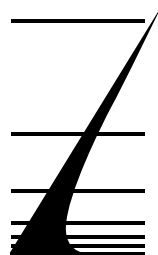


# The Market for Surface-to-Air Missiles

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Product Code #F657

A Special Focused Market Segment Analysis by:



**FORECAST** INTERNATIONAL



# Analysis 2

## The Market for Surface-to-Air Missiles 2010 - 2019

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## PROGRAMS

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The following reports are included in this section: (**Note:** a single report may cover several programs.)

Akash  
Arrow  
Aspide  
ASTER 15/ASTER 30  
Barak  
Chinese SAMs  
Chun Ma  
Chu-SAM  
Israeli Missile Defense  
MEADS  
MIM-104 Patriot  
Mistral  
NASAMS  
PAC 3  
R.440/R.460/VT-1  
Rapier/Tracked Rapier  
RBS23 BAMSE  
RBS70  
RBS90  
RIM-66/67 Standard  
RIM-116A RAM  
RIM-162 Evolved SeaSparrow  
Russian SAMs  
Seawolf/Landwolf  
Starstreak  
THAAD  
Tien Kung I/II  
Trishul  
Type 81 Tan-SAM  
Type 91 Keiko  
Umkhonto



## Introduction

The earliest known use of specifically designed anti-aircraft weapons occurred during the Franco-Prussian War (1870-1871). This disastrous war saw the fall of Napoleon III, the rise of the French Third Republic, and the unification of the German states under the Prussian king.

During the siege of Paris, French troops attempted to use balloons to resupply the city. To counter this "airlift," Krupp, the famous German weapons manufacturer, offered a modified one-pounder (20mm) gun. The gun, mounted on a horse-drawn carriage, enabled gunners to engage airborne targets.

Besides Germany, First World War combatants had ignored the development of anti-aircraft systems prior to 1914. This quickly changed and soon all armies had deployed large numbers of "anti-aircraft" guns based on smaller field pieces (the British developed an entirely new weapon to meet its needs). These modified field pieces were not very successful ("useless" was how one author described them), and even at low altitudes, they proved too cumbersome to effectively engage hostile aircraft. Platform-mounted machine guns were more effective, but their range was limited.

By the war's end, all the combatants understood that they needed specifically designed weapons to counter increasingly capable combat aircraft.

By the 1930s, Germany was again a leader in anti-aircraft system development. The 88mm Flak gun would become the most famous artillery piece of the war (besides aircraft, the "88" was highly effective against tanks).

As the Allied air offensive against Germany intensified, German scientists were called on to provide countermeasures. The *wunderwaffen* or "wonder weapons" were more appealing to Germany because they held out the promise of rapidly gaining a technological edge over its enemies. This effort included a number of ground-based anti-aircraft weapons such as the Rheintochter and Wasserfall. Information gained from captured Wasserfall rockets and technical information would help in the development of the Nike air defense system by the United States.

None of Germany's air defense missiles were ever fielded in quantities that could have affected the outcome of the war. These projects did help lay the groundwork for what would develop into a worldwide surface-to-air missile market.

In the years following World War II, air defense strategies continued to rely on fighter aircraft, as during

the Battle of Britain. However, many countries (especially those influenced by the former Soviet Union) began to build intricate, dense networks based around newly developed surface-to-air missiles (intermixed with various ordnance systems). Many of those countries could not be expected to match the capabilities of the major powers or the quality of their aircraft and, in some respects, their pilots. Yet, they could make substantial investments in SAMs, possibly negating the advantages enjoyed by a potential opponent. The first to do so was North Vietnam, during its long war with the United States. It was during this conflict that the capabilities of such a network were first felt.

**Southeast Asia.** Early on during its involvement in Southeast Asia, the USAF used a ruse called Operation Bolo to lure out the newly established North Vietnamese Air Force (NVAF) and destroy it in the air. By 1967, the U.S. had destroyed or driven to Chinese bases almost all of North Vietnam's MiG fighters. Thereafter, the NVAF, although it continued to challenge the U.S. in the skies over North Vietnam, was effectively neutralized as a serious threat to U.S. air operations.

North Vietnam was forced to rely more heavily on its ground-based systems; in particular, surface-to-air missiles. The first SAMs were shipped to North Vietnam in the aftermath of Operation Flaming Dart. Eventually, North Vietnam constructed one of the most formidable air defense networks in the world to counter the U.S. bombing campaigns.

The first Soviet SA-2 GUIDELINE surface-to-air missiles were detected in April 1965. By year's end, 56 sites had been pinpointed. The deployment of SAMs by North Vietnam forced the United States to modify its tactics and aircraft. The U.S. air arms were eventually equipped with radar warning receivers to detect incoming missiles, and provide new evasive maneuvers. The "Wild Weasel" anti-air defense aircraft was developed specifically to counter SAM sites.

Although countermeasures reduced the effectiveness of North Vietnamese missiles, the inhibiting and harassing effects (and the diversion of assets to SAM suppression) had their impact on U.S. air operations. By the end of 1966, despite suppression efforts, new tactics and equipment, 455 aircraft had been downed and an additional large number damaged.

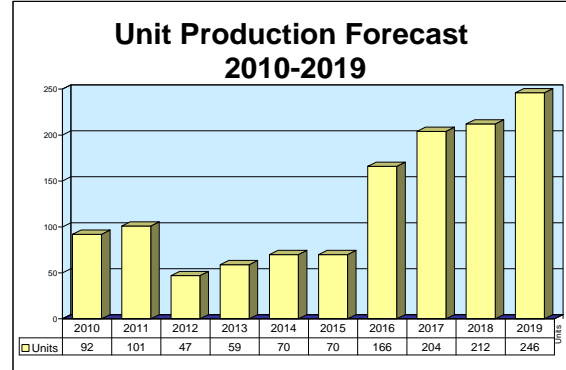
**Middle East Experience.** The next major conflict in which air defense missiles played an important part was the 1973 Arab-Israeli War. The air defense missile **Continued...**



# Barak

## Outlook

- Production continuing
- Barak ordered by Israeli and Indian militaries
- Israel and India are working on more advanced surface-to-air missiles
- Purchase of Akash will not stop Indian acquisition of Barak
- India and Israel are also working on a new medium-range SAM



## Orientation

**Description.** Vertical-launch air defense missile system.

**Sponsor.** Israel Ministry of Defense, Tel Aviv, Israel. India is cooperating with Israel on the development of new surface-to-air missiles.

**Status.** Production under way. Production deliveries of the Barak to the Israeli Navy began in 1994. The Barak entered service with the Chilean Navy in 1994, the Singaporean Navy in 1996, and the Indian Navy in 2003.

Rafael and IAI are working on a more capable version of Barak, also known as the B-8 and Barak 8.

**Total Produced.** Approximately 2,184 Barak 1 units, not including research and development missiles, were completed or in production through 2009.

**Application.** The Barak is an air defense missile system designed to attack and destroy any flying target (sea-skimming missiles, diving missiles, helicopters, and both subsonic and supersonic aircraft). Due to its unusually heavy warhead, it also has an attack capability against small ships and other targets.

**Price Range.** Estimated per-unit price of the Barak missile is \$381,500. A complete Barak air defense system is said to cost around \$25 million.

## Contractors

### Prime

<b>Israel Aerospace Industries Ltd (IAI)</b>	<a href="http://www.iai.co.il">http://www.iai.co.il</a> , Ben-Gurion Int'l Airport, 70100 Israel, Tel: + 972 3 935 3000, Fax: + 972 3 935 8278, Email: <a href="mailto:corpmtkg@iai.co.il">corpmtkg@iai.co.il</a> , Prime
<b>Rafael Advanced Defense Systems Ltd</b>	<a href="http://www.rafael.co.il">http://www.rafael.co.il</a> , PO Box 2250, Haifa, 31021 Israel, Tel: + 972 4 879 4444, Fax: + 972 4 879 4681, Email: <a href="mailto:intl-mkt@rafael.co.il">intl-mkt@rafael.co.il</a> , Prime

### Subcontractor

<b>Elta Systems Group</b>	<a href="http://www.iai.co.il">http://www.iai.co.il</a> , 100 Yitzchak Hanasi Blvd, PO Box 330, Ashdod, 77102 Israel, Tel: + 972 8 857 2312 (Barak Fire Control Radar System; Close Tracking Radar System for Barak)
<b>IAI Systems Missiles &amp; Space - MBT Missiles Division</b>	<a href="http://www.iai.co.il">http://www.iai.co.il</a> , PO Box 75, Yahud Industrial Zone, Yahud, 56000 Israel (System Computer and Integration)

## Barak

<b>Rafael Advanced Defense Systems Ltd, Manor - Advanced Defense Technologies</b>	http://www.rafael.co.il, PO Box 2250 (M1), Haifa, 31021 Israel, Tel: + 972 4 879 5287, Fax: + 972 4 879 2775 (Rocket Motor; Warhead)
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**NOTE(S):** Components for the Barak 1 are manufactured by Bharat Dynamics Limited (BDL) in India. The company also assembles missile subsystems at its Bangalore facility.

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to [www.forecastinternational.com](http://www.forecastinternational.com) (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800. Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

## Technical Data

	<u>Metric</u>	<u>U.S.</u>
<b>Dimensions(a)</b>		
Length	2.175 m	7.134 ft
Diameter	170 mm	6.70 in
Weight(b)	98 kg	215.6 lb
Weight, Warhead	22 kg	48.4 lb
Wingspan	685 mm	26.97 in
<b>Performance</b>		
Speed	Mach 1.8-2.0	Mach 1.8-2.0
Range (max)(c)	5,000 m	4 nm

(a) Estimated

(b) Weight has varied from 86 to 98 kilograms (the latter may include canister).

(c) Other sources state that the Barak missile has a range of 10 kilometers.

**Propulsion.** The missile uses an undesignated solid rocket motor. The Barak missile employs a three-level thrust motor and a disposable Thrust Vector Control system that controls the missile at low speeds and is then discarded.

**Control & Guidance.** There are two guidance methods that can be used with the Barak, depending on the target being engaged and other circumstances: a semi-active radar command-to-line-of-sight, which can use electro-optical and radar sensors, or a straight electro-optic system for visible target attack. The shipboard system is completely automated; the launch controller has only to release the missile for firing. A surveillance radar detects the target and passes it to a tracking radar, which orders the missile to be launched at the optimum time. The missile is outfitted with a

Thrust Vector Control system that uses jet vanes situated in the exhaust. The missile has four trapezoidal wings and fully mobile aft-mounted cruciform control surfaces.

**Launcher Mode.** The missile on the Barak 1 is vertically launched. The system uses thrust vector controls (TVC) that can be jettisoned once the missile has pitched over and is on line to its target. The missile then accelerates to maximum speed. The missile is able to attack aircraft and other missiles as a defensive weapon, and may be issued offensively to attack ships or specific targets on shore.

**Warhead.** The missile uses a 22-kilogram high-explosive/fragmentation warhead with an adaptive (possibly a laser) proximity fuze.

## Variants/Upgrades

Currently, only one version of the Barak missile is expected to enter production for the Israeli Navy. However, additional upgrades to the missile and system are being considered. The range of the system could be extended through the use of a booster motor, and a range of new warheads could be developed as well. Rafael could enhance the missile's seeker to include a

semi-active homing capability and improve its anti-surface role in littoral warfare environments.

In 2001, Rafael announced that it was working on a so-called Super Barak, possibly also known as the B-8 or Barak 8. Rafael and IAI are said to be working to increase the missile's range beyond what is termed

## Barak

medium-range, and improve its capability against countermeasures.

There were also reports of a Next Generation Defense Missile being developed, possibly as a follow-on to

Barak. One source said this was Barak NG (Next Generation). This new missile could have the capability to intercept long-range ballistic missiles during their re-entry phase.



**BARAK**

Source: Rafael

## Program Review

**Background.** Point defense against missiles and aircraft has been of growing concern since the 1973 Arab-Israeli (Ramadan or Yom Kippur) War, the 1982 Falklands (Malvinas) War, and the Iran-Iraq Gulf War (1979-1989). During the 1973 war, an Egyptian fast attack craft armed with Soviet Styx anti-ship missiles sank an Israeli Navy destroyer. This marked the first such use of an anti-ship missile in actual combat. The vessel was not equipped with a point defense system of any kind. Israel was keenly aware of the vulnerability of its naval vessels to stand-off anti-ship missile attacks (its own inventory of Gabriel missiles having had less range than its enemies' Soviet weapons), and commenced research efforts to address this shortcoming. The result was the development of Israel's first point missile defense system, currently known as Barak.

The missile itself was developed by Rafael Armament Authority of Israel in cooperation with then Israel Aircraft Industries (IAI), which was designing the overall system.

The Barak point missile defense system was designed to meet the following threats:

- aircraft armed with iron bombs and/or unguided rockets
- anti-ship surface-to-surface sea-skimming missiles
- air-to-surface anti-ship missiles
- smart bombs with television (TV), infrared (IR), or laser guidance

**Missile Models.** Israel has developed more than one version of Barak, including systems for shipborne and land-based deployment.

**Barak (Lightning).** Development of Barak, also known as the AB-2 Lightning and originally called the Point Defense Missile (PDM) system, began in 1979. The original system made its first public appearance at the Paris Air Show in 1981. There has been more than one variant of the overall system, although the missile has remained relatively the same. The Barak is a ship point defense system employing a vertically launched missile. The system is effective against both aircraft and missiles, including sea skimmers.

### *Defending Warships*

The early developmental model was composed of three main units: a deck launcher, which was fitted with an autonomous radar and contained eight Rafael PDMs; a fire control console mounted below decks in the ship's combat information center (CIC); and a processing unit.

The main components of the Barak system are as follows:

- The Launcher Control Unit (LCU), with power supply and servo motor control
- The Processing and Interface Unit (PIU), which interfaces with ship sensors and performs threat evaluation and target designation
- The Fire Control Console (FCC)
- The Search/Track/Illumination (STI) radar
- The eight-cell launcher, which incorporates the radar
- The missile

## Barak

- The Missile & Launcher Electronic Unit (MLEU) for antenna tracking and position control, launcher lead-angle computations, and communication with the missiles before launch

The launcher, derived from the twin 30mm TCM-30 mount, is computer-controlled and has two-axis stabilization; it carries the STI radar and the eight launch elements. The missiles are prepackaged in sealed canisters, which also act as launch tubes; after firing, the empty canisters are discarded and replaced with new ones. The STI radar uses a navalized version of the Elta EL/M-2021 airborne radar; it features high built-in electronic countermeasures (ECM) resistance and digital signal processing. The single inverted Cassegrain antenna performs search, tracking, and target illumination.

The initial Barak air defense missile system entered its final development stages in 1983. The first complete Barak system was delivered to the Israeli Navy in the spring of 1986.

**Barak 1.** A later variant of the Barak is called the Barak 1. The Barak 1 was publicly revealed for the first time at the 1983 Paris Air Show, and was designed to fit on Israeli Navy Reshev class patrol craft. Development of the Barak 1 was initiated following studies demonstrating that conventional missile launchers capable of 360-degree coverage would account for 25 percent of total weight of armament permitted for the Reshev class. Studies were begun on lightweight vertical launch systems in an effort to reduce the weight of the launcher. IAI is working on this program in cooperation with Rafael.

A missile incorporating the final aerodynamic configuration was vertically launched in a land-based test in April/May 1984. Unlike the original model, this variant used the latest vertical launch techniques for the missiles, and its guidance radars were situated high up on the ship's superstructure. Although the missile used in the system is said to have been virtually unchanged from that employed by the earlier versions, it did incorporate a pitch-over modification necessary for vertical launching from a ship.

By September/October 1984, Rafael had begun initial vertical launch trials of the system. Full-firing tests against sea-skimming targets reportedly commenced in late 1985. Notably, a vertical launch unit (VLU) containing up to eight missiles each can be fitted anywhere on a vessel to provide 32 missiles per system, operated from a single below-deck console.

The entire Barak 1 system weighs 3,900 kilograms. The mast-mounted STI radar and the below-deck fire control console together weigh 1,300 kilograms, and each of the

eight-round VLUs weighs 1,300 kilograms. The first sea trials were scheduled for 1988-89. The total development cost is reported to have been the equivalent of \$74 million.

**Barak 8.** Israel would like to arm its new naval surface combatants with a more advanced air defense missile system.

The Israeli Navy is considering the purchase of a corvette-size warship, possibly a Sa'ar 5+ weighing between 2,800 and 3,000 tons. These warships could carry the new Barak 8 air defense missile system, possibly once known as Super Barak.

### *Improved Missile for Evolving Threat*

The Barak 8 would measure 4.5 meters in length and have an engagement range of 70 kilometers (one source put the range at 100 kilometers). The guidance is active radar homing combined with mid-course updates. A two-stage rocket motor is used. This system would provide the ships with protection against aircraft and missiles. The Barak 8 system would also replace existing Barak 1 SAMs currently installed on Israeli warships.

Development of this missile system could cost an estimated \$200 million to \$300 million.

Israel Aerospace Industries (IAI) and Rafael are working on the Barak 8. The naval version uses the IAI-Elta EL/M-2248 Multi-Function Surveillance, Tracking and Missile Guidance (MF-STAR) radar with four fixed phased-arrays for 360-degree coverage. The land-based version uses Elta radar with a single revolving phased-array.

New Delhi involved itself in this program starting in 2006, although Indian sources have referred to this system as the Barak II (Israel also refers to this joint program as Barak NG or Barak Next Generation). These sources have also said that the missiles have a range of 70 kilometers, but will engage targets only out to a distance of 12 kilometers. Nova Integrated Systems Ltd of India will be system integrator. This is a joint venture of Tata Advanced Systems Ltd and IAI.

India and Israel signed a \$2.5 billion contract in July 2008. This contract's value includes the development of a longer-range Barak missile (around 120-150 kilometers) for use by the Indian Air Force. The Indian Air Force could acquire sufficient systems to equip nine air defense squadrons. The value of this project could be around \$1.3 billion of the \$2.5 billion total. The Indian Navy will operate the Barak 8, and may also acquire this new version.

Procurement of the Barak 8 by Israel will not begin as previously scheduled. The first test launch of a Barak 8

## Barak

missile will take place this year (2009), pushing back the original production start date from 2008 to 2009 or 2010. This system could meet Israel's new need for a low-altitude, close-range counter to rockets and certain types of ballistic missiles. India will start procuring the Barak NG around the same time.

In early 2006, Rafael and Thales Nederland successfully tested the Defender short-range air defense system. This system uses the Barak missile. The Defender uses the Flycatcher Mk 2 surveillance radar. The system was developed to meet the requirements of Venezuela.

IAI said in 2009 it had a customer for the land-based version of the Barak 8.

**Barak MR.** Israel and India will develop a new land-based surface-to-air missile based on the Barak. This will be a medium-range SAM and may be called Barak MR. The cost of this project is placed at \$1.4 billion. This joint effort was announced in mid-2007, but contract signing did not occur until February 2009.

The new system will be capable of engaging manned and unmanned aircraft, cruise missiles, and surface-to-surface rockets. This project is an outgrowth of the Barak 8 effort. The two-stage interceptor will have an active radar seeker and a mid-course guidance update capability. Range will be 150 kilometers.

The Indian Air Force may procure sufficient Barak MR systems (perhaps 162 systems) to equip nine air defense squadrons. Each squadron will possess two systems consisting of a fire control center, acquisition radar, guidance radar, and three launchers (each with eight ready-to-fire missiles for a total of 24). Another report said India will purchase sufficient systems to procure 12 squadrons. Furthermore, the operational date may be moving. Once, the Barak MR was to be operational in 2013. Now, this date is put closer to 2017.

The Barak MR replaces India's inventory of obsolete SA-3 Goa (S-125 Pechora) surface-to-air missiles. India has 30 squadrons equipped with the SA-3 Goa SAM.

**Spider III.** The Spider III air defense system was a modification of the Spider II, which depended on twin 30mm ordnance. In 1983, IAI unveiled the new version, which replaced the 30mm ordnance with missiles.

The missile used with the Spider III was the same as that employed by the Barak and ADAMS air defense systems. The PDM system could be installed on light armored vehicles for land-based operations.

A new system using a similar-sounding name emerged in 2003. The Surface-to-Air Python & Derby Air Defense System (SPYDER-SR) was first displayed at the DEFEXPO Exhibition in January 2004.

## Related News

**Israel and India Conclude Barak SAM Deal** – A deal for India to purchase upgraded Barak surface-to-air missiles from Israel is complete. The contract was signed in April and is worth \$1.1 billion. The new Barak 8 missiles will arm Indian Navy warships. Israel is India's largest defense supplier, surpassing Russia.

The Barak 8 system is capable of engaging missiles, aircraft, and unmanned air vehicles. A land-based version of the Barak 8 is also available. Israel Aerospace Industries will deliver these systems to India by 2017. (*Central Chronicle*, 11/09)

**Israel is India's Top Arms Supplier** – Israel has surpassed Russia as the top arms supplier to India. For decades, Moscow had been the lead arms supplier to the Indian military. Now, however, sales to India account for 50 percent of Israel's defense exports. In addition, Israeli sales to India make up 30 percent of all purchases. Equipment provided to India by Israel includes Barak surface-to-air missiles, assault rifles, night vision devices, radars, and electronic warfare systems.

New Delhi is also interested in joint design efforts with Israel. Areas of interest include submarine-launched cruise missiles, ballistic missile defense systems, laser-guided systems, as well as unmanned air vehicles. (*Thaindian News*, 11/09)

**New Indian Frigate Carries Barak SAM** – The Indian Navy's new INS Shivalik frigate will carry the Barak 1 surface-to-air missile (SAM) system. The Shivalik is being built in India as part of the Project 17 program. This Barak is an Israeli designed system, and it is already installed on 11 major surface combatants in service with the Indian Navy, including the INS Viraat aircraft carrier and INS Mysore destroyer.

India plans to build two additional Shivalik class frigates: the INS Satpura and INS Sahyadri. Under the Project 17A program, India will build seven additional frigates. (*Times Now*, 9/09)

## Barak

**Barak Missile Defense Systems Tested at Sea** – Israel has successfully tested the latest model of the Barak shipborne missile defense system. The Barak system was designed by Rafael and Israel Aerospace Industries (IAI). The missile was fired from an Israeli warship and successfully intercepted its target. The Barak missile is vertically launched and provides 360-degree protection to a surface warship. (CCTV, 07/09)

**IAI Signs Contract to Develop and Supply Land-Based Barak 8** – Israel Aerospace Industries (IAI) has recently signed a contract to develop and supply the land-based Barak 8 Air and Missile Defense (AMD) system to a foreign customer. The land-based system is based on the Naval Barak 8 AMD system that has been sold to the Israeli Navy and to foreign customers.

The Barak 8 AMD is an advanced all-weather, day/night system capable of multiple simultaneous engagements in complex scenarios, provides a 360-degree defense against a wide variety of airborne platforms and munitions from short and medium ranges. The Barak 8 AMD system includes a battle management, command, control, communication and intelligence center (BMC4I); an interceptor; and a Land-Based Multi-Function Surveillance, Track & Guidance Radar (LB-MF-STAR). The BMC4I, produced by the MBT Division of IAI's Missiles, Systems, and Space Group, offers both stand-alone operation for a single fire unit, and joint task force coordination (JTC). The JTC mode allows for the synergy of all available resources, giving the user maximum operational flexibility.

The Barak 8 interceptor, developed in collaboration with Rafael Advanced Defense Systems Ltd, can intercept at short and medium ranges. It is dual pulsed and has an advanced seeker, providing all-weather, day/night engagements in complex saturation scenarios. The interceptor is vertically launched from a mobile ground launcher.

The LB-MF-STAR, produced by ELTA Systems Ltd, IAI's group and wholly owned subsidiary, supports air defense missions and guides AMD weapons systems. It can deliver an accurate, high-quality arena situation picture and extract low Radar Cross Section (RCS) targets even in the toughest environmental conditions. The LB-MF-STAR is a digital Active Electronic Steering Array (AESA) radar system that incorporates new, advanced technologies and includes one rotating S-band phased-array antenna. (IAI, 6/09)

**India Signs Deal to Design SAM with Israel** – Israel and India have concluded an agreement to jointly develop a new medium-range surface-to-air missile. This deal is worth \$1.9 billion. India has yet to officially confirm the deal.

The new missile will have a 70-kilometer range. India's state-run Defense Research and Development Organization (DRDO) will work with Israeli Aerospace Industries (IAI) on this project. Development could take four to five years to complete.

Indian left-wing parties have raised objections to the proposed deal, alleging Israel paid bribes to government officials to win previous contracts. Israel sold Barak SAMs to India in 2000. Leftist politicians say India has the capability to develop medium-range air defense missiles and does not need to import them from Israel. (Adnkronos International, 3/09)

**Israel Tests Shipborne Missile Defense System** – Israel has successfully tested a shipborne missile defense system, with a series of four tests performed over the past few months. These tests were performed in cooperation with a foreign fleet. During the tests, Israeli warships were fired upon by threat simulators.

The Barak 1 was the missile used to protect the warships. This system can protect these warships from air-to-surface and ship-to-ship missiles over a 360-degree radius. This system is also effective against cruise missiles and precision guided munitions (PGMs). Israel Aerospace Industries (IAI) is involved in this program. (*Haaretz*, 10/08)

**Israel Providing Defense Equipment to Azerbaijan** – Israel may have sold \$100 million worth of arms to Azerbaijan, including ammunition, mortars, and communication facilities. During the summer of 2008, Azerbaijan, which feels threatened by Iran, is said to have purchased Israeli submachine guns, unmanned air vehicles (UAVs), and missile systems.

Meanwhile, relations between Azerbaijan and Israel are moving closer, and the intelligence agencies of the two countries are reportedly carrying out joint operations. (PanArmenian Network, 9/08)

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## Funding

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No specific funding information has been provided by the Israeli government, nor has Israel released any information on a procurement objective for the Barak.

## Contracts/Orders & Options

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In Jul 2008, Israel and India signed a contract for development of the Barak 8 and Barak MR. The contract is worth \$2.5 billion. The Barak 8, with a range of 70 kilometers, will arm Indian warships. The Barak MR, with a range of 150 kilometers, will be operated by Indian Air Force air defense squadrons. The Barak MR portion of this contract amounts to \$1.3 billion. A contract signing was delayed until Feb 2009 for the Barak MR.

In mid-2007, the Indian government approved a new joint deal with Israel to develop the Barak MR (Medium-Range) surface-to-air missile. The deal is worth \$1.4 billion. A contract was signed in 2008.

In 2006, India and Israel concluded a five-year \$480 million contract to develop the Barak NG (Next Generation). This system will arm Indian warships. This missile is also called Barak 2 and Barak 8.

In 2001, India signed a deal with Israel for the procurement of seven Barak air defense systems. The contract is reportedly worth \$270 million, but another report put the contract's value at \$100 million, and that it involved procurement of 11 Barak 1 systems and 250 missiles by the Indian Navy.

## Timetable

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<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Late	1970s	Development of Barak commences
Jun	1981	Barak system announced at Paris Air Show
Jun	1983	Barak PDM displayed at Paris Air Show
May	1984	Flight tests begun
Oct	1985	Purchase of Barak system by Ecuador reported
Jul	1986	Successful ground firing trial against TOW missile
	1988	Initial live-fire trials of Barak
	1991	Continued flight testing
	1992-93	Barak encounters funding problems
	1994-95	Barak enters Israeli Navy service
	2002-2003	Barak enters service with Indian Navy
	2006	India and Israel agree to develop Barak NG
	2008	Israel and India agree to design Barak MR
	2009(a)	First test flight of Barak 8
	2010(a)	Production of Barak 8 begins
	2017(a)	Barak MR enters production

(a) Estimate

## Worldwide Distribution/Inventories

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**Israel** is marketing its Barak air defense systems to countries throughout the world. South America is seen as a good potential market for Barak. Both **Ecuador** and **Colombia** may be interested in this SAM.

**India** plans to expand its deployment of the Barak SAM. The Indian Navy has already procured seven Barak I air defense missile systems from Israel (purchased under a \$268 million contract in 2000 for seven systems and 200 missiles). The systems will be installed on Indian warships, including the INS *Viraat* aircraft carrier, three Delhi class destroyers, and three Talwar class frigates. This deal was worth Rs 800 crore.

A new deal, worth upwards of \$100 million, could see the Barak installed on additional Indian Navy surface warships, and perhaps an ex-Russian Navy aircraft carrier New Delhi is in the process of acquiring. A total of 20

## Barak

Barak systems could be purchased by India. Up to this point, India has purchased some \$260 million worth of Barak missiles from Israel.

India wishes to arm its ex-Russian aircraft carrier *Admiral Gorshkov* with the Barak SAM. Also, Israel and India will jointly develop a new version of the Barak II air defense missile system. The countries signed a development agreement on January 27, 2006. This signing follows 17 months of negotiations. Israel and India will share the initial \$330 million investment in the system. Israel Aircraft Industries Ltd (now Israel Aerospace Industries) is the Israeli partner in the program. IAI will partner with India's state-run Defense Research and Development Laboratories (DRDL). The Barak will replace aging Russian OSA-M (SA.N-4 Gecko) and Volna RZ-31 (SA.N-1 Goa) missiles currently in service on Indian warships. Also, new frigates to be purchased from foreign shipyards are to be armed with the Barak.

**User Countries.** Barak operators include **Israel, Chile, Singapore, and India.**

## Forecast Rationale

Israel is the largest arms supplier to India, eclipsing Russia. This success is due in part to the provision of Israeli-built air defense systems to the Indian military.

India's ties with the Jewish state began in 1999, when Israel provided equipment and other support during the Kargil War. The fighting took place in the Kargil district of Kashmir between May and July 1999 and pitted Indian troops against a mixture of Pakistani paramilitaries and Kashmiri militants.

At first, India simply purchased air defense systems directly from Israel. The ordering of the Barak missile for Indian Navy warships is one such example.

Subsequently, India and Israel added the joint development of new missiles to their defense relationship. The Indian Navy and Israel are developing a further improved version known as the Barak NG (Next Generation). This is the Barak 8 in Israel. This missile will arm both Israeli and Indian warships. All

told, the Indian Navy could purchase 20 Barak SAM systems and 600 to 1,000 missiles. Development of the Barak 8 is complete and production now under way.

Building on the Barak 8, India and Israel initiated a new joint effort known as the Barak MR (Medium-Range). The Barak MR provides for the air defense needs of the Indian Air Force, despite an order for the Akash SAM. This program holds immense production potential. The Indian Air Force could outfit nine to 12 air defense squadrons with the Barak MR. These systems will replace older SA-3 Goa SAMs. However, the IAF operates some 30 Goa-equipped squadrons, so the potential for additional orders is good. The fielding date for the Barak MR had been 2013, but delays are pushing the date towards 2017.

Indian orders will help to maintain Rafael missile production lines, but are unlikely to propel Israel to the top of the surface-to-air missile market. For now, this market will remain dominated by MBDA and Raytheon.

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	Thru 2009	High Confidence				Good Confidence			Speculative			Total
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
<b>Rafael Advanced Defense Systems Ltd</b>												
<b>Barak 1 &lt;&gt; Israel</b>												
	2,184	70	70	0	0	0	0	0	0	0	0	140
<b>Barak 8 &lt;&gt; India</b>												
	0	22	20	30	30	40	40	50	60	62	72	426
<b>Barak 8 &lt;&gt; Israel</b>												
	0	0	11	17	29	30	30	48	55	55	55	330
<b>Barak MR &lt;&gt; India</b>												
	0	0	0	0	0	0	0	68	89	80	80	317

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
<b>Barak MR</b> ↔ Israel												
	0	0	0	0	0	0	0	0	0	15	39	54
<b>Subtotal</b>	2,184	92	101	47	59	70	70	166	204	212	246	1,267
<b>Total</b>	2,184	92	101	47	59	70	70	166	204	212	246	1,267



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