerning the Navy ORBAT; Commentary by Captain Amir Doron; Shaul Horev – Commentary (in writing, as he was studying abroad at that time). His commentary arrived late and was not sent to the team for perusal); Shlomo Erel – Comments/complements. Presentations/testimonies: 1. A Navy team; 2. Admiral (Res.) Telem (deceased); 3. Admiral Botzer (deceased); 4. The Planning Directorate; 5. Admiral (Res.) Erel; 6. Captain (Res.) Dov Shapir. Additional/complementary presentations/testimonies: Yisrael Levertovski (deceased); Gideon Raz; Administration for the Development of Weapons and Technological Infrastructure; Prof. Bodner; Israeli Navy – Helicopter staff; Haim Shahal; Admiral (Res.) Shlomo Erel; IAF and Administration for the Development of Weapons and Technological Infrastructure – complements; Navy’s meeting with Haim Shahal; Israeli Ministry of Finance representatives. The committee summoned Dr. Ilan Amit of Rafael/Military Studies, who responded: “I see no point in appearing”. Admiral Zeev Almog responded to the invitation in a short telegram (24 February 1988): “I agree to the Navy program. There is no need for me to arrive”.

The Navy's response (by Captain Raffi Apel) refutes Raz and Levite's alternative approach

In reaction to the INSS document, the Navy prepared a document of its own that commented on and responded to the INSS paper ("Where is the Navy going? – Navy's commentary", February 1988). The writer was Captain Raffi Apel, M.A. in Economics and Business Administration, an experienced professional naval officer, who was thoroughly acquainted with all the operational, professional and budgetary aspects of the future ORBAT project. Raffi accompanied the process from its onset, first as Head of the Navy's Weapons Department and member of the *Sa'ar-5* characterization team, and later as Head of the Navy's Planning and Economics Department. He was also a member of the reaction team who responded to the State Comptroller's report. The document of the Navy, submitted to the Tal Committee in February 1988, proposed professional, thorough and clear responses to all the focal claims brought up in the INSS document, disproving them one by one. In his introduction, Captain Raffi Apel addresses the Committee Chairman, Major General Israel Tal, calling his attention to the main inconsistencies found in the INSS approach and categorically refuting them, as follows:

"Enclosed please find the document written by Dr. Ariel Levite and Commodore (Res.) Raz. [...] The book is well organized, covering most of the Navy's activity fields. However, analysis of the findings and assessments included in it, leads one to the conclusion that the writers' approach is prejudiced and based on wrong professional and operational parameters, reflecting poor acquaintance with the state of the art, and reaching conclusions that are not anchored in established findings and statistics. Below is a summary commentary on the authors' main proposals for the Navy's buildup. 1) The proposed blend, which suggests increasing significantly the submarine force while downscaling the missile boat force, will result in losing the ability to win naval combats and abandoning the Israeli coasts – the Navy's primary mission, and will increase the cost of resources that must be allocated to the Navy. 2) The improved *Sa'ar-4* missile boats lack fundamental survivability components and over the horizon attack capabilities.

They would signify voluntary relinquishing of state-of-the-art naval combat technologies that the United States is currently offering us. 3) Dependence on a [narrow] arena naval picture (aircraft observations) means ignoring its limited ability to ensure positive identification in naval combat, a crucial point, especially on an arena such as ours, saturated with vessels of diverse nationalities, including of the super-powers. It also ignores the high costs involved, and the fact that vessel commanders will have to depend at sea on factors beyond their control. 4) The authors propose an ASW plan based on dedicated vessels about to be decommissioned. The plan is ineffective and stands no chance of success, ignoring the future operational arena of missile submarines, namely, underwater and far out at sea, as well as the poor capability of those vessels to defend themselves against remotely-launched missiles. Increasing the number of aircraft and helicopters taking off from land is significantly more expensive and less effective than ASW based on surface vessels equipped with an assortment of means (a helicopter, keel-mounted sonar, passive sonar towed-array), all centrally controlled, and capable of reacting immediately and continuously wherever they are. 5) In contrast to the authors' view, an aerial power has never been able to ensure on its own coast protection from the sea, at short or long ranges, all the more so in an era where missiles are launched over the horizon from sophisticated missile boats and submarines. Therefore, the aerial component must be part of the naval power, especially at close ranges, and if possible benefit from available air support from the shore “.

Examination and analysis by the Tal Committee

The committee summarized in writing its analyses and conclusions on all the central topics included in the CGS instructions and listed in his letter of appointment, and commented on each of them separately before presenting its established conclusions and final recommendations. Following are the committee's comments on the relevant topics. Missions: In its meetings and conclusions, the team (committee) followed the guidelines defined by the General Staff regarding the navy's missions and required capabilities. The threat: As stated in the Navy documents, with emphasis on the most relevant threat of

surface vessels and submarines, including comments on reinforcements transferred by sea to ground combat scenes in Arab countries. Air force participation: 1) The air force communicated to the team its view that responsibility for combat management at sea lies with the navy. 2) The air force identification capability is estimated as limited. 3) The air force capability to attack surface targets is very good, highly effective and relatively low risk. 4) The air force is not ready, nor is it expected to get prepared for detection and attack of submarines. 5) It is doubtful that the air force would be able to maintain continuity on the naval arena (both inputting together a naval picture and for attack purposes). Identification: 1) The team considers the ability to identify enemy vessels as an essential, central and vital element of naval combat. 2) Identification is based on an up-to-the-minute picture of the naval situation, put together and updated based on different level information sources (strategic, general staff, aerial, naval, integral to vessels, etc.). 3) The inclusion of low-frequency acoustic means is a promising direction of development in the sphere of identification, and may facilitate positive identification of individual vessels. 4) An integral helicopter or a remotely piloted helicopter plays an important role and has considerable contribution to early identification and to determining the results of a naval combat. A future long flight endurance UAV will have a high detection and identification potential. 5) Positive identification of a vessel is not necessarily a condition for opening fire (although this is always desirable). 6) Ultimately, the commander must evaluate the situation and take a command decision to open fire based on the best available information. Submarines: 1) The team accepts the characterization of the Dolphin submarine as presented by the Navy. 2) The team also agrees that the Navy's future submarine fleet should preferably be based on a submarine that matches the Dolphin concept. 3) The team is of the opinion that in periods of quiet, submarines have a vital role in intelligence collection throughout the year. 4) Submarines play a unique role in special missions. 5) The submarines' combat capabilities against surface vessels have been developing, including at long ranges; these capabilities include over the horizon missile launches. 6) Submarines have serious disadvantages in maneuverability at sea, shifting efforts from one arena to another

and strategic mobility. In addition, submarine availability is typically lower relative to other vessels. 7) Although the team acknowledges that they are important and necessary, it does not think that submarines should be relied on as a main component of the naval force. Among other things, building a submarine force in numbers that would resolve the issue of availability and of mobility (which requires deploying a large number of vessels in various places) would be extremely costly, unquestionably more costly than the alternative solution of surface vessels. Missile boats: The committee thinks that the Navy ORBAT will have to continue relying on missile boats as its main combat vessels, among other things in view of the submarine weaknesses listed above. The current ORBAT totals 12 *Sa'ar-4* missile boats, built between 1972 and 1979. Eight are of the original 400-ton displacement model that suffers from significant displacement constraints and limited payload. The rest comprise two *Chochit*-class vessels (with a helicopter on board), and two *Noshav*-class (480 tons, hull extended by 3.6 meter). Although these missile boats are aging, which impairs their availability and operability, their weapon systems are currently undergoing a series of upgrades that would keep them serviceable in the next decade. These upgrades are not expected to enhance the vessel's reliability or technical availability (as a platform), nor will they increase its missile and weapon capacity.

Several alternatives were considered for the Navy's future missile boat: 1) An ORBAT based on an existing missile boat (with upgrades), such as the *Noshav*, including modern weapon systems (such as a missile approach warning system, Barak missile launchers, improved missiles and electronic warfare means). 2) A new missile boat. Possible alternatives: a. The vessel proposed by Mr. Haim Shahal (BMB 575); b. A missile boat that would carry the weapons designed for the *Lahav*, excluding the helicopter and possibly the AS array. c. *Lahav* (*Sa'ar-5*). The team deems the *Lahav* characterization adequate, with right emphases in predicting the future battlefield, affording sufficient development space, and accommodating changes. The team thinks that a *Lahav* missile boat leading a *Sa'ar-4* force is likely to enhance considerably the force's engagement capability, and prove to be a quality multiplier. A comparison between the vessels under

investigation indicated that the *Lahav* (*Sa'ar-5*) clearly has a significant advantage over the three other missile-boat types, in the vast majority of features, except its price. However, each of the other types lacks one or several significant operational features whose absence might jeopardize the survivability of those vessels on the naval battlefield.

Summary of the Tal Committee conclusions and recommendations

On 16 March 1988, Maj. Gen. Israel Tal, Assistant to the Defense Minister, submitted to CGS Shomron his committee's written summary: 1) The team generally accepts the characterizations of the Dolphin submarine and the *Lahav* missile boat, deems them suitable for the foreseen future battlefield and reflecting a correct concept of naval combat. The team thinks that the Navy's future ORBAT should be based on these vessels. 2) It is noted that until the end of the century, the missile boat power will be largely based on *Sa'ar-4* (including *Chochit*) missile boats. *Lahav* missile boats (even in small numbers) will therefore give the missile boat force a head start in detection, identification, and over the horizon missile control, making the operational capabilities of the force as a whole take a leap forward. The team explored various alternatives based on its overall work, and after inspection and filtering, narrowed them down to three options: (1) Developing and producing four *Lahav* missile boats and three Dolphin submarines, at a total cost of \$1,720 million. (2) Developing and producing three *Lahav* missile boats and three Dolphin submarines, at a total cost of \$1,400 million. (3) Developing and producing three *Lahav* missile boats and two Dolphin submarines, at a total cost of \$1,211 million. In each of the alternatives, 50% of the work will be carried out in the United States, so that a major part of the project can be covered by FMS funds (if the United States agrees to using them in Germany and Israel). At any rate, the team thinks an option of further procurement must be maintained in the future, contingent on security situation assessments and available national and security resources in the coming years. The team's recommendations: 1) Based on the team's findings (as described in the document) and the priorities determined by the IDF in its general buildup plan, and

given the current political and commercial opportunity to produce submarines and missile boats as a package deal with FMS funds, the team recommends launching a project based on the mentioned funds, for the development and production of three *Lahav* missile boats and two Dolphin submarines, to enter the Navy ORBAT in 1996-97. 2) The team recommends that the contracts also define principles and conditions (earliest implementation – 1992), for ordering additional submarines and missile boats of the same classes in a similar deal, according to the developing needs and our ability to finance them. 3) The team recommends signing relevant contracts shortly, as long as this is possible politically, and while the companies' proposals stand valid. A sum of \$1,211 million must be allocated for the chosen alternative, of which \$1,031 million in FMS funds, and \$180 million in cash foreign currency (to cover 50% of the work in Germany, assuming that the United States will cover the second 50%). A sum of \$100 million in local currency from Navy sources will be kept as reserve, for unpredictable needs.

Structure of the deal according to a majority recommendation of the Tal Committee (\$ million, current prices)

Place of expenditure Item	Israel	Europe	United States	Total
3 <i>Lahav</i>	200	8	407	615
2 Dolphins	74	352	170	596
Total required	274	360	577	1,211
Currency sources		180		
FMS sources	274	180	577	1,031
Offset percentage	27%	17%	56%	

Personal concluding comments of Committee Chairman Maj. Gen. Tal

“Air power: The team’s work was naturally based on the objectives and missions of the Navy, as defined by the General Staff. Not only is this standpoint of the General Staff binding, I also agree with it. However, some people put in question the skills the Navy is required to have, thinking that the Navy should mainly lean

on air power in managing combat at sea. Indeed, the IAF has impressive capabilities and may occasionally have a decisive role in strategic and operative detection at sea, and in attacking surface naval vessels (albeit it has no AS capabilities). In spite of these impressive capabilities, the Aerial Arm cannot replace the Naval Arm. The Navy is the only one capable of assuming responsibility for combat at sea, just as the ground forces are the ones to determine the outcomes of combat on land. Combat on land and at sea, both lean, as far as possible, on massive air support; just “support”, not even “participation”. The integrity of the naval arena cannot not be disrupted. There are many reasons for this, and this is not the place to list them; however, two points must be emphasized: 1) Unity of command. This is a fundamental principle of the art of war, one that determines whether forces in combat are “managed” and “coordinated” or led and commanded. Aerial forces may cooperate and support combat at sea (detection, cover and attack), but they cannot replace the Navy’s organic forces and means under water, on the surface and in the air (currently helicopters, various UAV’s in future). 2) Availability. There is no guarantee that in time of war, the objective situation of our air force will permit it to divert efforts to the naval arena at any time and circumstances. In the Yom Kippur War, for example, on 11-12 October 1973 the Air Force Command assessed that within two days the air force would not be able to keep supporting the ground forces, given its rate of attrition. We cannot gamble on the fate of the naval arena, and must maintain a dedicated naval force. Submarines: Submarines vs. surface vessels (missile boats) are also under debate. Some claim that submarines should be the main naval force vessel, while others raise the banner for missile boats. This debate is irrelevant [...] Those who advocate the pre-eminence of submarines, demand that the Navy ORBAT be based on a force of six to twelve submarines, while additionally procuring new missile boats. These concepts are irrelevant, as already mentioned, because they are significantly more costly, and would require making changes to the IDF buildup plans and inter-arm priorities determined by the General Staff. Moreover, our dependence on United States FMS funds, the American refusal to build our submarines in the United States, and the restrictions on using FMS funds in Germany,

preclude building submarines in large numbers. In circumstances such as ours, submarines seem to be the luxury of the rich rather than the weapons of the poor. This is a pity, for I think that the submarine is indeed a mighty weapon, and the prospects of its survival in combat are excellent. Importance and morale of the Navy: Excluding the War of Independence, in which the Navy had several successes, the Navy has been historically “the black sheep” of the IDF. Although it was successful in the war of Attrition that followed the Six-Day War thanks to the commando flotilla, and although it proved itself as a combat force not only in theory but also in practice, no mythical aura developed around it, as around the paratroopers, the armored forces and the pilots. Nor did the Yom Kippur War, where it won the naval battles, or its continuous series of successes in the ongoing struggle for routine security – none of these made the General Staff acknowledge in full its value and strategic importance. A way must be found to bridge the tension and dissonance between the relatively small weight the naval arena carries in Israel’s national security, and the importance and quality of the naval force. We should acknowledge that in addition to the land and air force, having an optimal complementary naval power is a necessary condition towards maintaining the required balance in Israel’s military power. Small as it may be in quantity, the naval force must be great in quality. The morale and motivation of this excellent arm and its courageous fighters must be established on and nurtured by its worthiness. The size of the naval arm should not exceed Israel’s security needs. However, given its status as an independent arm in an integral General Staff, no difference must be permitted between the Navy and the Air force in matters of authority and role definition. Similar to the fighters on land and in the air, the fighters at sea should also rely on modern combat means. The slogan “Quality vs. Quantity” must also apply at sea. This is an operational must, but also a condition for safeguarding motivation and morale. Whatever decision is finally taken regarding the Navy’s buildup, it must be taken without delay, as the American and German willingness – both political and commercial – risks to dissipate. It should also be borne in mind that the vessels are becoming obsolete, and much time has already been lost”.

Summary: Development of Israel's Naval Force after the Yom Kippur War

The Tal Committee endorsed, then, the Navy's concept, and recommended (March 1988) building three *Sa'ar-5* missile boats and an optional fourth one, and two Dolphin submarines, and an optional third one. Since then, three *Sa'ar-5* (*Lahav*) missile boats have been built in the United States, complemented by eight *Sa'ar-4.5* (*Nirit*) missile boats, built locally at Israel Shipyards. Five submarines were built in Germany, and an additional one is under construction. Many of their systems have been developed and integrated in Israel. In spite of the unequivocal recommendations of the Tal Committee, Deputy CGS, Maj. Gen. Ehud Barak made another attempt to undermine the program. In mid-1988, under pretext that the Iran-Iraq war was over, the General Staff, under orders of the Deputy CGS, put together a new multi-year procurement plan – *Misgav*. According to that plan, the Navy was to provide a response on a single naval combat scene at a time, meaning that the procurement plan for the main ORBAT, which had already been approved, was to be cut down by \$140 million. A cut such as this would have prevented signing the already approved contracts for the construction of *Sa'ar-5* vessels and Dolphin submarines, which would have taken the Navy ten years back. The Navy commander, Admiral Ben Shoshan, who, throughout his four years in office, had been struggling against various attempts to cancel and change the procurement plans, announced to Defense Minister Rabin that if the cutback program were to be implemented, he would resign immediately, and publicize the scandalous decision-making process. The threat proved effective, and the cutback plan was canceled. On 17 November 1988, Defense Minister Rabin approved, at the CGS recommendation, signing a contract with the US Company Ingalls for the construction of three *Sa'ar-5* vessels, and a parallel contract for the construction of two Dolphin submarines with the German shipyard HDW. On 25 August 1989, a contract was signed for a package deal project by Navy Commander Admiral Micha Ram, in the presence of Admiral Ben Shoshan, then the IDF Defense Attaché in Washington, and the commander of the Lahav-Dolphin project, Commodore Yitzhak (Coral) Almog.

This present article reviews the shaping of Israel's modern naval force, which has been, and still is Israel's main offensive naval force. The force is designed to respond to new Arab naval threats, which grew significantly after the Yom Kippur war, primarily because the military means possessed by the IDF – at sea, in the air and on land – no longer met the evolving reality and the changing security needs.

The article proposed a fascinating historical description of the role the naval arena and the vessels operating in it have played in safeguarding Israel's security over the years. It also deals with issues such as force build-up, the effect of technology, the importance of leadership and the need to learn from past experience.



Admiral (Res.) Ze'ev Almog

Admiral Almog joined the Nahal infantry brigade in 1952, and in 1954 volunteered for Flotilla 13, where he was qualified as a combatant. In December 1957, he graduated the Israeli Naval Academy, and subsequently held several command positions in Flotilla 13 and in the Torpedo Boat Unit. In 1965, he received his B.A. from the Hebrew University of Jerusalem. In 1968-1971 (War of Attrition), he commanded Flotilla 13. In 1972-1974 (Yom Kippur War), he was commander of the Red Sea Arena. In 1975 he graduated the US Naval War College, and received an M.A. in Strategic Studies and Administration. In 1977-1978 he was a member of the founding team of the National Security College, where he also was an instructor. In 1979-1985 he served as Commander of the Israeli Navy, and played a major role in shaping Israel's modern Naval Force. In 1986-1995 he rehabilitated the Israel Shipyards, which had been on the verge of bankruptcy and in temporary liquidation, by privatizing it and restoring its profitability.

Admiral Almog has published several books, including *Bats in the Red Sea* (2007); *Flotilla 13* (2011, published by the US Naval Press); *Commander Flotilla 13—The Sails of My Life* (2014); *13 Flotylla* (2017, in Polish).

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