

NT Spike

Anti-Armor
March 2020

Program Briefing

Israel's NT Spike is a family of related antitank missiles sharing common sub-systems that was first unveiled in 1997. The family consists of the Spike MR (formerly NT-G Gill) man-portable ATGM, the Spike LR (formerly NT-S Spike) medium range ATGM, the Spike ER (formerly NT-D Dandy) helicopter launched ATGM, and the long-range Spike-NLOS. The missiles use common seeker technology. The Spike MR and LR are essentially the same, except that the Spike LR has a secondary fiber optic guidance option which enables it to be used against targets out to four kilometers. The Spike ER also has a secondary fiber-optic guidance channel which allows for a "fire-and-correct" guidance capability. In 2009, Rafael announced the new Spike NLOS version which uses a substantially larger fuselage and engine to push its range out to 25 km. Rafael has also debuted a very small version called Mini-Spike in 2012.

In 2004, Rafael signed a joint venture with Rheinmetall and Diehl to establish a European production line. According to Rafael 13,000 missiles had been ordered worldwide as of late 2007 and total deliveries through 2017 were 29,000 missiles to 29 countries of which about 5,000 had been fired for trials, training, and combat use. As of January 2020, there were 34 Spike missile users



around the world, (19 in the EU and NATO) with more than 33,000 Spike missiles supplied worldwide and over 5500 SPIKE missile firings, both in training and in combat.

Outside Europe, Spike has also been acquired by Singapore and several other countries.

The US Army and US Marine Corps plan small orders for the Spike LR in 2020-2021 through Rafael's American partner, Lockheed Martin.



Manufacturer

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EuroSpike GmbH, headquartered in Röthenbach a. d. Pegnitz, is a joint venture of Diehl BGT Defence (40%), Rheinmetall Defence Electronics (40%) and Rafael (20%) that was initiated in 2004. EuroSpike GmbH is responsible for marketing, sales and program management including logistics of the Spike missile family. Rheinmetall Defence Electronics in Bremen produces and integrates the launcher assemblies as well as being responsible for logistics and training. Diehl Defence is responsible for Spike final assembly as well as production of the warhead, energy supply and launch canisters at their plants in Maasberg, Saarland, and Röthenbach. The Überlingen plant is responsible for guidance, control, and seeker sections. The German orders involve a 70% German work share.

General Dynamics-Santa-Barbara Sistemas has license rights for manufacture in Spain. Lockheed Martin has partnered with Rafael for US sales.

Some co-production of the NT is undertaken in Poland due to its 2003 order, primarily at the ZM Mesko plant in Skarzysko-Kamienna.

Subsystems

Launch System

Launcher

Mini-Spike—Mini-Spike is fired from a self-contained transport/launch tube. In the infantry version, it is shoulder-fired using a gripstock. It can also be fire from existing Spike tripod launchers.



Israeli air force demonstrated a Spike-ER launch system for the UH-60 Blackhawk or other transport helicopters.

In 2000, Rafael began offering the Spike-ER which has an alternative launcher package for armored vehicles consisting of two launch tubes and a sensor module located on an elevating stalk to permit launch from concealed positions.

Rafael has also shown a naval derivative of the Spike-ER on a naval gun mount which it dubs as Typhoon. This was first displayed in 2001.

Spike SR—Spike-SR uses a command launch unit that is clipped on to the sealed missile container/launch tube. System weight is nine kilograms and effective range is 1.5 km.

Spike MR—Spike-MR (Israeli designation: Gil) uses a command launch unit that is clipped on to the sealed missile container/launch tube. After launch, the expended tube is removed, and the CLU attached to a new missile round.

Spike-LR—Spike-LR (Israeli designation: Gomed) is fired from tripod launcher. Like the Spike-MR, the basic version consists of a tubular transport tube/launcher on to which is clipped the command launch unit. It can also be mounted on modified M113 armored transporters. At the IDEF-97 show in Ankara, Turkey in September 1997, Rafael displayed its

OWS (Overhead Weapon Station), an externally mounted gun mount with modular features, intended to up-arm M113 armored troop carriers. The OWS includes a twin tube launcher for the NT-S antitank missile.

Spike-ER—Spike-ER (Israeli designation: Perakh Bar) was designed for helicopter launch and the missile is delivered in a sealed launch tube container. It was initially deployed on Israeli AH-1F “Tsefa” (Cobra) attack helicopters in 1995-96. The launch system is part of a package called HeliCOAT which includes the Spike-ER missiles along with the Toplite sighting system and associated fire controls. The Spike ER has been integrated on the Puma transport helicopter for Slovenia and on the Tiger for Spain. In 2009, the



Spike-NLOS—Spike-NLOS is fired from dedicated platforms including a truck mounted system, AFV (M113) mounted system and the remote-control SPARC launcher

Spike Vehicle Mounts—Spike has been adapted to a number of armored vehicles including the German Puma infantry fighting vehicle.

In 2020, BAE Systems conducted firing tests of the Spike LR from the Haggblunds CV90 infantry fighting vehicle.

Electronics

Guidance/Flight Control

Spike-MR—Spike-MR can only be fired in the “fire-and-forget mode”. The basic seeker is a CCD that permits operation in daytime or low light only, though promotional material suggests that it also has some adverse weather capability. The gunner selects a target and fires the missile, with the seeker locking on to the target. An infrared seeker is an option, though some sources have claimed that the missile can be fitted with a combined CCD/IR detector.

Spike-LR—Spike-LR uses the same seeker guidance package as the Spike-MR but has an optional fiber-optic link that permits corrections after launch in a “launch and correct mode”. As in the case of the Spike-MR, the Spike is launched after having locked on the seeker to the target. If the operator wishes to fire additional missiles, the fiber-optic cable can be cut shortly after launch. If not, the fiber optic cable passes seeker imagery back to the operator, who can then provide guidance adjustments. The Spike LR2 that entered

production in 2018 introduces a cooled seeker that offers extended range.

Spike-ER—Spike-ER uses the same guidance package as the Spike, including the terminal fiber optic link, but with an improved seeker.

Spike-NLOS—Spike-ER uses the same guidance package as the Spike, including the terminal fiber optic link for the first eight kilometers, but then employs a radio command data link out beyond eight kilometers.

Propulsion System

The NT missiles are powered by an ejector motor and a flight motor.

The ejector motor is in the aft compartment of the missile. The solid sustainer engine is in the forward

portion of the missile body and is exhausted through two ports on the fuselage side.

Warhead & Fuzing

The NT family carries a Rafael tandem shaped hollow charge armor-piercing warhead. The precursor charge is located behind the guidance seeker in the nose of the missile, and

forward of the sustainer rocket motor. The main charge is located in the center/rear of the missile, aft the forward set of wings.

An option PBF (Penetration-blast-fragmentation) warhead was also developed for the Finnish coastal defense version and first displayed at Eurosatory in 2004.

Training Systems

In 2006, Saab Training Systems began offering a Spike/Gill Weapon

Effect Simulator for NT Spike training.

Specifications

	<i>Spike-MR</i>	<i>Spike</i>	<i>Spike-ER</i>
Length:	3.9 ft (1.2m)	3.9 ft (1.2m)	4.7 ft (1.45m)
Diameter:	4.3 in (110mm)	4.3 in (110mm)	5.9 in (150mm)
Weight:	28.6 lb (13 kg)	28.6 lb (13 kg)	55.1 lb (25 kg)
Range:	1.5 mi (2.5 km)	2.5 mi (four km)	3.7 mi (six km)

Cost

The Polish acquisition in 2003 of 264 launchers and 2,675 Spike LR missiles cost 1.5 billion zloty (~\$495 million) which suggests a fire unit cost (one launcher + 10 missiles) of \$1.87 million. Polish sources have

stated the price of a finished missile is about \$100,000 which is higher than most other previously published estimates. A 2015 Polish order for Spike-LR puts the unit cost around \$150,000. The proposed Indian sale had a larger unit of fire and different

cost of \$1.67 million for a fire unit (one launcher + 20 missiles).

RoK officials stated that the NT-LOS cost W300 million each (~\$280,000).

A German order for Spike LR in 2017 put the unit cost at about \$140,000 each.

The US Army FY21 plan to acquire Spike NLOS has a unit cost of \$210,000 each. The FY20 US Marine Corps acquisition of three Spike NLOS systems had a unit cost of \$7 million each which includes a launcher vehicle as well as 10 missiles.

Program Overview

History

New Missile Family

Rafael proposed to develop a fiber-optic guided missile for the IDF in the 1970s, but IAI was given the contract instead, opting for the laser-guided MAPATS. Rafael continued to work on the concept, and in 1987, won approval to begin a program codenamed Gil by Maj. Gen. Uri Saguy, commander of the IDF ground forces. Flight tests of the missile began in 1992. After spending about NIS 100 million, the program was cancelled in 1992 when Saguy was replaced by Maj. Gen. Emmanuel Sakal. Testing continued of prototype missiles, and good test results of both manportable and helicopter launched missiles in 1994 led to continuing debate over the program. When Sakal was replaced by Gen. Zeev Livneh in 1994, the program saw yet another turn of fortune, and was reinstated. The NT Gil was originally introduced in the IDF in 1998.

Rafael displayed their new generation antitank missiles for the first time at the 1997 Paris Air Show. The new family consists of three missiles sharing a similar imaging infrared/fiber optic guidance system. The systems were originally called NT-G Gil, NT-S Spike, and NT-D Dandy, but were renamed Spike-MR, Spike-LR and Spike-ER in 2002.

Spike-MR Manportable ATGM

The Spike-MR is a lightweight missile in the same category as the

US Army's Javelin. The missile uses a lofted trajectory for impact on the upper surfaces of the enemy tank. The warhead is a tandem, shaped charge type for penetration of roof-mounted reactive armor. In 1997, a Rafael representative stated that the new missile was "in limited, small-scale production," presumably either low-rate production or in trials batches for final evaluation. Polish sources have stated that the missile was being manufactured at a rate of about 10 a month, though this might represent low-rate initial production. This version of the family does not use a fiber-optic link, but rather employs a lock-before-launch approach. The missile comes packed in a launcher/transport container. It is fired from a small tripod.

Spike-LR ATGM

The Spike is a similar missile to the Spike-MR but has a fiber-optic adjunct guidance system which enables it to be corrected after launch. It was apparently developed to meet Israeli special forces requirements. It is intended for either infantry use from a lightweight tripod or vehicle launch. It is intended to replace systems such as the Israeli MAPATS and the US TOW. The Spike was offered by Rafael as a possible contender in the US Army JAWS missile program in 1996, later called FOTT (Follow-On-To-TOW), but rejected.

Spike-ER Helicopter ATGM

The Spike-ER is the third and largest member of the initial family. The first NT-D missiles were deployed on an experimental basis on Israeli AH-1 Cobra (Tsefa) attack helicopters in 1995 or 1996. At the 1997 Paris Air Show, Romania displayed a full-scale model of a missile essentially the same as NT-D as part of a display of its new IAR Puma 2000 helicopter. IAR officials indicated that the missile had been developed "in collaboration with a third party country," presumably Israel.

Operational Problems

The NT missiles were first used in combat along the Lebanon border in 1998. The missiles appear to have guidance problems as several of the five missiles fired went out of control or hit unintended targets according to press accounts from the region.

LAHAT

In 1998, IAI's MBT Division began to promote a new antitank missile called LAHAT (Laser Homing Antitank). This is a guided projectile launched from a 105mm or 120mm tank gun and uses semi-active laser homing guidance. The missile could also be fired from low-recoil systems in a more conventional ATGM pattern using a modified booster.

Export Status

European Marketing

In September 1998, Rafael signed a letter of intent with STN Atlas Elektronik to serve as the basis for the start of a consortium called EuroSpike to jointly manufacture and market the NT family in Europe. STN is now part of Rheinmetall. The EuroSpike GmbH was formally formed as a joint venture between Rheinmetall (40%), Diehl Defense (40%) and Rafael (20% via its Dutch Ercas office) in June 2004, with EuroSpike acting as the prime contractor for Spike missiles in Europe. The EuroSpike clients include Finland, Poland, the Netherlands, Romania, and Italy.

Australia

Australia ordered the Spike LR2 in August 2018 as part of its acquisition of the Boxer AFV. The Spike LR2 will be delivered by the joint venture VRA Systems formed for the program by the Varley Group and Rafael which will produce a portion of the systems as well as being responsible for in-service support.

Azerbaijan

Azerbaijan reportedly ordered a small batch of about 100 Spike-LR missiles. A major arms deal was reached with Israel in 2011-2012 which is believed to include further orders of Spike.

Brazil

Brazil has been contemplating the use of Spike missiles on its new VBTP wheeled IFV.

Chile

There have been reports that 2,200-2,600 NT missiles have been ordered by Chile.

Colombia

There have been reports that Colombia ordered about 15 NT Spike-ER.

Croatia

Croatia has reportedly ordered about 30-60 Spike launchers for its Patria AMV armored vehicles. A total of 84 are on order, but not all have an ATGM launcher.

Czech Republic

In February 2006, the Czech Republic selected the NT Spike as part of a package to arm its newly ordered Steyr Pandur light armored vehicles. A total of 234 Pandur II were ordered at a cost of \$1.02 billion with delivery in 2007-2010. A portion of the fleet will be fitted with the Rafael Samson remote control weapon station which has provisions for the Spike missile launcher. In December 2007, the Czech government cancelled the program, so presumably the missile order will be cancelled as well.

Ecuador

Ecuador ordered 244 Spike missiles which were delivered in 2009.

Finland

Finland acquired 18 Spike launchers under an initial \$20 million order for use as a coastal defense missile. This system is variously called the CMS (coastal missile system) and the RO-2006 and differs from the usual Spike-ER in being fitted with a PBF (penetration-blast-fragmentation) warhead. It is deployed with two mobile companies of Uusimaa Brigade near Tammissaari in the Kotaka Coastal District.

Finnish troops conducted operational trials of the NT-G and NT-S versus the US Javelin and in May 2000, selected this missile for its light antitank missile requirement. This was reportedly based on its much lower price. The deal was reported to be valued at FMk 200 million (\$31 million); probably 100 launchers and 500 missiles. Production was conducted through the European Spike consortium headed by Rheinmetall. This medium range version is dubbed Spike 2.5.

Germany

In December 2008, the German Bundestag approved a bill to integrate the MELLs (MEhrrollenfähige Leichte Lenkflugkörper Systems: Multi-role Light Missile System) in two prototypes of the new Puma infantry armoured combat vehicle with a contract for €18m with the EuroSpike GmbH. On 26 June 2009, the Federal Agency for Defence and Procurement (BWB) awarded EuroSpike a €154m contract for 311 Spike-LR missiles with options for an additional 1,160 missiles. The Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr approved the serial production of the Spike in September 2011 and in December 2011, the Bundeswehr ordered the delivery of the second tranche of 1,160 missiles. On 22 March 2017, the German parliament approved the acquisition of 1,000 Spike LR anti-tank guided missiles and 97 launcher stations valued at € 58.3 million (\$172 million) from EuroSpike under the Bundeswehr's MELLs program. The contract consists of €112.4 million for the missiles, €25.6 million for the launchers, and €20.3 million for integration into the Bundeswehr's AGDUS laser-based training and simulation system. The procurement began in 2018, with 104 missiles and 39 launcher units to be obtained by 2020. The German Ministry of Defence estimates additional user costs for MELLs of €25 million projected over the course of 20 years until 2037, as well as €18.7 million in user costs for the AGDUS components. Previous contracts funded around 1,500 missiles and 16 MELLs weapons stations. Earlier statements indicated an overall objective of about 4,000 missiles.

In November 2019, the BAABW published contracting information noting a requirement for 11,500 MELLs missiles and 214 ICLU launchers. In November 2019, the Bundeswehr ordered 1,500

MELLS missiles as an initial investment in this overall requirement.

India

In March 2011, the Indian press reported that the army was about to place a \$1 billion order for 321 Spike launchers, 8,356 missiles and 15 training simulators. In 2013, the scope of the order was reportedly increased to 1,914 launchers and 37,860 missiles to equip 355 infantry battalions at a cost of Rs 15,000 crore (\$3.2 billion). In October 2014, India finally signed an agreement valued at INR800 billion (\$1.3 billion) for 321 launchers and 8,356 missiles. This sale was held up while awaiting approval of India's Cabinet Committee on Security. In November 2017, it was reported that the deal had been postponed due to testing problems under desert conditions and that the DRDO had been requested to provide a domestic alternative, presumably the Nag. However, in September 2018, it was reported that the program is still ongoing but will require another set of desert tests to validate the missile. The size of the order is now stated to be 170 launchers and 4,500 missiles. India has a stated requirement for 68,000 ATGMs.

Italy

Italy's Agusta has mounted the Spike-ER on its A-129 Mangusta attack helicopter as one of its weapon options. This helicopter is now under offer to a number of countries including Australia.

In 2006, there were reports that Spike had been selected by the Italian army for use from light AFVs. The purchase is about 1,155 missiles with a value around Euro 120 million.

Korea (RoK)

The RoK ordered a number of the new Spike NLOS missile in 2011 for coastal defense of its forward islands. These are mounted on Kia Motors KM25 trucks and Plasan Sand Cat 4x4 vehicles. ROK has also apparently selected the Spike-NLOS to

arm its AgustaWestland AW159 Wildcat helicopters.

Latvia

Latvia reportedly ordered a small batch of missiles and 5 launchers in 2010 from EuroSpike. In February 2018, Latvia placed a €108 million order for Spike missiles.

Lithuania

In September 2016, Lithuania placed an order valued at €400 million for 88 Samson Mk 2 launch stations along with associated Spike missiles. About €100 of the contract was directed to Rafael for the missiles.

Mexico

Mexico has reportedly placed an order for the Spike.

Netherlands

Since earlier in 1997, the Netherlands examined the Spike-MR as an alternative to continued participation in the TriGAT-MR antitank missile program. Firing trials were conducted, and the Netherlands army selected the Spike-MR in June 2001 and signed the production contract in August 2001. The Dutch order is for \$150 million for 297 launchers and 2,400 missiles and production is being undertaken by Rheinmetall's Eurospike consortium with Thales Nederland involved in the contracting.

Peru

Peru placed a second order for the Spike-LR in late 2012 for 24 launchers and 288 missiles at a value of \$32.5 million with delivery 24 months after the contract signature. The Peruvian armed forces have a requirement for 208 launchers with an expected cost of \$260 million.

Poland

Poland was the first potential export client for Spike. The NT-D was offered to Poland for its helicopter missile requirement as part of a deal by an Israeli consortium headed by Elbit Systems Ltd. A delegation un-

der defense vice-minister for procurement Jan Kuriata visited Israel in October 1994 and were shown a test-launch of a missile, apparently a prototype of the NT-D, from a Cobra helicopter over the Sholema range in the Negev desert. The Poles were provided with a seeker which was subjected to tests at the Military Institute of Weapon's Technology (WITU: Wojskowy Instytut Techniczny Uzbrojenia) in February 1995.

The Poles were tentatively planning to procure the NT-D. The original plan was to acquire 2,000 NT-D missiles for their PZL Huszar armed helicopters, plus an additional 3,000 Spike-MR for the Army with deliveries scheduled to begin in 1999. There were plans to co-produce the missiles in Poland. The Polish requirement was for a missile capable of hitting a moving tank target at 6 km. The Polish decision was undermined by developmental delays on the NT-D missile and the test was continually delayed. An initial demonstration launch of a production NT-D from a helicopter took place in Israel with Polish officials present during the second week of January 1997, using an Israeli Cobra attack helicopter as the launch platform. Apparently some of the early tests in Israel were unsatisfactory, leading to a timetable for a successful launch. There were also some concerns over discrepancies between Israeli statements about missile performance, and data from the trials. The test launch missed the 30 November 1996 deadline, leading to a loss of funding for the PZL-Świdnik helicopter program, and causing a certain amount of problems in Poland. Polish officials refused to reveal the results of the NT-D firing. In October 1997, the departing Democratic-Left Alliance government rushed into a contract deal with Israel for about \$500 million for the missiles and \$200 million for the avionics. The incoming AWS/Solidarity Electoral Action government however, later said that the contract was

under review for potential improprieties and it was halted in November 1997.

The Spike deal was renegotiated after Rafael ironed out the production problems, and the Polish government officially announced plans to acquire the system in August 2002. Under the program, Poland would acquire 300 Spike MR and/or LR launchers for the infantry at a cost of Z1,309 million, and modify 40 Mi-24 helicopters to fire the Spike-ER at a cost of Z828 million. The deal includes some level of co-production at ZM Mesko in Skarzysko-Kamienna. The contract was finally signed on 29 December 2003. The initial contract covered only the Spike-LR for the infantry and included 264 launchers and 2,675 missiles for delivery between 2004 and 2013. The first delivery of 2 launchers and 20 missiles was scheduled for late 2004. The contract value to the Polish partner, ZM Mesko was Z1.49 billion (\$397 million). The same day, the Bumar Capital Group signed a separate agreement with Rafael for about \$230 million connected with the associated technology transfer. Poland planned a separate contract for 96 Spike-LR systems which will be used on the new WZM/AMV light armored vehicles.

The Poles received the first 20 NT Spike missile directly from Israel in the second half of 2004 with 60 more, plus 24 launchers slated for 2005. The 2006 batch was expected to total 32 launchers and 200 missiles. Poland undertakes final partial manufacture of the missile at the ZM Mesko plant in Skarzysko Kamienie, and a contract valued at Z1 1.4 billion (\$430 million) was signed in December 2003. Associated plants are expected to include Przemyslowe Centrum Optyki in Warsaw (optics), Gamrat in Jaslo (rocket fuel) and PZL Plant no. 2 in Warsaw (electronics). In 2005, the Polish content of the missile was expected to be about 25% with the offset agreement requiring Rafael to acquire Polish components for its own manufacturing

program. The first missiles were deployed with the 17th Mechanized Brigade in early 2005. Polish sources have stated the price of a finished missile is about \$100,000 which is higher than most other published estimates at the time.

In December 2015, Poland placed a Z602 million (\$152 million) order for an additional 1,000 Spike LR missiles to be delivered in 2017-2020 from ZM Mesko. This contract suggests that the unit price is around \$150,000.

Romania

At the 1997 Paris Air Show, Romania displayed a full-scale model of a missile essentially the same as NT-D as part of a display of its new IAR Puma 2000 helicopter. IAR officials indicated that the missile had been developed "in collaboration with a third party country," presumably Israel. Romanian placed an order for about 1,000 Spike-ER missiles in 1998 for use from the modernized IAR-330 SOCAT helicopters; missile integration on the helicopter was undertaken by Eurospike/Rheinmetall. Romania apparently placed a follow-on order for Spike LR missiles in 2005 to arm the MLI-84 IFV with Eurospike/Rheinmetall helping to develop the unmanned turret. The total order is believed to be 1,950 missiles (1,000 ER/950 LR)

Singapore

In late 1999, it was announced that Singapore had become the first customer for the Spike-LR. Few details on the scope of the order were released, but the contract is apparently for 900-1,000 missiles. Singapore Technologies Dynamics has set up a joint venture with Rafael called Smart Systems Pte. Ltd, to manufacture the Spike locally for Asian requirements.

Slovenia

Slovenia reportedly ordered the Spike for mounting on armored vehicles.

South Africa

There have been reports that South Africa has acquired the Spike missile, but details are lacking.

Spain

On 11 January 2006, Spain selected the NT Spike over the Raytheon Javelin to fulfill a long delayed requirement for a light/medium ATGM. The scope of the program is about \$425 million with General Dynamics-Santa Barbara Sistemas (GC-SBS) in Oveido and Granada responsible for about 60% of the work; Rafael's share is expected to be about \$160 million. The program is stated to include 260 launchers and 2,600 Spike LR missiles with the contract to be completed by 2014.

In December 2007, Spain decided to acquire the Spike-LR for its Tiger attack helicopters instead of the Hellfire or TriGAT. The \$64 million (Euro 44 million) contract went to General Dynamics Santa Barbara Sistemas in Madrid who will act as the prime contractor with delivery scheduled to be complete by 2012.

Turkey

In January 1998, a partnership arrangement was announced between Israeli Aircraft Industries (IAI) and Kamov Helicopters in Russia to market the Ka-50 attack helicopter in the current Turkish competition. One of the optional armaments being offered for the Ka-50 is the NT-D missile. Turkey has also examined the use of the Spike from its Cobra light armored vehicles. Deals for the Spike have largely collapsed due to the deterioration in Turkish-Israeli relations over the past few years.

UK

In February 2001, the British MoD awarded two contracts valued at \$8.8 million for a yearlong assessment of the Javelin and Spike/Spike-MR. The Spike was being offered by Rafael teamed with Matra BAe Dynamics (now MBDA) while the Javelin by a team of Lockheed Martin and Raytheon. The UK would like to

field a light weight antitank missile system for its Joint Rapid Reaction Force by 2005. In February 2003, the British MoD selected the Javelin.

Britain acquired the Israeli Tamuz missile as an off-the-shelf acquisition in 2007 for operations in Afghanistan, labeling them the "Exactor" in UK service. This is a larger surface-to-surface missile developed by Israel in the 1970s to attrite enemy tank

formations at long range. In the British case, they were deployed on 14 M113 APC, with a launched for six missiles on each vehicle. This missile is sometime associated with the NT-Spike, but it is significantly larger and pre-dates the Spike program.

USA

The Spike was offered by Rafael as a possible contender in the US Army JAWS missile program in

1996, now called FOTT (Follow-On-To-TOW). The offer was rejected but there have been suggestions that the missile might be test as part of US Foreign Comparative Trials. The Spike NLOS was subsequently acquired by US Special Operations Command, though details are lacking. The USMC planned to acquire 3 Spike NLOS systems from FY20 funding.

Export Summary

The table below lists reported customers and details where available of their purchases.

<u>Country</u>	<u>Launchers</u>	<u>Missiles</u>	<u>Contract value (\$m)</u>
Azerbaijan	n/a	100	n/a
Bangladesh	n/a	n/a	n/a
Belgium	66	n/a	n/a
Chile	n/a	2,100 -LR/-MR	n/a
Colombia	n/a	315	n/a
Croatia	30-60	n/a	n/a
Czech Republic	n/a	n/a Spike-LR	n/a
Ecuador	n/a	244	n/a
Finland	118	700 Spike-MR, ER	\$51m
Germany	410	3,500	n/a
Germany	~200	11,500	(2019-continuing)
Italy	365	>4,000 MR/LR	n/a
Latvia	12	n/a	€108m
Lithuania	88	n/a	n/a
Netherlands	297	2,400 MR	\$150m
Korea (RoK)	n/a	n/a	n/a
Peru	48	516	n/a
Peru	24	288	\$32.5
Poland	264	3,675 LR	\$400m+150m
Portugal	20	n/a	n/a
Romania	n/a	1,950 ER, -LR	n/a
Singapore	n/a	1,000 LR	n/a
Slovenia	n/a	75 MR & LR	n/a
South Africa	n/a	n/a	n/a
Spain	260	2,800 Spike-LR	\$425m
Spain	44	Spike-ER (helo)	\$64
UK	14	600 NLOS aka Exactor	n/a
Total	>2,000	> 32,000	>\$2,090m

Current Development

Mini-Spike

Rafael debuted its Mini-Spike at Eurosatory 2012. This is the smallest member of the growing Spike family and company literature described it

as being "in development". The system includes an MICLU (Miniaturized Control Launch Unit) or the missile can be launched from the Spike-LR launcher with an electro-mechan-

ical adaptor (EMA). The missile employs both fire & forget/ fire & observe capabilities but uses wireless RF as the link to the missile instead of the usual fiber optic cable used on other members of the Spike family.

The missile apparently comes in two varieties with either a Blast - Fragmentation warhead or High Explosive Antitank warhead. A crew of two soldiers can carry six missiles, MICLU launcher and accessories. The lofted missile trajectory enables steep angle of attack for target engagements in line of sight and hidden behind an obscuration.

Spike C4I

The IDF has begun receiving an enhanced version of the Spike system dubbed Spike C4I. This variant incorporates an Azimuth Comet GPS system on the launcher together with a laptop and a VHF datalink to permit networking with army C4I systems.

Spike SR

In 2016, Rafael unveiled its Spike-SR (Short Range) missile. This is intended as a light infantry weapon to compete against weapons such as the Eryx, and Metis. Overall weight in firing position is under 10 kg and the missile has a range up to 1,500 meters. Its first client was an undisclosed client in Asia in May 2016 for several hundred missiles.

Spike LR2

In October 2017, the Israeli defense Forces placed a new order for more than 1,000 of the next-generation Spike-LR2 missiles. The new version uses an uncooled seeker which reduces the weight of the guidance package and helps extend the effective range of the missile to about 5.5km from a ground launcher.

Spike NLOS (Tammuz)

In August 2011, the IDF revealed that the Tamuz (Orange) missile had been developed in the mid-1980s and became operational in 1984 with the Meitar (String) brigade of the IDF artillery corps. This was a predecessor of the Spike family and was used in a combination with the Hermes 450 UAV for targeting. The first program

involved the conversion of about 40 obsolete M48 tanks into the "Pere" (Savage) configuration which included 12 launch cells plus the electro-optical fire control system. The missile was also launched from a modified M113 APC. It was first used in combat in the 2006 war with Lebanon with 527 fired, but its performance was not especially good, especially considering its \$100,000-unit cost. A further 26 missiles were fired in the 2009 operations in the Gaza strip, and 433 during the subsequent Operation Protective Edge against Hamas in 2014. It would appear that the Spike NLOS was in development as a second-generation version of this system.

In December 2009, Rafael announced the debut of the new Spike NLOS. This is a substantially larger missile than the Spike ER, weighing about 70 kg vs. 34 kg. The weight difference is due to a larger motor and larger flight control package to extend the range. Although the Spike NLOS can employ the usual fiber-optic guidance at ranges up to 8km, at ranges beyond that, a new radio command link is used. The system is intended mainly for heavy launchers, specifically vehicles and helicopters as the missile is not man-portable. Rafael has displayed a variety of launch systems for the missile, including a vehicle-mounted system on a 4x4 light truck and the remote control SPARC trailer system.

US Spike NLOS

The US Special Operations Command (SOCOM) has procured an unknown quantity of Spike NLOS systems.

In 2019, the Marine Corps Forces Special Operations Command identified the Spike NLOS as the preferred weapon system to satisfy an MARSOC Urgent Universal Needs Statement called 18024UA. Organic Precision Strike (Medium) to support current combat operations. The

MARSOC requirement was the ability to strike stationary and mobile point targets in real time out to the limits of their ability to positively identify targets with organic ground and airborne assets while minimizing collateral damage. Potential target sets include personnel in the open or under light cover, light frame or single layer brick buildings, and unarmored or lightly armored vehicles (moving and stationary), to include Vehicle-Borne Improvised Explosive Devices (VBIEDs) or High Value Targets (HVTs) moving at speeds up to 45mph. The Marine Corps plans to acquire the Spike NLOS from Rafael Advanced Defense Systems via their partnership with Lockheed Martin in partnership with Rafael.

The immediate program is valued at \$21.95 million to procure three Spike NLOS missile systems with the estimated project cost of one MARSOC Spike NLOS system of \$7.317 million, which includes the missile launch/guidance system, an associated vehicle or adaptation of an existing vehicle, an inventory of 10 missiles, and initial training and logistics support. This will be funded from the FY20 procurement budget. The Marines Corps has indicated that future purchases may take place, though they are not included in the FY21 budget plan.

The US Army has decided the fund procurement of 205 Spike NLOS missiles at a cost of \$43.05 million in FY21 to satisfy an immediate operational requirement for a "Long Range Precision Munition". For arming the AH-64 Apache helicopter. The requirement is viewed as an interim solution to provide longer stand-off ranges in an anti-access/area denial (A2/AD) environment until a more effective integrated Army Aviation Weapons Sub-Systems and Munitions (AAWSSM) LRPM solution can be developed.

Teal Group Analysis

With the demise of the European TriGAT-MR program, the prospects for Spike brightened considerably. It remains the most viable competitor to the US Javelin in Europe. The Spike’s loss to the Javelin in the British and French competitions were an early blow to its prospects in the European market. Given the anti-Israeli sentiments in the past German governments, sales to Germany were unlikely. But the prospects improved under the Merkel CDU government with its selection for the MELLIS requirement both in its infantry version

and as the principal anti-tank armament on the new Puma IFV. The Spike has become the predominant new-generation ATGM in Europe. Total orders to date in Europe are about 20,000 missiles and over 1,000 launchers with a value of about \$2 billion; Germany has a continuing requirement that could add about 10,000 missiles to this order.

Spike has some prospects in Asia, though recent reports of the postponement of the Indian order is a setback to the program in this region.

The market for antitank missiles has slipped over the past decade since

the end of the Cold War. The new accent has been on light ATGMs that can be used by special forces and peacekeeping forces. Spike-MR and Spike had found a significant niche in this market. The new Spike-SR will assist in securing a place in this market as well.

Rafael has begun to enjoy some success in the US market due to the US Army’s failure to update the TOW system with small orders coming from the US Army, USMC and SOCOM in FY20-21.

Production Forecast

User (Variant)	Thru 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
Rafael												
Israel (Spike)	4,000	1,000	—	—	—	—	—	—	—	—	—	5,000
export (Spike)	28,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	43,500
Total	32,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	47,500