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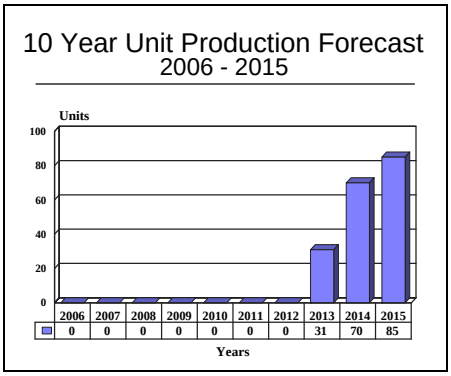
Polyphem - Archived 9/2007

Outlook

- Polyphem terminated
- Work on this technology is continuing in Germany
- IDAS could provide an air defense missile a submarine could launch while submerged
- LFK is now part of MBDA
- Diehl BGT Defence could be added to MBDA in the future



Orientation

Description. Multipurpose fiber-optic guided missile.

Sponsor. French, German, and Italian defense ministries.

Status. Polyphem program canceled. Germany could develop a fiber-optic guided missile for launching from submerged submarines.

Total Produced. Production has not commenced.

Application. Multipurpose fiber-optic guided missile for use by land forces and naval warships. A version was to be being offered for use by submarines against aircraft.

Price Range. Developers wanted the Polyphem missile's price to be under $100,000, but it may have increased to $176,470 (DEM300,000) apiece.

Contractors

Prime

Euromissile GIE	12 Rue De La Redoute, Fontenay Aux Roses, 92260 France, Tel: + 33 1 4187 1414, Fax: + 33 1 4661 6467, Prime

NOTE(S): Diehl BGT Defence, HDW, Kongsberg and Nammo are involved in the IDAS project.

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Technical Data

	Metric	U.S.
Dimensions		
Length	3 m	9.84 ft

Polyphem

	Metric	U.S.
Diameter	180-200 mm	7.1 in
Weight	150 kg	330 lb
Wingspan	110 cm	3.62 ft
Performance		
Speed	120-200 m/sec	394-656 ft/sec
Altitude	20-600 m	65-1,968 ft
Range (Solid Rocket)	15 km	9.3 mi
Range (Turbojet, Present)	30 km	18.6 mi
Range (Turbojet, Planned)	60 km	37.3 mi

Propulsion. Production version was to use a small turbojet designed by Teledyne CAE.

Control & Guidance. The missile was to be controlled via its fiber-optic link (provided by Alcatel) to the ground control station. The gunner/operator would use a joystick to control manually the missile if the need arose, although the system may have had an autonomous capability. The system would be ejected from its launcher via rocket boosters (provided by Rheinmetall), and once clear would ignite its main engine. It would fly to a predetermined altitude (and possibly location) and begin to search for potential targets. The missile was to be fitted with a 640 x 480 element focal plane infrared sensor.

Launcher Mode. The missile would be ejected from its environmentally sealed container by rocket boosters. The missiles were expected to be arranged in a vertical launcher on land vehicles and on pylons for helicopter launches. They would be fired from standard 21-inch torpedo tubes.

Warhead. The anti-tank and anti-aircraft versions were to use a 20- to 25-kilogram warhead, but another source said the weight had been increased to 30 kilograms. The anti-aircraft missile was expected to use either a proximity or a combination proximity/impact fuze. The anti-tank version was to be fitted with an impact fuze only.

POLYPHEM

Source: MBDA

Variants/Upgrades

When this program was first started, three Polyphem versions were mentioned: Polyphem 20, with a 15-kilometer range; Polyphem 60, with a 60-kilometer range; and Polyphem 150, with a 150-kilometer range. The latter two systems were to be equipped with turbojet engines. To allow greater range, the system's fiber-optic dispensing bobbin was being improved. These improvements would also allow the missile to achieve a higher maximum speed.

The land-based version intended for use by artillery units was known as TriFOM (Trilateral Fiber Optic Missile), while the missile mounted on helicopters was known as Polyphem-H. The submarine-launched version was called Triton, and the shipborne unit was known as Polyphem-S.

Germany and Norway are studying the possible development of a submarine-launched anti-aircraft missile. Companies involved in this study include: Howaldtswerke-Deutsche Werft GmbH (HDW); Diehl BGT Defence GmbH & Co. KG (DBD); and Kongsberg Defense & Aerospace AS (KDA). The German Ministry of Defense is supporting this study, which is known as IDAS (Interactibe Defense system for Air-attacked Submarines).

Program Review

Background. The Aerospatiale/Daimler-Benz Polyphem was first put forward in the early 1980s. The companies were primarily concentrating on perfecting the technology, and had not stated any particular application. Daimler-Benz (then MBB) commenced an experimental program using the Mamba-L missile in 1982, while Aerospatiale checked the quality of the image transmitted over an optical fiber being unwound at the rate of some 150 meters per second. In 1984, this concept formed the basis for a cooperation agreement between Aerospatiale and Daimler-Benz, the joint Polyphem program effort. The Polyphem project gets its name from a mythical Greek creature, the Cyclops, son of Poseidon.

Tethered Missile for Anti-Armor and Anti-Aircraft Missions

The demonstrator was tested at the French Centre d' Essais des Landes in order to demonstrate and validate the system's concept. This included demonstrating the spooling out of the fiber-optic cable from the missile, transmitting images from the missile to the firing units, and correcting commands from the firing units to the missile over a distance of up to 7 kilometers. The tests also looked at the stabilization of the television camera in the missile, and the received image presented to the gunner/operator. These tests continued through 1988 and into 1989, confirming that image quality was adequate under combat and reconnaissance conditions.

Preliminary design specifications for the anti-armor and anti-helicopter missiles that could evolve from Polyphem were outlined by Aerospatiale Missiles, Magny-les-Hameaux, in the late 1980s. The initial vehicle launch system was known as Polyphem 20, while the longer range versions with multiple launch capability were designated Polyphem 60 and Polyphem-150.

The program later evolved into the development of multiplatform weapons capable of engaging vehicles, ships, helicopters, radar sites, and certain fixed installations. The missile's warhead lethality was improved to allow it to engage a wider variety of targets.

Missile Models. The Polyphem was being developed for deployment on board naval surface combatants, helicopters, armored vehicles, and submarines.

TriFOM. The initial concept for the Polyphem envisioned a land-based missile system, which was later renamed TriFOM (Trilateral Fiber-Optic Missile). The three-year TriFOM contract was signed in 1998. Germany was administrator for this program and was to assemble the missiles. France was responsible for the missile's rear section, while Italy was providing the launcher, launch canister, and warhead.

Flight tests commenced in 2000 and continued through 2001. France was the most interested in the land-based TriFOM system for deployment with its artillery regiments.

France has also expressed an interest in the helicopter and submarine-launched versions of the Polyphem.

Polyphem-S. This version was based on the TriFOM but intended to meet user requirements for a lightweight anti-ship missile system. The Polyphem-S had a range of 60 kilometers and was capable of engaging naval surface targets, helicopters, and coastal sites.

Polyphem-SM: Triton. Another navalized version of this missile, known as Triton, was being developed by EADS in cooperation with HDW and Kongsberg. This weapon would enable submarines to attack anti-submarine warfare (ASW) aircraft.

The Triton had different dimensions than the standard Polyphem missile. Also, the missile's turbojet engine was replaced by a solid rocket motor. Because of this

change, the missile's range was limited to 15 kilometers.

At sea, a submerged submarine would detect engine or blade noise generated by maritime patrol aircraft or ASW helicopters from the characteristic splash of a dunking sonar, sonobuoy, or torpedo. According to one source, once the threat had been identified, the gunner/operator would have two engagement options:

- Direct Attack – If the target's range and bearing were known with sufficient accuracy, the gunner would be able to opt for a direct firing. In this form of engagement, the missile's sensor would explore a 3-kilometer-wide area over almost the entirety of the 10-kilometer-long flight path through air.
- Search/Attack – If an aircraft had been definitively detected, but its exact location was still undetermined, the operator would choose option two, in which the missile explores the airspace as it flies in an ascending, circular, spiral search pattern.

The turning radius of the latter mode was one kilometer. In this case, the Polyphem-SM would scan a large volume of airspace. The missile, which would be encapsulated in its watertight underwater vehicle (designated the VSM) – a concept already used on the Exocet SM 39 – would be able to be fired from the boat's torpedo tubes at any depth ranging from periscope to 300 meters (some four to six missiles could be carried in a single standard submarine torpedo tube). A missile's launch places no special constraints on a submarine and can be made even in very heavy seas (over Force 6).

Once it had left the submarine, the system would travel underwater at a speed of 15 meters/second along a preprogrammed path, and surface about one kilometer (some said seven kilometers or more) from the submarine's position (from the time of launch). Once freed from the undersea constraints, the VSM would split open longitudinally, and the booster on the Polyphem-SM would ignite, followed by the sustainer stage. The missile would then follow whichever of the two engagement patterns was selected by the operator and ultimately home in on the selected target. The missile's flight altitude could be anything up to 5,000 meters.

On the basis of the video images transmitted via the optical fiber to the submarine control station, one of four ways of countering the threat could be selected by the operator:

- approach the target so as to trigger target acquisition and subsequent lock-on by the camera following target identification;
- allow the missile to search for other targets in the scanning mode, and, if necessary, fire a second missile at the first target;
- launch other missiles when no further doubt exists as to the proximity of a threat within the missile lethality envelope; or
- send a missile destruct command in the event of an error in target identification. This was believed to be a sort of fail-safe in the event that a friendly aircraft was accidentally engaged.

Since the gunner/operator would know the distance between the submarine and the missile at all times, the officer would also know its residual intercept potential.

Validation and demonstration tests of this missile commenced in early 2001 and continued through mid-2002. Due to delays, the start of full-scale development was pushed back to 2004/2005. Italy decided to withdraw from this program in mid-2003, followed shortly by Germany. These decisions effectively ended the Polyphem program.

Stealth Polyphem. Germany was interested in the development of a stealth version of Polyphem. Under a new study, Germany was looking to reduce the missile's radar cross-section from $0.15m^2$ to $0.001m^2$.

Air Defense for Submerged Submarines

IDAS. Diehl BGT Defence has proposed the development of a submarine-launched missile intended to engage aircraft. This concept is known as Interactive Defense system for Air-attacked Submarines (IDAS). In addition to Diehl BGT Defence, the German shipyard HDW and Kongsberg of Norway are involved in this project. Nammo is also involved in this project.

The IDAS would be based on an IRIS-T short-range air-to-air missile equipped with a fiber-optic tether. A test missile was ejected from a launch tube during a test in late 2003. The firing of a missile from a submerged submarine could take place this year (2006) with an IDAS development phase following in 2007. One report said an operational missile could be available as early as 2009, but a more likely date is around 2012 or later.

Significant News

British Lynx Downed by Russian SAM – Military experts claim the British Lynx helicopter that recently crashed in Iraq was brought down by a Russian-made surface-to-air missile. Five British soldiers died in the crash. Experts say the helicopter was struck by an SA-14 Gremlin manportable SAM, not a shoulder-fired rocket. The missile was said to have been fired from the roof of the Basra headquarters of Moqtadr al-Sadr's Mehdi Army. (*Sunday Mirror*, 5/06)

Indian Navy Wants to Arm Warships with Barak SAM – The Indian Navy wants to put the Barak surface-to-air missile system (SAM) on all of its frontline warships. This is the conclusion after the Indian Navy demonstrated the capability of the Barak SAM for Indian Prime Minister Manmohan Singh.

The Barak is currently operational on India's aircraft carrier INS "Viraat," two Delhi class destroyers, two Godavari class frigates, and two Rajput class destroyers, among a few others. The next ships to receive the Barak system will be India's three new Brahmaputra class missile frigates. These ships are built indigenously. The Barak system could be installed over the next three to six months.

In December 2005, the Indian government approved the procurement of seven additional Barak air defense systems. Each system consists of six-eight vertical tube launchers and six or more missiles, track and guidance radar, and a fire-control system. The Barak is capable of intercepting aircraft, missiles, and unmanned air vehicles (UAVs).

This decision is not good news for the Trishul, which is being developed by Indian's Defense Research and Development Organization (DRDO). The Akash, another DRDO program, is not capable of intercepting missiles. Therefore, the Indian Navy has pushed hard for permission to acquire additional Barak SAMs.

On January 27, 2006, Israel Aircraft Industries (IAI) and India's Defense Research and Development Laboratories (DRDL) signed an agreement to jointly develop and produce a next-generation Barak incorporating greater range than the original. (*The Indian Express*, 5/06)

Taliban Wants Better Weapon to Defeat Armored Vehicles – Taliban commanders are looking for better anti-armor weapons to defeat the vehicles operated by Canadian troops in Afghanistan. Canadian troops in Afghanistan are equipped with Bison and LAV III armored troop carriers and Coyote reconnaissance vehicles. The Taliban militants are armed with RPG-7s, which have proven effective against these armored vehicles.

The Taliban wants to acquire better shoulder-launched weapons, such as ones similar to the German Armbrust, or the jeep-mounted, Russian-built AT-1 Snapper anti-armor missiles. Also, the Taliban wants to purchase additional anti-tank mines.

Meanwhile, there are rumors the Taliban has managed to reactivate a handful of U.S-made FIM-92 Stinger shoulder-fired surface-to-air missiles (SAMs) through the purchase of new battery packs. Reportedly, a turncoat Taliban commander has offered to surrender two Stinger SAMs for the reward of $100,000 per missile offered by the Afghan government.

In 2005, Pakistani forces along the Afghan border seized as many as six dilapidated Stinger SAMs. (*The Chronicle Herald*, 5/06)

Russia Will Not Cancel SAM Sale to Iran – Russia has refused a request by the United States to cancel a deal to sell air defense missile systems to Iran. Tehran is procuring Tor-M1 (SA-15 Gauntlet) mobile surface-to-air missile systems from Russia. The deal is worth $700 million.

Russian Defense Minister Sergei Ivanov has confirmed that Moscow will go ahead with deliveries. Ivanov made his statement during a visit to Beijing. Russia will provide Iran with 29 Tor-M1 systems. (Radio Free Europe, 4/06)

MBDA Completes Integration of German Missile Company LFK – MBDA has completed the full integration of LFK GmbH, the German missile manufacturer, into the group. This follows official clearance by the European Commission and by the German Ministry of Economics and Technology.

The acquisition, announced in 2005, was approved by the two shareholders of LFK GmbH, EADS and MBDA, and by the three shareholders of MBDA, EADS, BAE Systems, and Finmeccanica. MBDA's new component in

Germany will become a full part of MBDA's group structure, adopting all of its procedures and processes while also addressing Europe's third largest missile market, Germany.

There will be no change to the current MBDA shareholder agreement under which BAE Systems (37.5 percent), EADS (37.5 percent) and Finmeccanica (25 percent) jointly own MBDA. The management and administration of MBDA Deutschland will remain in Unterschleißheim, southern Germany. (MBDA, 3/06)

South Korea Could Buy SAMs from Russia – South Korea, interested in upgrading its air defense capability, may purchase new Russian surface-to-air missiles (SAMs).

President Roh Moo-hyun wants to diversify South Korea's military procurement sources and improve relations with Russia. Seoul sees Russia as key to its future security and capable of influencing North Korea.

Seoul has sought high-technology weapons from Russia including anti-aircraft missile systems. These weapons would be provided in lieu of Russia's debt repayment to South Korea. In the past, South Korea has received $214 million worth of Russian arms including T-80 tanks, METIS-M anti-armor missiles, and BMP-3 infantry combat vehicles. These arms were delivered from 1995-1998 to pay off Russian debts.

South Korea wants to acquire new air defense systems. These weapons will include a capability to engage ballistic missiles. Candidates to meet this need include the Russian S-300 and the U.S. Patriot system, the latter outfitted with the PAC 3 interceptor. (*The Korea Times*, 2/06)

Palestinians Using New Anti-Armor Missile – Palestinian terrorist groups are using homemade rockets and missiles to attack targets in Israel. The Palestinians have developed the Al-Batar, an anti-armor missile equipped with a powerful 3.5-kilogram warhead. This missile has a range of 3 kilometers and has been used in attacks on Israeli homes.

The Palestinians also employ an array of rockets to attack Israeli targets, including the Shihab-3, which has a larger diameter and warhead than the Kassam but the same 9-kilometer range. The Saria-2 is a 3-kilometer range rocket developed by Islamic Jihad. The Nasser-3 is manufactured by Hamas.

Other rockets used by the Palestinians include the Aksa-3, Tzumud, Kuds, and Najam-3. (Arutz Sheva, 2/06)

Spain Selects Israeli Missile Over Raytheon Offering – Spain has decided to purchase Israeli-built missiles to meet its man-portable anti-armor requirements, with Rafael to supply some 2,600 SPIKE anti-armor missiles to the Spanish military. The deal is worth $300 million.

Raytheon, along with its partner Lockheed Martin, had offered the Javelin anti-armor missile, which has been used during combat in Afghanistan and Iraq. The Javelin is in service with the United States armed forces and the militaries of 10 other nations.

While this loss is a blow to Raytheon, the company and Rafael plan to develop jointly a ballistic missile defense system for the Israeli government. Rafael and Raytheon will jointly bid to develop a short-range ballistic-missile defense system. This system is aimed at defeating attacks by Kassam rockets used by Palestinian terrorist groups.

Boeing and Israel Aircraft Industries (IAI) are also preparing a joint bid for the contract. This missile defense contract is valued between $50 million and $100 million. (*Boston Business Journal*, 2/06)

Canada Interested in New Man-Portable ATGW – Canada wants to acquire a new man-portable anti-armor missile system for use by its infantry. Options include the U.S.-built FGM-148 Javelin, the Israeli SPIKE, and a European missile system.

The Javelin, built by Lockheed Martin and Raytheon, has seen combat in both Afghanistan and Iraq. The system was mostly used to destroy fortified structures such as bunkers.

Rafael of Israel is offering its SPIKE anti-armor missile. The SPIKE has been exported to Finland, Singapore, the Netherlands, and Poland. Meanwhile, MBDA may be offering the TriGAN or MILAN ER to Canada. (FI, 11/05)

Funding

The Polyphem's development costs were split evenly by France, Germany, and Italy. France planned to procure 480-500 missiles and 22 fire units for EUR139 million, with Italy purchasing 400 missiles. Germany was to acquire the smallest number of missiles, possibly around 50-100, for deployment of its K-130 corvettes. France and Italy had wanted the missile for land-based deployment.

Contracts / Orders & Options

A 51-month project definition contract was awarded to Aerospatiale and Daimler-Benz (now DaimlerChrysler) in January 1992. Rheinmetall, Dusseldorf, Germany, is a subcontractor to DaimlerChrysler. With the addition of Italmissile, the contract's value ranged from FRF350 million ($63 million) to about FRF470 million ($84.6 million).

Timetable

Month	Year	Major Development
	1980	France and Germany begin work on FOG-M technology
	1984	DASA and Aerospatiale conclude cooperative accord: Polyphem born
	1986	Preliminary tests with modified AS.12/SS.12M conducted
	1992	Polyphem definition contract awarded
	1995	Exploratory Polyphem development completed
June	1997	First full-system test firing completed
	2001	Projection definition
June	2003	Italy withdraws from Polyphem
July	2003	Germany withdraws from Polyphem
	2003	Germany and Norway studying new submarine-launched SAM
	2004	No full-scale development decision made
	2004	Polyphem program abandoned
	2006-2007[(a)]	Submarine-launched SAM R&D program launched

[(a)]Estimate

Worldwide Distribution / Inventories

User Countries. The Polyphem was never ordered.

Forecast Rationale

Europe has seen the number of missile firms on the continent steadily shrink over the last two decades. The latest consolidation involved the integration of LFK into MBDA. This European tactical missile giant now has its eye on pulling Diehl into its fold.

Diehl BGT Defence is Germany's most profitable missile firm. The company is producing the IRIS-T short-range air-to-air missile, a version of which it hopes to sell as a ground-based air defense system.

Bigger Companies to Survive

Many European defense executives believe the only way to survive in today's highly competitive market is through the creation of megacorps equal in size and diversity of product to those in the United States. The European market has shown more effort in the development of air defense missiles for launching from submerged submarines.

Despite Polyphem's termination, its technology could re-emerge as part of a new program. Research in this area continues and Germany could develop new applications for the technology. Instead of a surface-warship-mounted weapon, Germany may develop a new fiber-optic guided missile for use by submerged submarines.

Fixed-wing aircraft and helicopters engaged in anti-submarine warfare operations have long enjoyed the advantage of hunting prey unable to strike back. Dogged by these aircraft and pounded by depth charges,

Polyphem

a submarine captain could only depend on his skills and his boat's stealth to elude these pursuers.

A new missile, capable of being launched while the submarine is submerged, could change the balance of power between submarines and ASW forces. So far, Germany has not launched any official design program. Diehl BGT Defence says a number of navies have expressed interest in this weapon, including the United States.

Prior to launching a design program, Germany will likely need to find some program partners. The tight German defense budget will probably preclude any sole development effort. Even if a program can be launched in the near term, an operational missile would not be available before 2010. The following forecast for the IDAS is very tentative and could easily be revised (or dropped) in the future.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level			Speculative			
Missile	**(Engine)**	**thru 05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**Total 06-15**
EUROMISSILE													
POLYPHEM	UNSPECIFIED	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - EUROMISSILE		0	0	0	0	0	0	0	0	0	0	0	0
NOT SELECTED													
IDAS	NOT SELECTED	0	0	0	0	0	0	0	0	31	70	85	186
Subtotal - NOT SELECTED		0	0	0	0	0	0	0	0	31	70	85	186
Total Production		0	0	0	0	0	0	0	0	31	70	85	186